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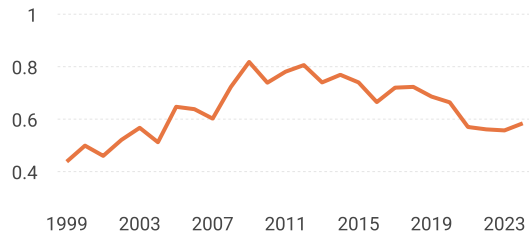

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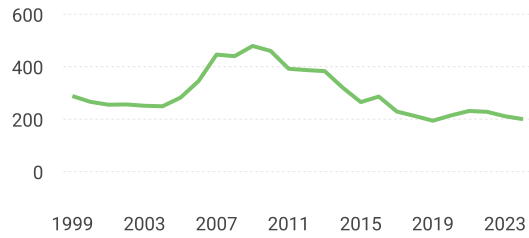

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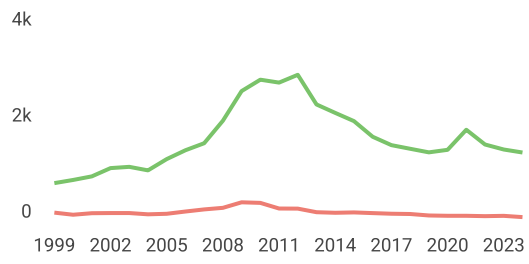

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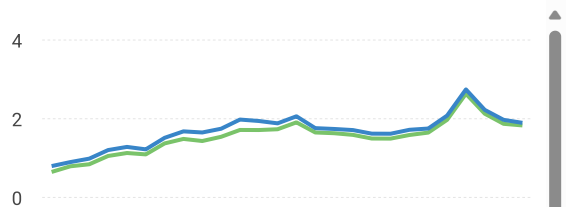

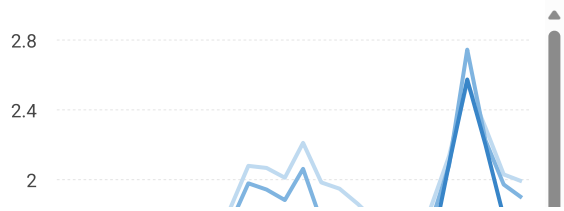

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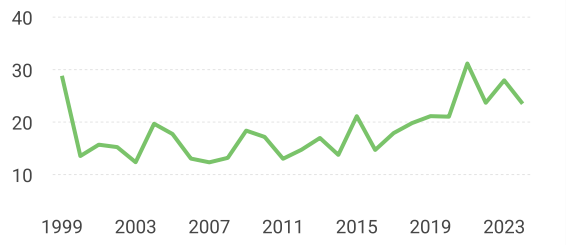

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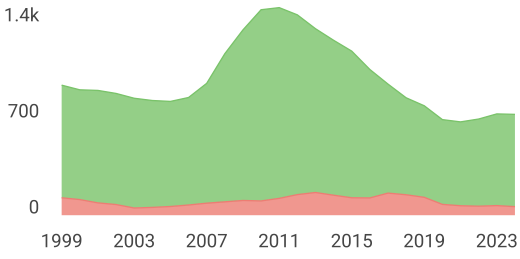

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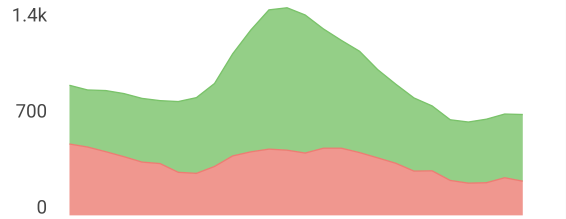

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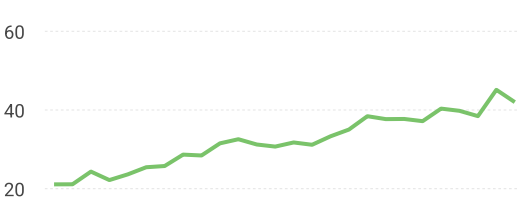

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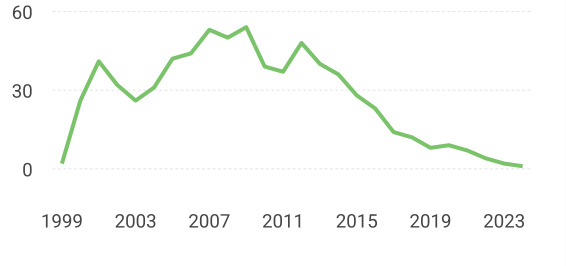

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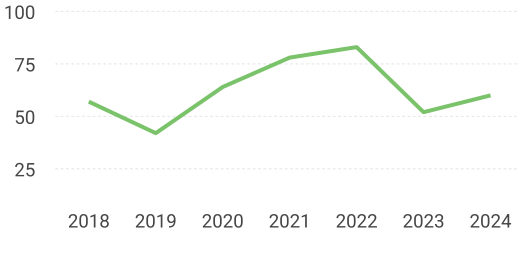

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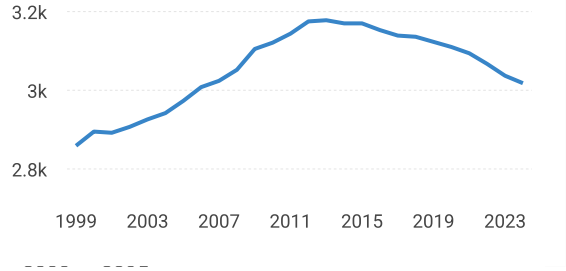

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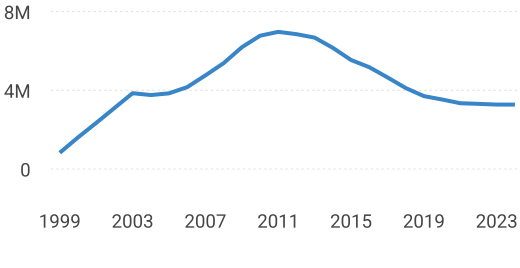

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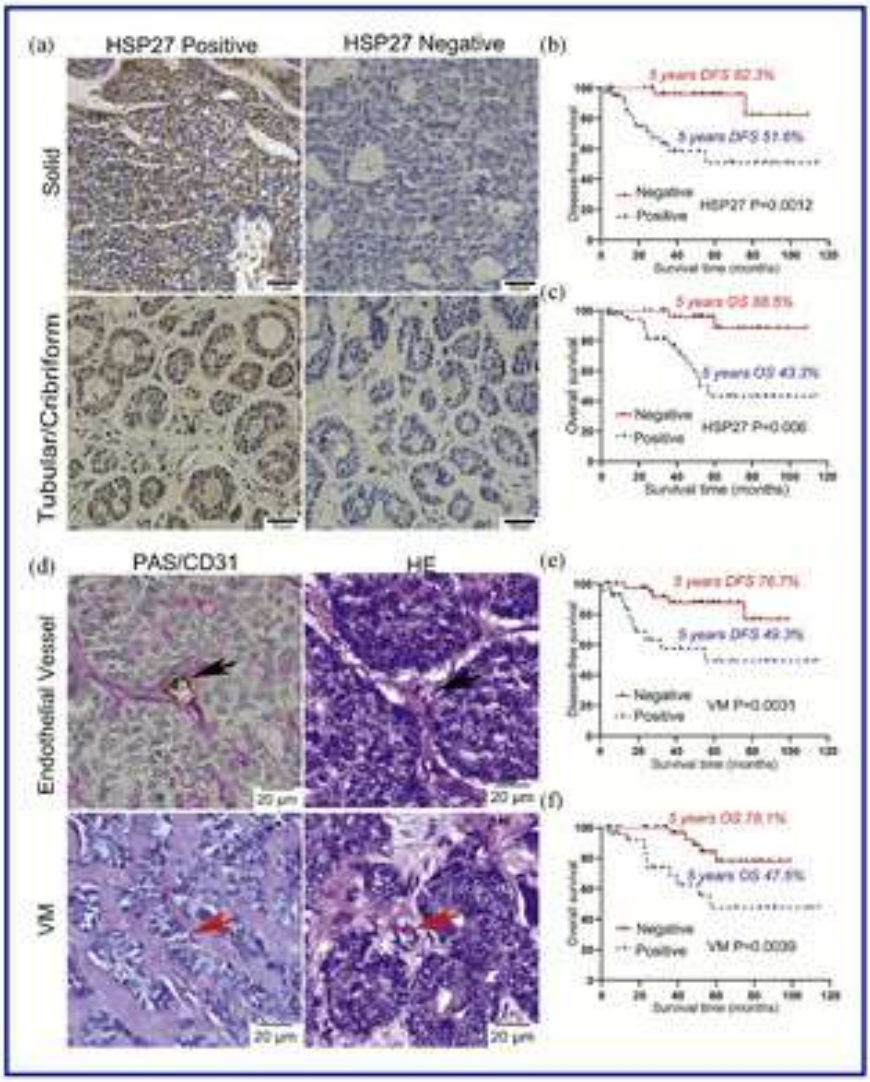

HPS27 Promotes Vascular Mimicry in Adenoid Cystic Carcinomas

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ABSTRACTS

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Comorbidities between temporomandibular disorders and somatization in young adults: exploring links with personality, emotional, and sleep disturbances

Adrian Ujin Yap, BDS, MSc, PhD,[a,b,c] Ni Luh Dewi, BDS,[a] and Carolina Marpaung, BDS, MDS, PhD[a]

Objective. The comorbidities between temporomandibular disorders (TMDs) and somatization and their associations with personality traits, emotional disorders, and sleep disturbances were investigated.

