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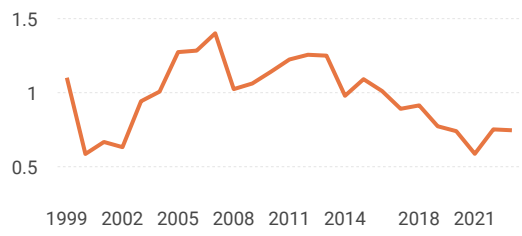

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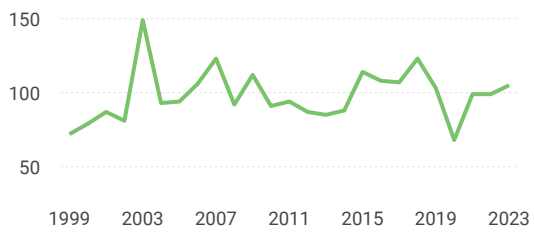

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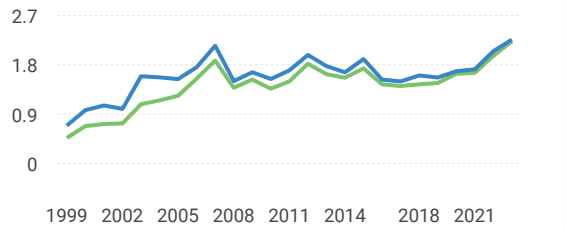

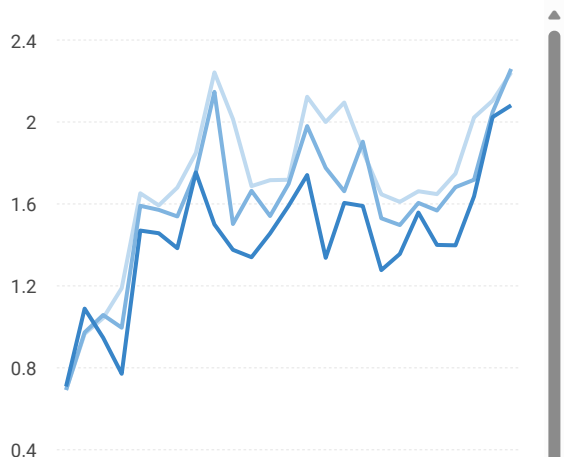

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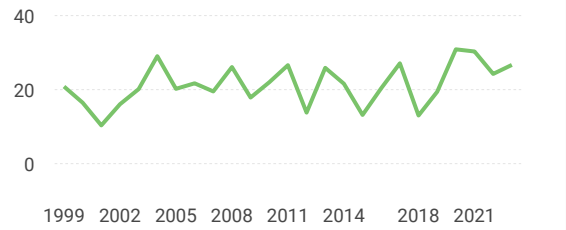

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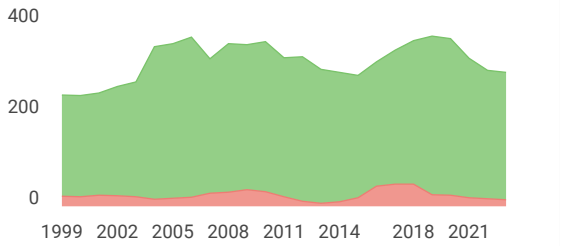

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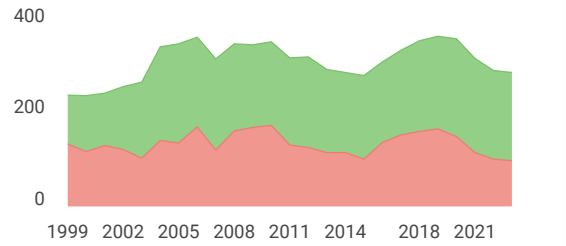

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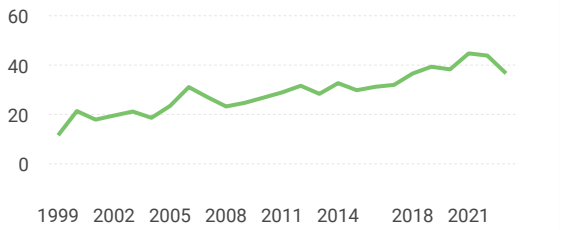

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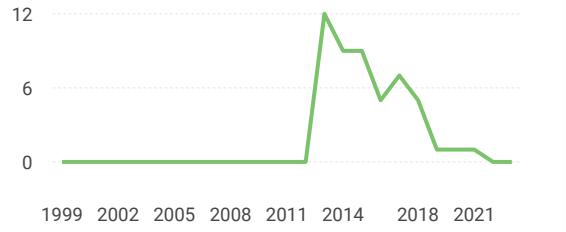

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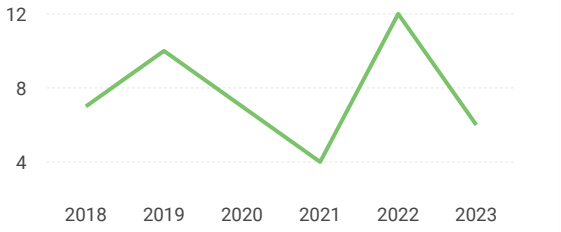

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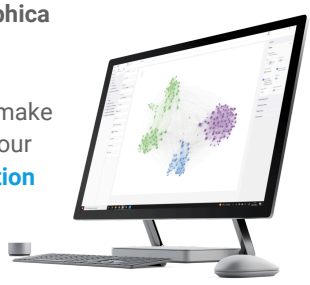

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Psychologic Factors in Temporomandibular Disorders and Somatization: A Multidimensional Analysis of Personality, Coping, and Distress Among Young Adults

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Purpose: To analyze the association of temporomandibular disorders (TMDs) and somatic symptoms with the psychologic variables of personality, coping, and distress in young adults. Physical and psychologic correlates were also explored, along with the risk factors for TMDs/somatization. ***Materials and Methods:*** Participants were enlisted from a local university, and the presence of TMDs and somatic symptoms was determined with the Short-form Fonseca Anamnestic Index and Patient Health Questionnaire-15. The psychologic variables of personality, coping, and distress were assessed with the Big-Five Personality Inventory-10; brief-COPE Inventory; and Depression, Anxiety, Stress Scales-21, respectively. Statistical evaluations were performed with Mann-Whitney *U* test, Spearman correlation, and logistic regression analyses (α = .05). ***Results:*** Among the 455 participants (mean age: 22.7 ± 1.2 years), 18.2% and 5.7% had TMDs and medium-to-high somatization, respectively. Participants with TMDs exhibited substantially higher somatization and psychologic distress scores than those with no TMDs. Significant differences in TMDs, conscientiousness, extraversion, and psychologic distress scores were observed between participants with no-to-mild and medium-to-high somatization. The association between TMD and somatization scores was weak but significant. Neuroticism and dysfunctional coping style were moderately correlated to general distress, depression, anxiety, and stress (rs = 0.44 to 0.62). ***Conclusions:*** Findings suggest that anxiety is the main risk factor for the presence of TMDs and medium-to-high somatization in nonclinical young adults, while conscientiousness is a protective factor for somatization.
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Temporomandibular disorders (TMDs) comprise a cluster of musculoskeletal conditions affecting the stomatognathic system. Classically described TMD features include temporomandibular joint (TMJ)/masticatory muscle pain, TMJ sounds, and limited or deviated jaw movements.[1,2] TMD prevalence ranges from 6% to 16% based on protocolized diagnostic criteria and ≤ 75% of the general population have TMD signs/symptoms.[3,4] They can be broadly divided into pain-related and intra-articular conditions.[5] Women, particularly those of reproductive age, are at higher risk of TMDs.[6,7] TMDs can negatively affect both the quality of sleep and life.[8,9] The multifactorial etiology of TMDs and their adherence to the "biopsychosocial model of illness" has been confirmed by various studies.[10,11] Among the psychologic variables implicated are somatization, psychologic distress, personality, and coping.[11–15]

High prevalence and levels of somatization (expression of psychologic distress through somatic symptoms), depression, anxiety, and stress were observed in clinical

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and nonclinical samples with TMDs.[12–14,16,17] The importance of psychologic distress in the etiology of TMDs, as well as the strong correlation between TMDs and somatic symptoms, has led some to posit that TMDs are a type of "central sensitization syndrome" that encompass conditions such as fibromyalgia, chronic fatigue, and irritable bowel syndromes.[18,19] East and Southeast Asians appear to be more susceptible to somatization due to the stigma, interpersonal sensitivity, and low social support accompanying mental illness.[17,20,21]

In addition to psychologic distress, personality and coping have also been linked to TMDs and somatization.[15,22,23] Personality is the set of traits and distinctive patterns of thoughts, feelings, and behaviors that makes a person unique, whereas coping is the set of predictable strategies that a person uses to minimize stress and reduce negative emotions. Personality traits and coping styles have independent and interactive effects on the way psychologic distress is controlled and relieved.[24] People with TMDs were reported to have "distressed" and "neurotic" (propensity toward negative affect and self-doubt) personality traits.[15,25,26] Furthermore, they had also been found to employ more dysfunctional coping behaviors.[15,27,28] Nevertheless, studies in this area are infrequent, and only one addressed all three interrelated psychologic variables concurrently in a small cohort of TMD patients.[15]

With these premises, the present study's objectives were to analyze the association of TMD and somatic symptoms with the psychologic variables of personality, coping, and distress in a nonclinical community-based sample of young adults. Physical and psychologic correlates were also explored along with the psychologic predictors of TMDs and somatization. The research hypotheses were: *(a)* young adults with TMD and somatic symptoms have certain personality traits and dispositional coping styles as well as higher levels of psychologic distress, *(b)* the various physical and psychologic variables are correlated, and *(c)* the presence of TMDs and somatization are associated with specific psychologic risk factors.