Study Design. Adults aged 18 to 24 years completed an electronic survey encompassing TMD symptoms (5Ts), Patient Health Questionnaire-15, Big Five Personality Inventory-10, Depression Anxiety Stress Scales-21, and Pittsburgh Sleep Quality Index. Data were assessed using non-parametric tests/correlation analysis and logistic regression analysis ($\alpha = 0.05$).

Results. The sample comprised 365 participants, of whom 22.2% and 19.5% were 5Ts-negative without and with somatization, respectively, and 18.1% and 40.3% were 5Ts-positive without and with somatization, respectively. Significant differences in neuroticism, distress, depression, anxiety, stress, and sleep quality were observed between 5Ts-negative participants with somatization and 5Ts-positive participants with somatization compared with 5Ts-negative participants without somatization and 5Ts-positive participants without somatization. Distress, anxiety, stress, and sleep were moderately correlated with somatic but not TMD symptoms ($r_s = 0.45-0.52$).

Conclusions. Irrespective of whether they had TMDs, participants with somatization exhibited heightened levels of neuroticism and emotional and sleep disturbances. (Oral Surg Oral Med Oral Pathol Oral Radiol 2024;137:493−500)

Temporomandibular disorders (TMDs), are characterized by pain and/or dysfunction of the masticatory muscles and temporomandibular joints (TMJs). They are the second most prevalent musculoskeletal condition, surpassed only by chronic lower back pain.[1] TMDs represent a substantial public health concern, with 33% to 75% of the general population experiencing TMD signs/symptoms, including facial/preauricular pain, TMJ noises (clicking, popping, and/or grating sounds), and limited movement/locking of the jaws.[1−4] Women, particularly those in their child-bearing years, are more disposed to TMDs than men.[4,5] The multifaceted etiology of TMDs follows the biopsychosocial model of illness and has been associated with somatization and emotional and sleep disturbances.[6−11]

Somatization is a generic term referring to the experience and communication of psychological distress as somatic symptoms, often medically unexplained.[12] Permeating all health care settings, somatization poses difficulties in clinical diagnosis as well as management and is linked to greater health care use and costs.[12] Populations of East and Southeast Asian descent appear to be more disposed to somatic manifestations and somatization.[13,14] This disposition often manifests in their use of somatic idioms in their speech and may be related to the unacceptability/stigma attached to the psychosocial expression of distress in these cultures.[14] Somatization and the interconnected phenomenon of central sensitization, an amplified response of the central nervous system to sensory stimuli and peripheral nociception, are strongpredictors of altered pain modulation in chronic musculoskeletal disorders, including TMDs.[15,16] They may also play pivotal roles in the pathophysiology of other forms of long-standing pain, clarifying the high occurrence of comorbid chronic pain conditions in patients with TMD.[16,17] This relationship has prompted some experts to consider TMD a type of functional somatic or central sensitization syndrome.[16,18]

As somatization and psychological distress are intertwined and related to difficulty falling/staying asleep and disrupted sleep, much of the emotional and sleep disturbance related to TMDs could be underpinned by somatization, given the high prevalence of somatization among individuals with TMDs.[7,8,12,19,20] Moreover, specific personality traits, namely neuroticism, are known to be closely related to distress and several

Statement of Clinical Relevance

Somatization has emerged as the primary risk factor for the presence of temporomandibular disorder symptoms in young adults and may underpin emotional and sleep disturbances related to temporomandibular disorders.

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pain-related cognitive and behavioral traits, such as pain catastrophizing.[21] Although somatization and TMDs have been affiliated with neuroticism (i.e., a tendency to experience negative emotions), research concerning dimensional personality assessment remains limited.[21,22] Therefore, the objectives of this study were to examine the comorbidities between TMDs and somatization and to explore their links with personality characteristics and emotional and sleep disturbances in young adults. The correlations between physical and psychological variables were also examined, along with the risk factors for TMD symptoms. The research hypotheses were (1) TMDs and somatization frequently co-exist; (2) young adults with somatization have significantly higher levels of neuroticism and emotional and sleep disturbances; and (3) somatization, neuroticism, depression, anxiety, stress, and sleep quality are moderately to strongly correlated; and (4) the likelihood of experiencing TMD symptoms is significantly increased by somatization, emotional distress, and poor sleep.

METHODS AND MATERIALS

Study design and participants

Approval for this analytical observational study was granted by the ethics committee of Trisakti University Dental School (ID: 013/S3/KEPK/FKG/9/2021). Enrollment of young adults was conducted at a private university utilizing non-probability voluntary response sampling. The study included university students between the ages of 18 and 24 with proficiency in English. Individuals who had undergone prior orofacial trauma/orthognathic surgery, were undergoing treatment for debilitating physical/mental conditions, or had submitted incomplete surveys were excluded. To achieve a 95% confidence level and 5% precision, a minimum of 318 participants was required, considering the university's admission of 20,638 students and a 70% possible occurrence of TMD/somatic symptoms in young people.[3,23] Prospective participants were recruited in person or through intranet postings and provided with the study details. Informed consent was attained before administering a comprehensive electronic survey encompassing the quintessential 5 TMD symptoms (5Ts) of the Diagnostic Criteria for TMDs (DC/TMD), the Patient Health Questionnaire-15 (PHQ-15), Big Five Personality Inventory-10 (BFI-10), Depression Anxiety Stress-Scales-21 (DASS-21), and Pittsburgh Sleep Quality Index (PSQI).[24–28]

Study measures

TMD and somatic symptoms. The presence of TMDs was ascertained via the 5Ts, which assesses the 5 major TMD symptoms identified by the DC/TMD, namely TMD pain, headache, TMJ noises, closed locking, and open locking.[24] The self-reported 5Ts exhibit exceptional performance with high sensitivity (96%-99%), specificity (100%), and accuracy (area under the receiver operating characteristics curves of 0.98-1.00) when referenced to DC/TMD pain-related and/or intra-articular diagnoses.[24] Participants were classified as 5Ts-negative if they responded "no" to all 5 symptoms and 5Ts-positive if they answered "yes" to any of the 5 items. For the 5Ts-positive participants, the number of symptoms was also documented for statistical analyses. Somatization was assessed with the PHQ-15, which comprised the 15 most common symptoms associated with severe forms of somatization,[25] including trouble sleeping; fatigue; and musculoskeletal, gastrointestinal, cardiopulmonary, and neurologic symptoms. The PHQ-15 has well-established psychometric properties and is commonly used in research and clinical settings.[25,29] Items were evaluated using a 3-point scale according to which "not bothered at all" was recorded as 0 points, "bothered a little" as 1 point, and "bothered a lot" as 2 points. The total PHQ-15 score was calculated, with higher scores signifying a greater burden of somatic symptoms. A total PHQ-15 score of 5 or higher indicated the presence of somatization.[29]