MATERIALS AND METHODS

Study Design and Participants

Approval for this study was granted by the ethics committee of the Faculty of Dentistry, Universitas Trisakti (project number: 013/S3/KEPK/FKG/9/2021). Potential participants were recruited from young adults attending a local university either via public internet postings or in-person invitations. A nonprobabilistic voluntary sampling method was applied. The inclusion criteria were individuals aged 18 to 24 years old and proficient in the English language. The exclusion criteria were individuals with prior orofacial trauma/orthognathic surgery, uncontrolled autoimmune or metabolic diseases, major psychiatric disorders, and drug/substance abuse. At least 363 participants were required for the study based on an estimated TMD prevalence of 60%, 95% CI level, 5% margin of error, and a student enrollment of 20,638 students.[16] All potential participants were provided with the study information and informed consent was obtained from eligible individuals. An online survey comprising demographic information; the Short-form Fonseca Anamnestic Index (SFAI); Patient Health Questionnaire-15 (PHQ-15); Big Five Personality Inventory-10 (BFI-10); brief-COPE (Coping Orientations to Problems Experienced) Inventory (BCI); and Depression, Anxiety, Stress-Scales-21 (DASS-21) were subsequently administered.[29–33] Participants were given the survey link and completed the questionnaires independently.

Physical Symptom Measures

The presence of TMDs was determined with the SFAI, which contains two pain (TMJ and masticatory muscle pain) and three function-related (TMJ sounds, opening, and side-movement difficulties) items. The SFAI demonstrated high accuracy (AUC 0.97–0.99), sensitivity (91% to 98%), and specificity (93% to 97%) for pain and/or intra-articular conditions when referenced to the DC/TMD standard.[29] Recently, its reliability and validity for identifying people with TMDs (as determined by the DC/TMD) were independently confirmed.[34] The items are scored using the following response scale: "no" = 0 points, "sometimes" = 5 points, and "yes" = 10 points. Total SFAI scores ≥ 15 points indicate the presence of TMDs with higher scores suggesting greater TMD symptom severity.

The presence of somatization was ascertained with the PHQ-15 which comprises the 15 most common "DSM-IV somatization disorder" somatic symptoms.[30,35] The psychometric properties of the PHQ-15 are well recognized, and it has been incorporated into Axis II of the DC/TMD.[5,36] The items are scored using the following three-point Likert scale: "not bothered at all" = 0 points, "bothered a little" = 1 point, and "bothered a lot" = 2 points. Total PHQ-15 scores of 5, 10, and 15 points indicate low, medium, and high somatic symptom severity respectively.[30] Participants were then dichotomized into "no TMDs" (NT) and with TMDs" (WT) in addition to "no-to-low" (NL) and "medium-to-high" (MH) somatization groups. Both SFAI and PHQ-15 were appraised over 30 days.

Psychologic Measures

Personality was evaluated with the BFI-10, which consists of two items for each of the "big five" personality dimensions, namely, openness, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN).[31] The BFI-10 has been validated for investigating both

Table 1 Demographic Characteristics of the Study Sample

		Age			Gender		
Variable	n (%)	Mean (SD)	Median (IQR)	*P**	Male n (%)	Female n (%)	*P***
Total	455 (100)	22.5 (1.2)	22.0 (2)	–	66 (14.5)	389 (85.5)	–
TMDs: SFAI							
NT	372 (81.8)	22.5 (1.2)	23.0 (2)	.409	55 (14.8)	317 (85.2)	.863
WT	83 (18.2)	22.4 (1.2)	22.0 (3)		11 (13.3)	72 (86.7)	
Somatization: PHQ-15							
NL	429 (94.3)	22.5 (1.2)	23.0 (2)	< .001	61 (14.2)	368 (85.8)	.563
MH	26 (5.7)	21.5 (1.5)	21.0 (2)		5 (19.2)	21 (80.8)	

*Indicates Mann-Whitney *U* tests $P < .05$.
**Indicates chi-square test $P < .05$.

between-person traits and within-person processes.[37] The items are scored using a five-point Likert scale ranging from "disagree strongly" = 1 point to "agree strongly" = 5 points, with an item in each dimension assessed in reverse. Dimension scores are calculated with higher scores indicating greater partiality toward the specific trait.