Personality traits and emotional and sleep disturbances. Personality traits were appraised with the BFI-10, which contained 2 items for each of the following personality dimensions together referred to as OCEAN: openness, the tendency to be curious and receptive to new experiences/ideas; conscientiousness, the tendency to be responsible and self-disciplined; extraversion, the tendency to be outgoing and sociable; agreeableness, the tendency to be trusting and cooperative; and neuroticism.[26] The high reliability and validity of the BFI-10 have been demonstrated in Asian populations.[30] The items were evaluated using a 5-point scale varying from "disagree strongly," scored as 1 point, to "agree strongly," scored as 5 points, with 1 item in each dimension being reverse scored. Scores for each personality dimension were calculated, with higher scores signifying a stronger inclination toward specific traits. Emotional disturbances were assessed with the DASS-21, which comprised 7 items for each of the subscales of depression, anxiety, and stress.[27] The measurement properties of the DASS021 and its bifactor structure consisting of the subscales and a general factor for "psychological distress" have been systematically documented.[31] Items were evaluated using a 4-point scale ranging from "did not apply to me at all" scored as 0 points to "applied to me very much, or most of the time" as 3 points. The total and subscale scores were calculated, with higher scores signifying greater distress, depression, anxiety, and stress. The scoring range for classifying subscale severity is provided in the DASS manual.[27]

Sleep quality/disturbances were examined with the PSQI, which contains 19 items assessing the seven sleep indicators of subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.[28] The high reliability and validity of the PSQI have been demonstrated in clinical and non-clinical populations.[32] The items were evaluated using a 4-point scale ranging from "not during the past month/very good," which scored 0 points, to "three or more times a week/very bad," which scored 3 points. The total and component scores were calculated according to defined rules, with higher scores indicating worse sleep quality and more sleep dysfunction, respectively. A total PSQI score of overall sleep quality of 5 or higher indicates the presence of poor sleep.[28]

Statistical analyses

Statistical analyses were conducted using SPSS Statistics software version 28.0 (IBM SPSS, Inc.) with a significance level of 0.05, considered statistically significant.

TMD/somatic symptom groupings served as independent variables, and the BFI-10, DASS-21, and PSQI scores as dependent variables. Quantitative data were presented as frequencies and percentages and assessed using the chi-square test. Qualitative data were reported as means with SDs or medians with IQRs and tested for normality using the Shapiro-Wilk test. As the qualitative data exhibited non-normal distribution, they were assessed using Kruskal-Wallis/post-hoc Mann−Whitney U tests and Spearman rank order correlations. Correlation coefficients (r_s) were classified as weak, moderate, and strong based on cut-off points of 0.1, 0.4, and 0.7, respectively.[33] Univariate and multivariate logistic regression analyses were also performed to identify the risk factors associated with TMD symptoms. A stepwise variable selection method was employed for multivariate analysis using a significance threshold of $P < .10$ to remove insignificant factors. Outcomes were reported in terms of odds ratios (ORs) and corresponding 95% CIs.

RESULTS

From the initial pool of 501 potential participants, 45 and 91 were excluded due to ongoing medical treatments and incomplete surveys, respectively. The final sample consisted of 365 participants with a mean age of 22.5 ± 1.3 years, of whom 85.8% were women. Among all 365 participants, 22.2% and 19.5% were 5Ts-negative without (NN) and with somatization (NS), respectively, whereas 18.1% and 40.3% were 5Ts-positive without somatization (PN) and with somatization (PS), respectively. Although no significant variations were found in age, a significant difference in gender distribution was discerned, with the NS/PS groups (90.1/89.8%) containing a greater proportion of women than the NN/PN groups (77.8/81.8%; Table I).

Tables II and III show the mean/median personality dimensions and emotional and sleep disturbance scores for the various groups. Significant differences in conscientiousness (NN > PS) and neuroticism (PS, NS > PN, NN), as well as distress, depression, anxiety, and stress (PS, NS > PN, NN), were observed (Table II). Apart from sleep efficiency and use of sleep medication, considerable variations in total PSQI and sleep component scores were detected (Table III). Irrespective of TMD presence, participants with somatization exhibited significantly greater total PSQI, lower subjective sleep quality, higher sleep latency, higher sleep disturbance, and daytime dysfunction compared with those without somatization (PS, NS > PN, NN). Furthermore, the median total PSQI of both the PS and NS groups surpassed 5 points, indicating poor sleep quality.

The results of correlation and logistic regression analyses are shown in Tables IV and V. Distress, anxiety, stress, and overall sleep quality were moderately correlated with somatic but not TMD symptoms (r_s = 0.45-0.52). Additionally, moderate associations

Table I. Demographic characteristics of the study sample

Variable	*No. (%)*	*Age*			*Gender*		
		Mean (SD)	*Median (IQR)*	*P value* post hoc*	*Male n (%)*	*Female n (%)*	*P value†*
Total	365 (100)	22.46 (1.31)	22.0 (3)		52 (14.2)	313 (85.8)	
NN	81 (22.2)	22.70 (1.22)	23.0 (2)	0.177	18 (22.2)	63 (77.8)	.043‡
NS	71 (19.5)	22.23 (1.49)	22.0 (3)		7 (9.9)	64 (90.1)	
PN	66 (18.1)	22.45 (1.31)	22.0 (2)		12 (18.2)	54 (81.8)	
PS	147 (40.3)	22.45 (1.26)	22.0 (2)		15 (10.2)	132 (89.8)	

*Results of Kruskal−Wallis test.
†Results of chi-square test.
‡*P < .05.NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T*, quintessential 5 temporomandibular disorder symptoms.

Table II. Mean and median psychological variable scores for study groups

Psychological variable	*NN*	*NS*	*PN*	*PS*	*P value* post hoc*
Personality					
Openness (P1)					
Mean (SD)	6.19 (1.37)	6.28 (1.29)	5.92 (1.44)	6.50 (1.54)	.077
Median (IQR)	6.0 (2)	6.0 (2)	6.0 (2)	6.0 (2)	
Conscientiousness (P2)					
Mean (SD)	6.94 (1.60)	6.54 (1.17)	6.70 (1.36)	6.34 (1.23)	.011†
Median (IQR)	7.0 (2)	7.0 (1)	7.0 (2)	6.0 (2)	NN > PS
Extraversion (P3)					
Mean (SD)	7.0 (1.55)	7.04 (1.60)	7.02 (1.57)	6.70 (1.71)	.415
Median (IQR)	7.0 (2)	7.0 (2)	7.0 (2)	7.0 (3)	
Agreeableness (P4)					
Mean (SD)	7.12 (1.27)	7.20 (1.51)	7.42 (1.27)	6.97 (1.35)	.138
Median (IQR)	7.0 (2)	7.0 (2)	7.0 (1)	7.0 (2)	
Neuroticism (P5)					
Mean (SD)	6.12 (1.84)	7.01 (1.63)	6.36 (1.62)	7.06 (1.55)	< .001†
Median (IQR)	6.0 (2)	7.0 (2)	6.0 (3)	7.0 (2)	PS, NS > PN, NN
Emotional disturbance					
Total DASS (E1)					
Mean (SD)	9.95 (9.12)	16.83 (10.23)	10.08 (8.15)	17.20 (9.09)	< .001†
Median (IQR)	8.0 (13.5)	14.0 (14)	8.0 (12.5)	16.0 (12)	PS, NS > PN, NN
Depression (E2)					
Mean (SD)	2.17 (3.03)	4.15 (3.72)	2.15 (2.86)	3.75 (3.40)	< .001†
Median (IQR)	1.0 (4)	3.0 (5)	1.0 (3)	3.0 (4)	NS, PS > PN, NN
Anxiety (E3)					
Mean (SD)	3.06 (2.79)	5.27(3.43)	3.26 (2.93)	5.82 (3.34)	< .001†
Median (IQR)	3.0 (4)	5.0 (5)	3.0 (4)	5.0 (4)	PS, NS, > PN, NN
Stress (E4)					
Mean (SD)	4.72 (4.26)	7.41 (4.25)	4.67 (3.74)	7.63 (3.70)	< .001†
Median (IQR)	4.0 (6)	7.0 (5)	4.0 (6.25)	8.0 (5)	PS, NS > PN, NN†

*Results of Kruskal−Wallis and Mann−Whitney *U* tests.
†$P < .05$ and > denotes statistically significant differences between groups.*NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T,* quintessential 5 temporomandibular disorder symptoms.

were observed between neuroticism and distress, depression, anxiety, and stress (r_s = 0.44-0.61). Moderate-to-strong relationships were found among the different negative emotions (r_s = 0.60-0.80), and overall sleep quality was moderately associated with somatization, distress, anxiety, and stress (r_s = 0.46-0.52). Although univariate analysis revealed significant associations between the presence of TMD symptoms and somatization (OR, 1.13; 95% CI, 1.08-1.18), conscientiousness (OR, 0.85; CI, 0.72-0.99), anxiety (OR, 1.09; 95% CI, 1.02-1.16), and overall sleep quality (OR, 1.08; 95% CI, 1.01-1.16), multivariate analysis identified somatization (OR, 1.14; 95% CI, 1.08-1.20) as the primary risk factor.

DISCUSSION

The interplay of comorbidities between TMDs and somatization and their associations with personality traits and emotional and sleep disturbances were investigated in conjunction with an examination of the correlations between biopsychosocial variables and the determination of the risk factors for TMD symptoms. The first and second research hypotheses were supported, as 69.0% (147/213) of the 5Ts-positive participants had concurrent somatization, and these young adults with somatization exhibited significantly higher levels of neuroticism, depression, anxiety, stress, and poor sleep. Both the third and fourth hypotheses were partly supported, as somatization was moderately correlated with emotional and sleep disturbances but not neuroticism, and the presence of TMD symptoms was increased largely by somatization. The study focused on university students as a young adult population due to their significant life changes and susceptibility to psychological distress.[34] Furthermore, TMD signs/symptoms typically increase during adolescence and early adulthood and reach their peak between the ages of 20 and 40.[4,35]

Personality traits and emotional disturbances

Personality refers to the unique set of psychological traits and patterns of thoughts, feelings, and behaviors that distinguish a person from others. Although neuroticism had been linked to both TMDs and somatization, only the PS and NS groups, individuals with somatization, exhibited significantly higher levels of

Table III. Mean and median sleep variable scores for study groups

Variable	*NN*	*NS*	*PN*	*PS*	*P value* post hoc*
Sleep quality/disturbance					
Total PSQI (S1)	4.70 (2.23)	7.46 (3.28)	5.08 (2.84)	7.45 (3.0)	< .001†
Mean (SD)	4.0 (3)	7.0 (4)	4.0 (3)	7.0 (4)	PS, NS > PN, NN
Median (IQR)					
Subjective sleep quality (S2)	0.95 (0.50)	1.24 (0.55)	0.88 (0.57)	1.39 (0.68)	< .001†
Mean (SD)	1.0 (0)	1.0 (1)	1.0 (0)	1.0 (1)	PS, NS > NN, PN
Median (IQR)					
Sleep latency (S3)	1.12 (1.04)	1.69 (1.05)	1.26 (1.11)	1.69 (0.97)	< .001†
Mean (SD)	1.0 (2)	2.0 (1)	1.0 (2)	2.0 (1)	NS, PS > PN, NN
Median (IQR)					
Sleep duration (S4)	0.90 (0.80)	1.20 (0.82)	0.67 (0.66)	1.10 (0.84)	< .001†
Mean (SD)	1.0 (1)	1.0 (1)	1.0 (1)	1.0 (0)	NS, PS > PN
Median (IQR)					NS > NN
Sleep efficiency (S5)	0.33 (0.65)	0.24 (0.64)	0.33 (0.69)	0.27 (0.59)	.564
Mean (SD)	0 (0.5)	0 (0)	0 (0)	0 (0)	
Median (IQR)					
Sleep disturbance (S6)	0.75 (0.43)	1.72 (1.97)	1.17 (1.02)	1.41 (1.32)	< .001†
Mean (SD)	1.0 (0.5)	1.0 (0)	1.0 (0)	1.0 (1)	NS, PS > PN> NN
Median (IQR)					
Use of sleep medication (S7)	0.01 (0.11)	0.06 (0.23)	0.03 (0.25)	0.07 (0.30)	.257
Mean (SD)	0(0)	0 (0)	0 (0)	0(0)	
Median (IQR)					
Daytime dysfunction (S8)	0.63 (0.83)	1.32 (1.03)	0.74 (0.77)	1.52 (1.08)	< .001†
Mean (SD)	0 (1)	1.0 (1)	1.0 (1)	1.0 (1)	PS, NS > PN, NN
Median (IQR)					

*Results of Kruskal−Wallis and Mann−Whitney *U* tests.
†$P < .05$ and > denotes statistically significant differences between groups.*NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T*, quintessential 5 temporomandibular disorder symptoms; *PSQI*, Pittsburgh Sleep Quality Index.

neuroticism than the NN group, controls without TMDs or somatization.[21,22] As neuroticism entails a disposition toward experiencing negative emotions; these findings corroborated the notably greater distress, depression, anxiety, and stress observed in the PS and NS groups compared with the PN and NN groups.

Given the pervasiveness of somatization among patients with TMD (up to 77%) and the high

Table IV. Correlations among physical, psychological, and sleep variables

Variable	*TT*	*TS*	*P1*	*P2*	*P3*	*P4*	*P5*	*E1*	*E2*	*E3*	*E4*
TT	-	-	-	-	-	-	-	-	-	-	-
TS	0.36*	-	-	-	-	-	-	-	-	-	-
P1	0.04	0.16*	-	-	-	-	-	-	-	-	-
P2	−0.10*	−0.18*	-0.24*	-	-	-	-	-	-	-	-
P3	0.01	0.03	-0.15*	0.17*	-	-	-	-	-	-	-
P4	−0.03	−0.03	0.01	−0.01	0.08	-	-	-	-	-	-
P5	0.08	0.23*	0.26*	-0.25*	-0.30*	-0.02	-	-	-	-	-
E1	0.16*	0.48*,†	0.31*	-0.29*	0.28*	-0.03	0.59*,†	-	-	-	-
E2	0.07	0.39*	0.28*	-0.28*	-0.33*	-0.06	0.44*,†	0.82*,†	-	-	-
E3	0.21*	0.47*,†	0.28*	-0.24*	-0.19*	0.01	0.51*,†	0.89*,†	0.60*,†	-	-
E4	0.14*	0.45*,†	0.28*	-0.25*	-0.23*	-0.03	0.61*,†	0.95*,†	0.69*,†	0.80*,†	-
S1	0.15*	0.52*,†	0.21*,†	-0.20*	−0.11*	-0.02	0.25*	0.48*,†	0.38*	0.46*,†	0.46*,†

Results of Spearman's correlation.
TT, total number of temporomandibular disorder symptoms; *TS*, total Patient Health Questionnaire-15 score; Personality: *P1*, openness; *P2*, conscientiousness; *P3*, = extraversion; *P4*, agreeableness; *P5*, neuroticism; Emotional disturbance: *E1*, total Depression Anxiety Stress-Scales-21 score (psychological distress); *E2*, depression; *E3*, anxiety; *E4*, stress and sleep quality/disturbance; *S1*, Pittsburgh Sleep Quality Index (overall sleep quality).
*$P < .01$
†Correlation coefficient >0.4.

Table V. Risk factors for temporomandibular disorder symptoms in Southeast Asian young adults

Variable	Univariate Odds ratio (95% CI)	P value*	Multivariate Odds ratio (95% CI)	P value†
Gender				
Male	Reference			
Female	1.36 (0.75-2.44)	0.311		
Somatization	1.13 (1.08-1.18)‡	< .001‡	1.14 (1.08-1.20)‡	< .001‡
Personality				
Openness	1.04 (0.90-1.21)	0.563		
Conscientiousness	0.85 (0.72-0.99)‡	0.037‡		
Extraversion	0.92 (0.81-1.05)	.919		
Agreeableness	0.98 (0.84-1.14)	.753		
Neuroticism	1.11 (0.98-1.26)	.089		
Emotional disturbance				
General distress (total DASS)	1.02 (0.99-1.04)	.079		
Depression	1.01 (0.95-1.08)	.667		
Anxiety	1.09 (1.02-1.16)‡	.01‡		
Stress	1.04 (0.99-1.10)	.098		
Sleep				
Overall sleep quality (total PSQI)	1.08 (1.01-1.16)‡	.032‡		

*Results of univariate analysis.
†Results of multivariate logistic regression analysis.
‡$P < .05$.*PSQI*, Pittsburgh Sleep Quality Index; *DASS;* Depression Anxiety Stress-Scales-21.

percentage of young adults with TMDs in this study (69.0%), it is plausible that emotional disturbances associated with TMDs might stem from somatization tendencies rather than the TMDs themselves.[7,8] This possibility is supported by the moderate correlations between distress, anxiety, and stress observed with somatic but not TMD symptoms. Collectively, the aforementioned findings suggest that TMDs are a form of functional somatic/central sensitization syndromes and explain the high frequencies of concomitant chronic pain conditions in patients with TMD.[19,18] As a personality trait, conscientiousness is characterized by self-discipline and goal-directed behaviors. Individuals with comorbid TMDs and somatization (PS group) presented significantly lower levels of conscientiousness than controls (NN group). This may be partly explained by pain-related disabilities/interferences, which are also related to the emotional disturbances that often accompany TMDs/somatization.[36]