Dispositional coping styles were explored with BCI, which has two items for each of the fourteen coping strategies employed in response to daily life stresses.[32] The BCI is widely used for measuring coping and attempts to condense it has yielded contentious factor structures.[38] The items are scored using a four-point Likert scale ranging from "I haven't been doing this at all" = 1 point to "I've been doing this a lot" = 4 points. The different strategies are categorized into the following three coping styles: problem-focused coping (active coping, instrumental support, and planning), emotion-focused (acceptance, emotional support, humor, positive reframing, and religion), and dysfunctional coping (behavioral disengagement, denial, self-distraction, self-blame, substance use, and venting).[32,39] Coping style scores are derived by totaling the respective strategy scores. Higher coping style scores indicate more extensive use of functional (problem and emotion-focused) and dysfunctional coping strategies.

Psychologic distress was examined with the DASS-21, which includes seven items for each of the emotional subscales, namely, depression, anxiety, and stress.[33] The good measurement properties of the DASS-21 are also well-established. Additionally, the DASS-21 has been shown to have a bifactor structure consisting of a general factor for distress (negative affect) and the three subscales.[40] The items are scored using a four-point Likert scale ranging from "did not apply to me at all" = 0 points to "applied to me very much, or most of the time" = 3 points. Total and subscale DASS-21 scores are calculated with greater scores indicating higher levels of general distress (total DASS-21), depressive, anxiety, and stress symptoms. The cut-off points for the various subscale severity classification (normal to extremely severe) are presented in the DASS manual.[33]

Statistical Assessment

Statistical evaluations were carried out using the Statistical Package for the Social Sciences software version 27.0 (IBM) with a significance level of .05. Categorical data were presented as frequencies with percentages and analyzed using chi-square tests. Numerical data were presented as means/medians with SDs/interquartile ranges (IQRs) and analyzed for normality using Kolmogorov-Smirnov test. Because non-normal distributions were observed, numerical data were assessed using Mann-Whitney *U* tests and Spearman rank-order correlation. Correlation coefficients (rs) of 0.1, 0.4, and 0.7 indicate weak, moderate, and strong associations between the various variables.[41] Univariate and multivariate logistic regression analyses were conducted to identify the risk factors for the presence of TMDs and medium-to-high somatization. A step-wise variable selection procedure was employed with a threshold of $P < .10$ for removing insignificant ones. Outcomes were presented as odds ratios (ORs) together with 95% CIs.

RESULTS

Out of a total of 487 young adults who signed up for the study, 32 were declined because they met the exclusion criteria. The mean age of the remaining 455 participants was 22.7 ± 1.2 years and 85.5% were women. TMDs and medium-to-high somatization were present in 18.2% and 5.7% of the study sample respectively. While age and gender distribution between the NT and WT groups did not vary considerably, the NL group was considerably older than the MH group (Table 1).

Table 2 Physical and Psychologic Variable Scores for NT and WT Groups

Physical/psychologic variable		NT	WT	*P**	Differences
Somatization	PHQ-15 scores				
	Mean	3.9 (3.1)	5.7 (4.1)		
	Median	4.0 (4)	5.0 (4)	**< .001**	**WT > NT**
Personality	Openness				
	Mean	6.3 (1.4)	6.5 (1.5)		
	Median	6.0 (2)	6.0 (2)	.478	
	Conscientiousness				
	Mean	6.7 (1.4)	6.4 (1.2)		
	Median	7.0 (2)	6.0 (1)	.064	
	Extraversion				
	Mean	6.9 (1.7)	6.8 (1.6)		
	Median	7.0 (2)	7.0 (2)	.794	
	Agreeableness				
	Mean	7.1 (1.4)	7.0 (1.4)		
	Median	7.0 (2)	7.0 (2)	.463	
	Neuroticism				
	Mean	6.7 (1.7)	7.01 (1.7)		
	Median	7.0 (2)	7.0 (2)	.082	
Coping styles	Problem-focused				
	Mean	17.9 (3.2)	17.4 (3.7)		
	Median	18.0 (4)	18.0 (5)	.360	
	Emotion-focused				
	Mean	28.1 (4.7)	27.8 (5.1)		
	Median	28.0 (6)	28.0 (6)	.708	
	Dysfunctional				
	Mean	23.6 (4.3)	24.5 (4.6)		
	Median	23.0 (6)	25.0 (7)	.080	
Psychologic distress	General				
	Mean	13.8 (9.9)	17.5 (10.1)		
	Median	12.0 (14)	16.0 (13)	**.001**	**WT > NT**
	Depression				
	Mean	3.2 (3.5)	3.8 (3.5)		
	Median	2.0 (4)	3.0 (4)	**.045**	**WT > NT**
	Anxiety				
	Mean	4.4 (3.4)	6.1 (3.6)		
	Median	4.0 (4)	6.0 (5)	**< .001**	**WT > NT**
	Stress				
	Mean	6.3 (4.3)	7.5 (4.2)		
	Median	6.0 (6)	7.0 (7)	**.012**	**WT > NT**

Values are expressed as means (SD) and medians (IQR). Bold indicates $P < .05$.
*Mann-Whitney *U* test.

Tables 2 and 3 show the mean and median physical and psychologic variable scores for the different groups. The WT group had substantially greater PHQ-15 scores than the NT group. While variations in personality dimension and coping style scores were insignificant, the WT group exhibited considerably higher general distress, depression, anxiety, and stress scores than the NT group.

Table 3 Physical and Psychologic Variable Scores for the NL and MH Somatization Groups

Physical/psychologic variable		NL	MH	*P**	Differences
TMD	SFAI scores				
	Mean	6.1 (8)	11.2 (8.9)	**.001**	MH > NL
	Median	5.0 (10)	10.0 (10)		
Personality	Openness				
	Mean	6.3 (1.5)	6.7 (1.2)		
	Median	6.0 (2)	7.0 (1)	.101	
	Conscientiousness				
	Mean	6.6 (1.4)	5.9 (0.9)		
	Median	7.0 (2)	6.0 (1)	**.001**	NL > MH
	Extraversion				
	Mean	6.9 (1.7)	6.2 (1.3)		
	Median	7.0 (2)	6.0 (2)	**.022**	NL > MH
	Agreeableness				
	Mean	7.1 (1.4)	6.8 (1.4)		
	Median	7.0 (2)	7.0 (3)	.211	
	Neuroticism				
	Mean	6.7 (1.7)	7.2 (1.3)		
	Median	7.0 (2)	7.0 (2)	.158	
Coping styles	Problem-focused				
	Mean	17.8 (3.3)	16.9 (3.3)		
	Median	18.0 (4)	17.5 (5)	.156	
	Emotion-focused				
	Mean	28.2 (4.8)	26.7 (5.2)		
	Median	28.0 (6)	26.0 (8)	.089	
	Dysfunctional				
	Mean	23.7 (4.4)	24.7 (3.9)		
	Median	23.0 (7)	25.0 (7)	.220	
Psychologic distress	General				
	Mean	14.2 (1.0)	19.7 (10.3)		
	Median	13.0 (13)	19.0 (12)	**.004**	MH > NL
	Depression				
	Mean	3.2 (3.5)	4.9 (3.4)		
	Median	2.0 (4)	5.0 (5)	**.004**	MH > NL
	Anxiety				
	Mean	4.6 (3.4)	6.7 (4.1)		
	Median	4.0 (4)	6.0 (5)	**.005**	MH > NL
	Stress				
	Mean	6.4 (4.3)	8.2 (3.8)		
	Median	6.0 (6)	7.5 (4)	**.022**	MH > NL

Values are expressed as means (SD) and medians (IQR). Bold indicates $P < .05$.
*Mann-Whitney *U* test.

Table 4 Correlations Between Physical and Psychologic Variables

Variable	SFAI	PHQ-15	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
SFAI	-	-	-	-	-	-	-
PHQ-15	0.21*	-	-	-	-	-	-
Openness	0.05	0.02	-	-	-	-	-
Conscientiousness	–0.13*	–0.15*	–0.23**	-	-	-	-
Extraversion	–0.05	–0.08	–0.15**	0.18**	-	-	-
Agreeableness	–0.06	–0.11*	0.03	0.01	0.09	-	-
Neuroticism	0.11*	0.14**	0.22**	–0.21**	–0.28**	–0.01	-
Problem-focused	–0.04	–0.07	–0.06	0.17**	0.13**	0.04	–0.10**
Emotion-focused	–0.02	–0.05	–0.09	0.09	0.19**	0.11*	–0.15**
Dysfunction	0.08	0.18**	0.16**	–0.18**	–0.06	–0.10*	0.24**
General	0.15*	0.26**	0.27**	–0.26**	–0.29**	–0.04	**0.59****
Depression	0.10*	0.22**	0.25**	–0.26**	–0.34**	–0.08	**0.46****
Anxiety	0.18**	0.27**	0.23**	–0.22**	–0.19**	0.01	**0.51****
Stress	0.13*	0.26**	0.24**	–0.22**	–0.24**	–0.05	**0.62****

Variable	Problem-focused	Emotion-focused	Dysfunctional	General	Depression	Anxiety
SFAI	-	-	-	-	-	-
PHQ-15	-	-	-	-	-	-
Openness	-	-	-	-	-	-
Conscientiousness	-	-	-	-	-	-
Extraversion	-	-	-	-	-	-
Agreeableness	-	-			-	-
Neuroticism	-	-	-	-	-	-
Problem-focused	-	-	-	-	-	-
Emotion-focused	**0.73****	-	-	-	-	-
Dysfunction	0.36**	0.32**	-	-	-	-
General	0.02	–0.03	**0.50****	-	-	-
Depression	–0.10*	–0.10*	**0.45****	**0.84****	-	-
Anxiety	0.08	0.04	**0.44****	**0.88****	**0.60****	-
Stress	0.05	–0.01	**0.47****	**0.95****	**0.71****	**0.79****

Results of Spearman correlation. Bold indicates correlation coefficient > 0.4.
*$P < .05$.
**$P < .01$.