Sleep quality/disturbances

The relationship between TMDs and poor sleep has been widely documented.[10,11] Nevertheless, whether this phenomenon can be attributed mainly to TMDs or the consequences of somatization and emotional disturbances remains to be ascertained. As with emotional disturbances, significant differences in overall sleep quality and most sleep components were found between individuals with somatization (PS and NS groups) and without somatization (PN and NN groups), irrespective of TMD presence. Overall, sleep quality was moderately correlated with somatization, distress, anxiety, and stress. The association between sleep quality and TMD symptoms, albeit significant, was weak, inferring that sleep impairments associated with TMDs are influenced largely by somatization and emotional disturbances. Sleep−pain, and sleep−emotion interactions are highly complex, and bidirectional relationships involving both linear and circular models with mutually deleterious effects have been proposed.[37,38] The somewhat weaker relationship between sleep quality and depression may be underpinned by the generally normal levels of depression (0-4 points) in the study cohort.

Risk factors for TMD symptoms

Univariate analysis indicated that somatization, anxiety, and sleep disturbances increased the risk of experiencing TMD symptoms by 13%, 9%, and 8%, respectively, whereas conscientiousness reduced the risk by 15%. The triad of bodily pains, psychological distress, and sleep disturbances was also found to predict the onset of painful TMDs in the multicenter Orofacial Pain: Prospective Evaluation and Risk Assessment study, which recommended a multisystem approach for evaluating TMDs.[39] Individuals high in conscientiousness are likely to show greater commitment to self-management interventions and the adoption of functional coping strategies, leading to a potential reduction in TMD symptoms.[40,41] After adjustment for confounding variables, multivariate analysis identified somatization as the primary risk factor, increasing the odds of TMD symptoms by 14% in non-clinical young adults.

Although somatization appears to be linked with attentional and perceptual aspects of symptoms, emotional disturbances are more closely related to behavioral characteristics.[42] Persons with TMDs should thus be routinely screened for somatization and co-existing psychological distress, which can complicate the diagnostic process and affect treatment approaches as well as outcomes.[43] Additionally, pharmacologic and psychological treatments for somatization and somatoform disorders, including anti-depressants, cognitive behavioral therapy, and mindfulness therapy, might be beneficial for TMD management.[44]

Study limitations

This analytical observational study was subject to several limitations. First, the use of a cross-sectional design did not permit temporal and causal inferences to be made. Although personality traits remain relatively stable, TMD symptoms, somatization tendencies, and emotional and sleep disturbances can fluctuate over time. Consequently, a prospective cohort investigation should ideally be performed to explore the dynamic changes. Second, the study population comprised only young adults, with a notable preponderance of women, who are more susceptible to TMDs and somatization.[5,45] The gender imbalance in respondents can be ascribed to the higher proclivity of women to engage in online surveys than men.[46] Future research endeavors could incorporate more men in addition to other age and racial groups, and these findings must be validated in patients with TMD. Third, participants with TMD pain-related and intra-articular symptoms were not distinguished from all participants. The interplay between somatization and emotional and sleep disturbances may vary among young adults experiencing painful and non-painful TMD symptoms. Finally, the study measures relied on self-reporting, which could have introduced potential sources of information bias. In addition to recall and social desirability bias, confirmation bias and other forms of partiality may also have occurred.[47]

CONCLUSIONS

In this study of the young adults with TMDs, approximately seven-tenths had comorbid somatization. Regardless of the presence of TMDs, the participants with somatization experienced substantially higher levels of neuroticism, distress, depression, anxiety, and stress and experienced poorer sleep than those without somatization. Distress, anxiety, stress, and overall sleep quality were moderately correlated with somatic but not with TMD symptoms. Whereas the univariate model suggested that the triad of somatization, psychological distress (specifically anxiety), and sleep disturbance increased the risk of experiencing TMD symptoms, stepwise multivariate analysis identified somatization as the primary and most influential risk factor. Therefore, somatization may underlie emotional disturbances and poor sleep associated with TMDs. Routine screening for somatization and concurrent psychological distress in TMD patients is strongly recommended. This proactive approach can help mitigate diagnostic complications, enhance treatment planning, and ultimately lead to improved treatment outcomes.

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DECLARATION OF INTEREST

None.

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Comorbidities between temporomandibular disorders and somatization in young adults: exploring links with personality, emotional, and sleep disturbances

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Comorbidities between temporomandibular disorders and somatization in young adults: exploring links with personality, emotional, and sleep disturbances

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Objective. The comorbidities between temporomandibular disorders (TMDs) and somatization and their associations with personality traits, emotional disorders, and sleep disturbances were investigated.

Study Design. Adults aged 18 to 24 years completed an electronic survey encompassing TMD symptoms (5Ts), Patient Health Questionnaire-15, Big Five Personality Inventory-10, Depression Anxiety Stress Scales-21, and Pittsburgh Sleep Quality Index. Data were assessed using non-parametric tests/correlation analysis and logistic regression analysis ($\alpha = 0.05$).

Results. The sample comprised 365 participants, of whom 22.2% and 19.5% were 5Ts-negative without and with somatization, respectively, and 18.1% and 40.3% were 5Ts-positive without and with somatization, respectively. Significant differences in neuroticism, distress, depression, anxiety, stress, and sleep quality were observed between 5Ts-negative participants with somatization and 5Ts-positive participants with somatization compared with 5Ts-negative participants without somatization and 5Ts-positive participants without somatization. Distress, anxiety, stress, and sleep were moderately correlated with somatic but not TMD symptoms ($r_s = 0.45–0.52$).

Conclusions. Irrespective of whether they had TMDs, participants with somatization exhibited heightened levels of neuroticism and emotional and sleep disturbances. (Oral Surg Oral Med Oral Pathol Oral Radiol 2024;137:493–500)

Temporomandibular disorders (TMDs), are characterized by pain and/or dysfunction of the masticatory muscles and temporomandibular joints (TMJs). They are the second most prevalent musculoskeletal condition, surpassed only by chronic lower back pain.[1] TMDs represent a substantial public health concern, with 33% to 75% of the general population experiencing TMD signs/symptoms, including facial/preauricular pain, TMJ noises (clicking, popping, and/or grating sounds), and limited movement/locking of the jaws.[1–4] Women, particularly those in their child-bearing years, are more disposed to TMDs than men.[4,5] The multifaceted etiology of TMDs follows the biopsychosocial model of illness and has been associated with somatization and emotional and sleep disturbances.[6–11]

Somatization is a generic term referring to the experience and communication of psychological distress as somatic symptoms, often medically unexplained.[12] Permeating all health care settings, somatization poses difficulties in clinical diagnosis as well as management and is linked to greater health care use and costs.[12] Populations of East and Southeast Asian descent appear to be more disposed to somatic manifestations and somatization.[13,14] This disposition often manifests in their use of somatic idioms in their speech and may be related to the unacceptability/stigma attached to the psychosocial expression of distress in these cultures.[14] Somatization and the interconnected phenomenon of central sensitization, an amplified response of the central nervous system to sensory stimuli and peripheral nociception, are strongpredictors of altered pain modulation in chronic musculoskeletal disorders, including TMDs.[15,16] They may also play pivotal roles in the pathophysiology of other forms of long-standing pain, clarifying the high occurrence of comorbid chronic pain conditions in patients with TMD.[16,17] This relationship has prompted some experts to consider TMD a type of functional somatic or central sensitization syndrome.[16,18]

As somatization and psychological distress are intertwined and related to difficulty falling/staying asleep and disrupted sleep, much of the emotional and sleep disturbance related to TMDs could be underpinned by somatization, given the high prevalence of somatization among individuals with TMDs.[7,8,12,19,20] Moreover, specific personality traits, namely neuroticism, are known to be closely related to distress and several

Statement of Clinical Relevance

Somatization has emerged as the primary risk factor for the presence of temporomandibular disorder symptoms in young adults and may underpin emotional and sleep disturbances related to temporomandibular disorders.