The MH group had substantially greater SFAI scores than the NL group. Significant differences in conscientiousness and extraversion scores, but not coping style scores, were discerned. The MH group had considerably higher general distress, depression, anxiety, and stress scores than the NL group.

Tables 4 and 5 display the outcomes of correlational and regression analyses. The correlation between SFAI and PHQ-15 scores, although significant, was weak (rs = 0.21) as with their associations with general distress, depression, anxiety, and stress (rs = 0.13–0.27). Neuroticism and dysfunctional coping style were moderately associated with general distress, depression, anxiety, and stress (rs = 0.44–0.62).

Strong correlations were noted between the two functional coping styles (problem and emotion-focused coping), as well as between general distress and all three DASS-21 subscales (rs = 0.73–0.95). While univariate exploration showed that TMDs were related to general distress, anxiety, and stress, multivariate analysis indicated that only anxiety (OR = 1.15; 95% CI = 1.07–1.22) was a risk factor for the presence of TMDs. Conscientiousness, extraversion, general distress, depression, anxiety, and stress were all related to somatic symptoms with the univariate model. However, multivariate analysis indicated that conscientiousness (OR = 0.70; 95% CI = 0.51–0.95) and anxiety (OR = 1.13; 95% CI = 1.02–1.26) were protective and risk

Table 5 Risk Factors for the Presence of TMDs and Medium-to-High Somatization

		Univariate		Multivariate	
Risk factor		OR (95% CI)	*P**	OR (95% CI)	*P***
Presence of TMDs					
Gender	Male	Reference			
	Female	1.14 (0.57–2.28)	.720		
Personality	Openness	1.10 (0.93–1.30)	.273		
	Conscientiousness	0.86 (0.71–1.02)	.081		
	Extraversion	0.98 (0.84–1.13)	.739		
	Agreeableness	0.95 (0.81–1.14)	.601		
	Neuroticism	1.13 (0.98–1.31)	.091		
Coping	Problem-focused	0.89 (0.72–1.10)	.299		
	Emotion-focused	0.93 (0.73–1.19)	.932		
	Dysfunctional	1.34 (0.97–1.85)	.077		
Psychologic distress	General	1.04 (1.01–1.06)	**.003**		
	Depression	1.05 (0.99–1.12)	.131		
	Anxiety	1.15 (1.07–1.22)	**< .001**	**1.15 (1.07–1.22)**	**< .001**
	Stress	1.07 (1.01–1.12)	**.014**		
Presence of MH somatization					
Gender	Male	Reference			
	Female	0.70 (0.25–1.92)	.696		
Personality	Openness	1.23 (0.94–1.61)	.140		
	Conscientiousness	**0.64 (0.47–0.87)**	**.004**	**0.70 (0.51–0.95)**	**.021**
	Extraversion	**0.76 (0.59–0.97)**	**.030**		
	Agreeableness	0.83 (0.62–1.11)	.209		
	Neuroticism	1.20 (0.94–1.53)	.150		
Coping	Problem-focused	0.80 (0.56–1.13)	.197		
	Emotion-focused	0.73 (0.48–1.09)	.122		
	Dysfunctional	1.35 (0.80–2.29)	.263		
Distress	General	**1.05 (1.01–1.09)**	**.007**		
	Depression	**1.12 (1.02–1.23)**	**.018**		
	Anxiety	**1.16 (1.05–1.28)**	**.003**	**1.13 (1.02–1.26)**	**.021**
	Stress	**1.09 (1.00–1.19)**	**.043**		

Results of univariate and multivariate logistic regression analyses. Bold indicates $P < .05$.

factors for the presence of medium-to-high somatization correspondingly.

DISCUSSION

The present study is the first to establish the association of TMD and somatic symptoms with the psychologic variables of personality, coping, and distress in nonclinical community-based young adults. All three research hypotheses were partly supported because participants with TMD/somatic symptoms exhibited particular personality traits or greater psychologic distress, certain psychologic variables were moderate to strongly correlated, and anxiety was a risk factor for both TMDs and somatization. Young adults were chosen because they represented the bulk of TMD patients and the peak age for the occurrence of TMD symptoms.[2,42] In addition, university students were identified because they have high levels of life, social, and academic stress as well as high rates of psychologic distress.[43] Because somatic symptoms are frequently experienced by the general population, participants were dichotomized into no-to-low and medium-to-high somatization groups.[44,45] Personality and coping can play both independent and interactive roles in influencing physical and psychologic symptoms and thus were analyzed synchronously together with general distress, depression, anxiety, and stress.[46]