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pain-related cognitive and behavioral traits, such as pain catastrophizing.[21] Although somatization and TMDs have been affiliated with neuroticism (i.e., a tendency to experience negative emotions), research concerning dimensional personality assessment remains limited.[21,22] Therefore, the objectives of this study were to examine the comorbidities between TMDs and somatization and to explore their links with personality characteristics and emotional and sleep disturbances in young adults. The correlations between physical and psychological variables were also examined, along with the risk factors for TMD symptoms. The research hypotheses were (1) TMDs and somatization frequently co-exist; (2) young adults with somatization have significantly higher levels of neuroticism and emotional and sleep disturbances; and (3) somatization, neuroticism, depression, anxiety, stress, and sleep quality are moderately to strongly correlated; and (4) the likelihood of experiencing TMD symptoms is significantly increased by somatization, emotional distress, and poor sleep.

METHODS AND MATERIALS

Study design and participants

Approval for this analytical observational study was granted by the ethics committee of Trisakti University Dental School (ID: 013/S3/KEPK/FKG/9/2021). Enrollment of young adults was conducted at a private university utilizing non-probability voluntary response sampling. The study included university students between the ages of 18 and 24 with proficiency in English. Individuals who had undergone prior orofacial trauma/orthognathic surgery, were undergoing treatment for debilitating physical/mental conditions, or had submitted incomplete surveys were excluded. To achieve a 95% confidence level and 5% precision, a minimum of 318 participants was required, considering the university's admission of 20,638 students and a 70% possible occurrence of TMD/somatic symptoms in young people.[3,23] Prospective participants were recruited in person or through intranet postings and provided with the study details. Informed consent was attained before administering a comprehensive electronic survey encompassing the quintessential 5 TMD symptoms (5Ts) of the Diagnostic Criteria for TMDs (DC/TMD), the Patient Health Questionnaire-15 (PHQ-15), Big Five Personality Inventory-10 (BFI-10), Depression Anxiety Stress-Scales-21 (DASS-21), and Pittsburgh Sleep Quality Index (PSQI).[24–28]

Study measures

TMD and somatic symptoms. The presence of TMDs was ascertained via the 5Ts, which assesses the 5 major TMD symptoms identified by the DC/TMD, namely TMD pain, headache, TMJ noises, closed locking, and open locking.[24] The self-reported 5Ts exhibit exceptional performance with high sensitivity (96%-99%), specificity (100%), and accuracy (area under the receiver operating characteristics curves of 0.98-1.00) when referenced to DC/TMD pain-related and/or intra-articular diagnoses.[24] Participants were classified as 5Ts-negative if they responded "no" to all 5 symptoms and 5Ts-positive if they answered "yes" to any of the 5 items. For the 5Ts-positive participants, the number of symptoms was also documented for statistical analyses. Somatization was assessed with the PHQ-15, which comprised the 15 most common symptoms associated with severe forms of somatization,[25] including trouble sleeping; fatigue; and musculoskeletal, gastrointestinal, cardiopulmonary, and neurologic symptoms. The PHQ-15 has well-established psychometric properties and is commonly used in research and clinical settings.[25,29] Items were evaluated using a 3-point scale according to which "not bothered at all" was recorded as 0 points, "bothered a little" as 1 point, and "bothered a lot" as 2 points. The total PHQ-15 score was calculated, with higher scores signifying a greater burden of somatic symptoms. A total PHQ-15 score of 5 or higher indicated the presence of somatization.[29]

Personality traits and emotional and sleep disturbances. Personality traits were appraised with the BFI-10, which contained 2 items for each of the following personality dimensions together referred to as OCEAN: openness, the tendency to be curious and receptive to new experiences/ideas; conscientiousness, the tendency to be responsible and self-disciplined; extraversion, the tendency to be outgoing and sociable; agreeableness, the tendency to be trusting and cooperative; and neuroticism.[26] The high reliability and validity of the BFI-10 have been demonstrated in Asian populations.[30] The items were evaluated using a 5-point scale varying from "disagree strongly," scored as 1 point, to "agree strongly," scored as 5 points, with 1 item in each dimension being reverse scored. Scores for each personality dimension were calculated, with higher scores signifying a stronger inclination toward specific traits. Emotional disturbances were assessed with the DASS-21, which comprised 7 items for each of the subscales of depression, anxiety, and stress.[27] The measurement properties of the DASS021 and its bifactor structure consisting of the subscales and a general factor for "psychological distress" have been systematically documented.[31] Items were evaluated using a 4-point scale ranging from "did not apply to me at all" scored as 0 points to "applied to me very much, or most of the time" as 3 points. The total and subscale scores were calculated, with higher scores signifying greater distress, depression, anxiety, and stress. The scoring range for classifying subscale severity is provided in the DASS manual.[27]

Sleep quality/disturbances were examined with the PSQI, which contains 19 items assessing the seven sleep indicators of subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.[28] The high reliability and validity of the PSQI have been demonstrated in clinical and non-clinical populations.[32] The items were evaluated using a 4-point scale ranging from "not during the past month/very good," which scored 0 points, to "three or more times a week/very bad," which scored 3 points. The total and component scores were calculated according to defined rules, with higher scores indicating worse sleep quality and more sleep dysfunction, respectively. A total PSQI score of overall sleep quality of 5 or higher indicates the presence of poor sleep.[28]

Statistical analyses

Statistical analyses were conducted using SPSS Statistics software version 28.0 (IBM SPSS, Inc.) with a significance level of 0.05, considered statistically significant.

TMD/somatic symptom groupings served as independent variables, and the BFI-10, DASS-21, and PSQI scores as dependent variables. Quantitative data were presented as frequencies and percentages and assessed using the chi-square test. Qualitative data were reported as means with SDs or medians with IQRs and tested for normality using the Shapiro-Wilk test. As the qualitative data exhibited non-normal distribution, they were assessed using Kruskal-Wallis/post-hoc Mann−Whitney U tests and Spearman rank order correlations. Correlation coefficients (r_s) were classified as weak, moderate, and strong based on cut-off points of 0.1, 0.4, and 0.7, respectively.[33] Univariate and multivariate logistic regression analyses were also performed to identify the risk factors associated with TMD symptoms. A stepwise variable selection method was employed for multivariate analysis using a significance threshold of $P < .10$ to remove insignificant factors. Outcomes were reported in terms of odds ratios (ORs) and corresponding 95% CIs.

RESULTS

From the initial pool of 501 potential participants, 45 and 91 were excluded due to ongoing medical treatments and incomplete surveys, respectively. The final sample consisted of 365 participants with a mean age of 22.5 ± 1.3 years, of whom 85.8% were women. Among all 365 participants, 22.2% and 19.5% were 5Ts-negative without (NN) and with somatization (NS), respectively, whereas 18.1% and 40.3% were 5Ts-positive without somatization (PN) and with somatization (PS), respectively. Although no significant variations were found in age, a significant difference in gender distribution was discerned, with the NS/PS groups (90.1/89.8%) containing a greater proportion of women than the NN/PN groups (77.8/81.8%; Table I).

Tables II and III show the mean/median personality dimensions and emotional and sleep disturbance scores for the various groups. Significant differences in conscientiousness (NN > PS) and neuroticism (PS, NS > PN, NN), as well as distress, depression, anxiety, and stress (PS, NS > PN, NN), were observed (Table II). Apart from sleep efficiency and use of sleep medication, considerable variations in total PSQI and sleep component scores were detected (Table III). Irrespective of TMD presence, participants with somatization exhibited significantly greater total PSQI, lower subjective sleep quality, higher sleep latency, higher sleep disturbance, and daytime dysfunction compared with those without somatization (PS, NS > PN, NN). Furthermore, the median total PSQI of both the PS and NS groups surpassed 5 points, indicating poor sleep quality.

The results of correlation and logistic regression analyses are shown in Tables IV and V. Distress, anxiety, stress, and overall sleep quality were moderately correlated with somatic but not TMD symptoms (r_s = 0.45-0.52). Additionally, moderate associations

Table I. Demographic characteristics of the study sample

		Age			*Gender*		
Variable	*No. (%)*	*Mean (SD)*	*Median (IQR)*	*P value* post hoc*	*Male n (%)*	*Female n (%)*	*P value†*
Total	365 (100)	22.46 (1.31)	22.0 (3)		52 (14.2)	313 (85.8)	
NN	81 (22.2)	22.70 (1.22)	23.0 (2)	0.177	18 (22.2)	63 (77.8)	.043‡
NS	71 (19.5)	22.23 (1.49)	22.0 (3)		7 (9.9)	64 (90.1)	
PN	66 (18.1)	22.45 (1.31)	22.0 (2)		12 (18.2)	54 (81.8)	
PS	147 (40.3)	22.45 (1.26)	22.0 (2)		15 (10.2)	132 (89.8)	

*Results of Kruskal−Wallis test.
†Results of chi-square test.
‡$P < .05$.*NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T*, quintessential 5 temporomandibular disorder symptoms.