TMDs and Psychologic Variables

The prevalence of TMDs observed with the SFAI was consistent with that reported for the general population when established with protocolized diagnostic criteria.[3] While personality dimension and coping style scores were statistically insignificant, participants with TMDs had substantially higher total and subscale DASS-21 scores than their peers without TMDs. Therefore, personality and coping may not have much bearing on the manifestation of TMD symptoms when compared to psychologic distress. Stress is the feeling of emotional or physical tension in response to pressure or adversity, whereas anxiety and depression are the persistent feelings of unease or apprehension and low mood and despair, respectively. Although significant differences in all psychologic distress variables were discerned between the WT and NT groups, the univariate model indicated that only general distress, anxiety, and stress were associated with TMDs. This result can be attributed to the largely normal level of depression (0 to 4 points) detected in the young adults examined.

The few studies conducted in clinical samples yielded disparate results with TMD patients having more "neurotic" personalities and dysfunctional or maladaptive coping styles.[15,26–28] Ferrando et al,[15] who explored all three psychologic variables concurrently, found that neuroticism (the tendency to experience negative emotions) and depression featured predominantly in TMD patients with muscle disorders, whereas conscientiousness was present in those with joint disorders. Furthermore, patients with muscle disorders also used functional coping strategies less regularly than the control group. The discrepancy in findings could be ascribed in part to the greater prevalence and severity of depression and anxiety among TMD patients, which is thought to be closely related to personality traits and mediated by dispositional coping.[12–14,24] In addition to normal levels of depression, the nonclinical young adults with TMDs presented only moderate anxiety (6 to 7 points) and mild stress (8 to 9 points).

Somatization and Psychologic Variables

About 6% of the participants reported medium-to-high somatic symptoms, which was comparable to the estimated 8% prevalence of somatic symptom disorder in general practice.[47] Though substantial variations in conscientiousness (the tendency to be self-disciplined, well-organized, and goal-oriented), extraversion (the tendency to be friendly and outgoing), total, and subscale DASS-21 scores were noted between the NL and MH groups, no significant differences in coping style scores were perceived. The univariate analysis yielded similar results. Hence, dispositional coping styles may play a lesser role in the manifestation of somatic symptoms. Participants with medium-to-high somatization were found to be less conscientious/extroverted and had considerably higher levels of general distress, depression, anxiety, as well as stress. Because individuals with more somatic symptoms have greater psychologic distress, they may not be in the best mental state to work hard or socialize. However, Rokvić et al,[23] in their initial investigation, stated that neuroticism and anxiety were most closely related to somatization in the general population. Notwithstanding, studies on the relationship of TMDs/somatization to personality and dispositional coping styles remain scant and further cross-cultural research in this area is warranted.

Correlations and Protective/Risk Factors

Though the WT and MH groups had significantly higher PHQ-15 and SFAI scores than the NT and NL groups, the correlation between SFAI and PHQ-15 scores was weak. This relationship is anticipated to be stronger in TMD patient populations given their high prevalence of comorbid chronic pain conditions and medium-to-high somatization.[14,48] The normal levels of depression and lower severity of anxiety and stress explained the weak associations between SFAI/PHQ-15 and psychologic distress scores when compared to TMD patients.[49] Neuroticism and dysfunctional coping were found to be moderately correlated to general distress, depression, anxiety, and stress. Polygenic analysis has established the genetic connections between personality, particularly neurotic traits, and psychopathology.[50] Furthermore, it was found that personality and coping jointly accounted for up to 50% of the variance in psychopathology.[51]

Panayiotou et al[24] determined that neuroticism was related to dysfunctional coping, whereas conscientiousness and extraversion were associated with functional coping in a community sample. In the present study, the correlations between neuroticism and dysfunctional coping as well as conscientiousness and extraversion and functional coping were mostly significant albeit weak. The correlation between the two functional coping styles was strong, suggesting that individuals who employed problem-focused coping strategies also used emotion-focused ones. However, this relationship could be influenced by moderators such as type of illness, study design, and context, in addition to individual beliefs about coping and interventions.[52] The strong correlations between general distress and the depression, anxiety, and stress subscales provided additional support for the bifactor structure of the DASS-21.[40]