Table II. Mean and median psychological variable scores for study groups

Psychological variable	*NN*	*NS*	*PN*	*PS*	*P value* post hoc*
Personality					
Openness (P1)					
Mean (SD)	6.19 (1.37)	6.28 (1.29)	5.92 (1.44)	6.50 (1.54)	.077
Median (IQR)	6.0 (2)	6.0 (2)	6.0 (2)	6.0 (2)	
Conscientiousness (P2)					
Mean (SD)	6.94 (1.60)	6.54 (1.17)	6.70 (1.36)	6.34 (1.23)	.011†
Median (IQR)	7.0 (2)	7.0 (1)	7.0 (2)	6.0 (2)	NN > PS
Extraversion (P3)					
Mean (SD)	7.0 (1.55)	7.04 (1.60)	7.02 (1.57)	6.70 (1.71)	.415
Median (IQR)	7.0 (2)	7.0 (2)	7.0 (2)	7.0 (3)	
Agreeableness (P4)					
Mean (SD)	7.12 (1.27)	7.20 (1.51)	7.42 (1.27)	6.97 (1.35)	.138
Median (IQR)	7.0 (2)	7.0 (2)	7.0 (1)	7.0 (2)	
Neuroticism (P5)					
Mean (SD)	6.12 (1.84)	7.01 (1.63)	6.36 (1.62)	7.06 (1.55)	< .001†
Median (IQR)	6.0 (2)	7.0 (2)	6.0 (3)	7.0 (2)	PS, NS > PN, NN
Emotional disturbance					
Total DASS (E1)					
Mean (SD)	9.95 (9.12)	16.83 (10.23)	10.08 (8.15)	17.20 (9.09)	< .001†
Median (IQR)	8.0 (13.5)	14.0 (14)	8.0 (12.5)	16.0 (12)	PS, NS > PN, NN
Depression (E2)					
Mean (SD)	2.17 (3.03)	4.15 (3.72)	2.15 (2.86)	3.75 (3.40)	< .001†
Median (IQR)	1.0 (4)	3.0 (5)	1.0 (3)	3.0 (4)	NS, PS > PN, NN
Anxiety (E3)					
Mean (SD)	3.06 (2.79)	5.27(3.43)	3.26 (2.93)	5.82 (3.34)	< .001†
Median (IQR)	3.0 (4)	5.0 (5)	3.0 (4)	5.0 (4)	PS, NS, > PN, NN
Stress (E4)					
Mean (SD)	4.72 (4.26)	7.41 (4.25)	4.67 (3.74)	7.63 (3.70)	< .001†
Median (IQR)	4.0 (6)	7.0 (5)	4.0 (6.25)	8.0 (5)	PS, NS > PN, NN†

*Results of Kruskal–Wallis and Mann–Whitney *U* tests.
†$P < .05$ and > denotes statistically significant differences between groups.*NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T*, quintessential 5 temporomandibular disorder symptoms.

were observed between neuroticism and distress, depression, anxiety, and stress (r_s = 0.44-0.61). Moderate-to-strong relationships were found among the different negative emotions (r_s = 0.60-0.80), and overall sleep quality was moderately associated with somatization, distress, anxiety, and stress (r_s = 0.46-0.52). Although univariate analysis revealed significant associations between the presence of TMD symptoms and somatization (OR, 1.13; 95% CI, 1.08-1.18), conscientiousness (OR, 0.85; CI, 0.72-0.99), anxiety (OR, 1.09; 95% CI, 1.02-1.16), and overall sleep quality (OR, 1.08; 95% CI, 1.01-1.16), multivariate analysis identified somatization (OR, 1.14; 95% CI, 1.08-1.20) as the primary risk factor.

DISCUSSION

The interplay of comorbidities between TMDs and somatization and their associations with personality traits and emotional and sleep disturbances were investigated in conjunction with an examination of the correlations between biopsychosocial variables and the determination of the risk factors for TMD symptoms. The first and second research hypotheses were supported, as 69.0% (147/213) of the 5Ts-positive participants had concurrent somatization, and these young adults with somatization exhibited significantly higher levels of neuroticism, depression, anxiety, stress, and poor sleep. Both the third and fourth hypotheses were partly supported, as somatization was moderately correlated with emotional and sleep disturbances but not neuroticism, and the presence of TMD symptoms was increased largely by somatization. The study focused on university students as a young adult population due to their significant life changes and susceptibility to psychological distress.[34] Furthermore, TMD signs/symptoms typically increase during adolescence and early adulthood and reach their peak between the ages of 20 and 40.[4,35]

Personality traits and emotional disturbances

Personality refers to the unique set of psychological traits and patterns of thoughts, feelings, and behaviors that distinguish a person from others. Although neuroticism had been linked to both TMDs and somatization, only the PS and NS groups, individuals with somatization, exhibited significantly higher levels of

Table III. Mean and median sleep variable scores for study groups

Variable	*NN*	*NS*	*PN*	*PS*	*P value* post hoc*
Sleep quality/disturbance					
Total PSQI (S1)	4.70 (2.23)	7.46 (3.28)	5.08 (2.84)	7.45 (3.0)	< .001†
Mean (SD)	4.0 (3)	7.0 (4)	4.0 (3)	7.0 (4)	PS, NS > PN, NN
Median (IQR)					
Subjective sleep quality (S2)	0.95 (0.50)	1.24 (0.55)	0.88 (0.57)	1.39 (0.68)	< .001†
Mean (SD)	1.0 (0)	1.0 (1)	1.0 (0)	1.0 (1)	PS, NS > NN, PN
Median (IQR)					
Sleep latency (S3)	1.12 (1.04)	1.69 (1.05)	1.26 (1.11)	1.69 (0.97)	< .001†
Mean (SD)	1.0 (2)	2.0 (1)	1.0 (2)	2.0 (1)	NS, PS > PN, NN
Median (IQR)					
Sleep duration (S4)	0.90 (0.80)	1.20 (0.82)	0.67 (0.66)	1.10 (0.84)	< .001†
Mean (SD)	1.0 (1)	1.0 (1)	1.0 (1)	1.0 (0)	NS, PS > PN
Median (IQR)					NS > NN
Sleep efficiency (S5)	0.33 (0.65)	0.24 (0.64)	0.33 (0.69)	0.27 (0.59)	.564
Mean (SD)	0 (0.5)	0 (0)	0 (0)	0 (0)	
Median (IQR)					
Sleep disturbance (S6)	0.75 (0.43)	1.72 (1.97)	1.17 (1.02)	1.41 (1.32)	< .001†
Mean (SD)	1.0 (0.5)	1.0 (0)	1.0 (0)	1.0 (1)	NS, PS > PN> NN
Median (IQR)					
Use of sleep medication (S7)	0.01 (0.11)	0.06 (0.23)	0.03 (0.25)	0.07 (0.30)	.257
Mean (SD)	0(0)	0 (0)	0 (0)	0(0)	
Median (IQR)					
Daytime dysfunction (S8)	0.63 (0.83)	1.32 (1.03)	0.74 (0.77)	1.52 (1.08)	< .001†
Mean (SD)	0 (1)	1.0 (1)	1.0 (1)	1.0 (1)	PS, NS > PN, NN
Median (IQR)					

*Results of Kruskal–Wallis and Mann–Whitney *U* tests.
†$P < .05$ and > denotes statistically significant differences between groups.*NN*, 5Ts-negative without somatization; *NS*, 5Ts-negative with somatization; *PN*, 5Ts-positive without somatization; *PS*, 5Ts-positive with somatization; *5T*, quintessential 5 temporomandibular disorder symptoms; *PSQI*, Pittsburgh Sleep Quality Index.

neuroticism than the NN group, controls without TMDs or somatization.[21,22] As neuroticism entails a disposition toward experiencing negative emotions; these findings corroborated the notably greater distress, depression, anxiety, and stress observed in the PS and NS groups compared with the PN and NN groups.

Given the pervasiveness of somatization among patients with TMD (up to 77%) and the high

Table IV. Correlations among physical, psychological, and sleep variables

Variable	*TT*	*TS*	*P1*	*P2*	*P3*	*P4*	*P5*	*E1*	*E2*	*E3*	*E4*
TT	-	-	-	-	-	-	-	-	-	-	-
TS	0.36*	-	-	-	-	-	-	-	-	-	-
P1	0.04	0.16*	-	-	-	-	-	-	-	-	-
P2	−0.10*	−0.18*	-0.24*	-	-	-	-	-	-	-	-
P3	0.01	0.03	-0.15*	0.17*	-	-	-	-	-	-	-
P4	−0.03	−0.03	0.01	−0.01	0.08	-	-	-	-	-	-
P5	0.08	0.23*	0.26*	-0.25*	-0.30*	-0.02	-	-	-	-	-
E1	0.16*	0.48*,†	0.31*	-0.29*	0.28*	-0.03	0.59*,†	-	-	-	-
E2	0.07	0.39*	0.28*	-0.28*	-0.33*	-0.06	0.44*,†	0.82*,†	-	-	-
E3	0.21*	0.47*,†	0.28*	-0.24*	-0.19*	0.01	0.51*,†	0.89*,†	0.60*,†	-	-
E4	0.14*	0.45*,†	0.28*	-0.25*	-0.23*	-0.03	0.61*,†	0.95*,†	0.69*,†	0.80*,†	-
S1	0.15*	0.52*,†	0.21*,†	-0.20*	−0.11*	-0.02	0.25*	0.48*,†	0.38*	0.46*,†	0.46*,†

Results of Spearman's correlation.
TT, total number of temporomandibular disorder symptoms; *TS*, total Patient Health Questionnaire-15 score; Personality: *P1*, openness; *P2*, conscientiousness; *P3*, = extraversion; *P4*, agreeableness; *P5*, neuroticism; Emotional disturbance: *E1*, total Depression Anxiety Stress-Scales-21 score (psychological distress); *E2*, depression; *E3*, anxiety; *E4*, stress and sleep quality/disturbance; *S1*, Pittsburgh Sleep Quality Index (overall sleep quality).
**P* < .01
†Correlation coefficient >0.4.

Table V. Risk factors for temporomandibular disorder symptoms in Southeast Asian young adults

Variable	Univariate Odds ratio (95% CI)	P value*	Multivariate Odds ratio (95% CI)	P value†
Gender				
Male	Reference			
Female	1.36 (0.75-2.44)	0.311		
Somatization	1.13 (1.08-1.18)‡	< .001‡	1.14 (1.08-1.20)‡	< .001‡
Personality				
Openness	1.04 (0.90-1.21)	0.563		
Conscientiousness	0.85 (0.72-0.99)‡	0.037‡		
Extraversion	0.92 (0.81-1.05)	.919		
Agreeableness	0.98 (0.84-1.14)	.753		
Neuroticism	1.11 (0.98-1.26)	.089		
Emotional disturbance				
General distress (total DASS)	1.02 (0.99-1.04)	.079		
Depression	1.01 (0.95-1.08)	.667		
Anxiety	1.09 (1.02-1.16)‡	.01‡		
Stress	1.04 (0.99-1.10)	.098		
Sleep				
Overall sleep quality (total PSQI)	1.08 (1.01-1.16)‡	.032‡		

*Results of univariate analysis.
†Results of multivariate logistic regression analysis.
‡$P < .05$. *PSQI*, Pittsburgh Sleep Quality Index; *DASS;* Depression Anxiety Stress-Scales-21.

percentage of young adults with TMDs in this study (69.0%), it is plausible that emotional disturbances associated with TMDs might stem from somatization tendencies rather than the TMDs themselves.[7,8] This possibility is supported by the moderate correlations between distress, anxiety, and stress observed with somatic but not TMD symptoms. Collectively, the aforementioned findings suggest that TMDs are a form of functional somatic/central sensitization syndromes and explain the high frequencies of concomitant chronic pain conditions in patients with TMD.[19,18] As a personality trait, conscientiousness is characterized by self-discipline and goal-directed behaviors. Individuals with comorbid TMDs and somatization (PS group) presented significantly lower levels of conscientiousness than controls (NN group). This may be partly explained by pain-related disabilities/interferences, which are also related to the emotional disturbances that often accompany TMDs/somatization.[36]

Sleep quality/disturbances

The relationship between TMDs and poor sleep has been widely documented.[10,11] Nevertheless, whether this phenomenon can be attributed mainly to TMDs or the consequences of somatization and emotional disturbances remains to be ascertained. As with emotional disturbances, significant differences in overall sleep quality and most sleep components were found between individuals with somatization (PS and NS groups) and without somatization (PN and NN groups), irrespective of TMD presence. Overall, sleep quality was moderately correlated with somatization, distress, anxiety, and stress. The association between sleep quality and TMD symptoms, albeit significant, was weak, inferring that sleep impairments associated with TMDs are influenced largely by somatization and emotional disturbances. Sleep−pain, and sleep−emotion interactions are highly complex, and bidirectional relationships involving both linear and circular models with mutually deleterious effects have been proposed.[37,38] The somewhat weaker relationship between sleep quality and depression may be underpinned by the generally normal levels of depression (0-4 points) in the study cohort.

Risk factors for TMD symptoms

Univariate analysis indicated that somatization, anxiety, and sleep disturbances increased the risk of experiencing TMD symptoms by 13%, 9%, and 8%, respectively, whereas conscientiousness reduced the risk by 15%. The triad of bodily pains, psychological distress, and sleep disturbances was also found to predict the onset of painful TMDs in the multicenter Orofacial Pain: Prospective Evaluation and Risk Assessment study, which recommended a multisystem approach for evaluating TMDs.[39] Individuals high in conscientiousness are likely to show greater commitment to self-management interventions and the adoption of functional coping strategies, leading to a potential reduction in TMD symptoms.[40,41] After adjustment for confounding variables, multivariate analysis identified somatization as the primary risk factor, increasing the odds of TMD symptoms by 14% in non-clinical young adults.

Although somatization appears to be linked with attentional and perceptual aspects of symptoms, emotional disturbances are more closely related to behavioral characteristics.[42] Persons with TMDs should thus be routinely screened for somatization and co-existing psychological distress, which can complicate the diagnostic process and affect treatment approaches as well as outcomes.[43] Additionally, pharmacologic and psychological treatments for somatization and somatoform disorders, including anti-depressants, cognitive behavioral therapy, and mindfulness therapy, might be beneficial for TMD management.[44]

Study limitations

This analytical observational study was subject to several limitations. First, the use of a cross-sectional design did not permit temporal and causal inferences to be made. Although personality traits remain relatively stable, TMD symptoms, somatization tendencies, and emotional and sleep disturbances can fluctuate over time. Consequently, a prospective cohort investigation should ideally be performed to explore the dynamic changes. Second, the study population comprised only young adults, with a notable preponderance of women, who are more susceptible to TMDs and somatization.[5,45] The gender imbalance in respondents can be ascribed to the higher proclivity of women to engage in online surveys than men.[46] Future research endeavors could incorporate more men in addition to other age and racial groups, and these findings must be validated in patients with TMD. Third, participants with TMD pain-related and intra-articular symptoms were not distinguished from all participants. The interplay between somatization and emotional and sleep disturbances may vary among young adults experiencing painful and non-painful TMD symptoms. Finally, the study measures relied on self-reporting, which could have introduced potential sources of information bias. In addition to recall and social desirability bias, confirmation bias and other forms of partiality may also have occurred.[47]

CONCLUSIONS

In this study of the young adults with TMDs, approximately seven-tenths had comorbid somatization. Regardless of the presence of TMDs, the participants with somatization experienced substantially higher levels of neuroticism, distress, depression, anxiety, and stress and experienced poorer sleep than those without somatization. Distress, anxiety, stress, and overall sleep quality were moderately correlated with somatic but not with TMD symptoms. Whereas the univariate model suggested that the triad of somatization, psychological distress (specifically anxiety), and sleep disturbance increased the risk of experiencing TMD symptoms, stepwise multivariate analysis identified somatization as the primary and most influential risk factor. Therefore, somatization may underlie emotional disturbances and poor sleep associated with TMDs. Routine screening for somatization and concurrent psychological distress in TMD patients is strongly recommended. This proactive approach can help mitigate diagnostic complications, enhance treatment planning, and ultimately lead to improved treatment outcomes.

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DECLARATION OF INTEREST

None.

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