Multidimensional analysis of personality, coping, and distress with the multivariate model revealed that anxiety was the primary risk factor for the presence of TMDs and medium-to-high somatization, increasing their prospects by 15% and 13%, respectively. These findings corroborated other studies concerning nonclinical adolescent/young adult samples that showed anxiety (a

perceived stress response) and stress were predictors of TMDs and somatization.[17,53,54] Moreover, polymorphism in catechol-O-methyltransferase was associated with both TMDs and anxiety in young people.[55] Conscientiousness was found to be a protective factor for medium-to-high somatization reducing it by 30%. This result supported the inverse relationship between conscientiousness and somatic symptoms reported in a prior study on university students.[56] Conscientiousness and two of its facets, specifically order and industriousness, can influence health outcomes by modifying the effects of daily stressors.[57] Given the connection between TMDs/somatization and psychologic distress, positive psychologic interventions including mindfulness-based stress reduction and cognitive-behavioral therapies that reduce anxiety and stress and promote resilience could conceivably reduce the incidence of TMD/somatic symptoms in young people. They have also been shown to improve pain, depression, and anxiety symptoms as well as the quality of life of patients.[58,59]

Study Limitations

This observational study has its limitations. First, causal relationships among the various physical and psychologic variables cannot be established with the cross-sectional design employed. Longitudinal investigations are necessary to better explore causality and sequential interactions between the different factors. Second, the study sample involved only university students and consisted of more women. Other young, middle-aged, and older adult groups as well as more men must be incorporated in future work to allow for the generalization of findings and to minimize possible age-gender predilections. Third, only Asian young adults were studied, and results cannot be extrapolated to other racial and ethnic groups. Therefore, the study needs to be extended to other countries and cultures before absolute conclusions can be drawn. The research should also be repeated in TMD patient populations considering their probable variances in personality, coping, and distress when contrasted to nonclinical community samples. Lastly, as physical and psychologic variables were self-reported, they may be exposed to various information partialities including recall, social desirability, confirmation, and other biases.[60]

CONCLUSIONS

This study is the first to determine the relationship of TMD/somatic symptoms with personality, coping, and psychologic distress in nonclinical community–based young adults. TMDs and medium-to-high somatization were present in 18.2% and 5.7% of the study sample. Young adults with TMDs had substantially higher levels of general distress, depression, anxiety, and stress than their counterparts with no TMDs. Those with medium-to-high somatization were low in conscientiousness as well as extraversion and exhibited higher levels of psychologic distress compared to their peers with normal-to-low somatic symptoms. Neuroticism and dysfunctional coping style were found to be moderately correlated to general distress, depression, anxiety, and stress. Multivariate regression analysis determined that anxiety was the primary risk factor for the presence of TMDs and medium-to-high somatization and indicated that conscientiousness could be a protective factor for somatization in young adults. Because positive psychologic interventions were shown to be effective for managing both pain and psychologic symptoms, they hold promise as adjunctive therapies for various aspects of TMDs and somatization.

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Psychologic Factors in Temporomandibular Disorders and Somatization: A Multidimensional Analysis of Personality, Coping, and Distress Among Young Adults

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Psychologic Factors in Temporomandibular Disorders and Somatization: A Multidimensional Analysis of Personality, Coping, and Distress Among Young Adults

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Purpose: To analyze the association of temporomandibular disorders (TMDs) and somatic symptoms with the psychologic variables of personality, coping, and distress in young adults. Physical and psychologic correlates were also explored, along with the risk factors for TMDs/somatization. ***Materials and Methods:*** Participants were enlisted from a local university, and the presence of TMDs and somatic symptoms was determined with the Short-form Fonseca Anamnestic Index and Patient Health Questionnaire-15. The psychologic variables of personality, coping, and distress were assessed with the Big-Five Personality Inventory-10; brief-COPE Inventory; and Depression, Anxiety, Stress Scales-21, respectively. Statistical evaluations were performed with Mann-Whitney *U* test, Spearman correlation, and logistic regression analyses ($\alpha = .05$). ***Results:*** Among the 455 participants (mean age: 22.7 ± 1.2 years), 18.2% and 5.7% had TMDs and medium-to-high somatization, respectively. Participants with TMDs exhibited substantially higher somatization and psychologic distress scores than those with no TMDs. Significant differences in TMDs, conscientiousness, extraversion, and psychologic distress scores were observed between participants with no-to-mild and medium-to-high somatization. The association between TMD and somatization scores was weak but significant. Neuroticism and dysfunctional coping style were moderately correlated to general distress, depression, anxiety, and stress ($r_s = 0.44$ to 0.62). ***Conclusions:*** Findings suggest that anxiety is the main risk factor for the presence of TMDs and medium-to-high somatization in nonclinical young adults, while conscientiousness is a protective factor for somatization.
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Temporomandibular disorders (TMDs) comprise a cluster of musculoskeletal conditions affecting the stomatognathic system. Classically described TMD features include temporomandibular joint (TMJ)/masticatory muscle pain, TMJ sounds, and limited or deviated jaw movements.[1,2] TMD prevalence ranges from 6% to 16% based on protocolized diagnostic criteria and ≤ 75% of the general population have TMD signs/symptoms.[3,4] They can be broadly divided into pain-related and intra-articular conditions.[5] Women, particularly those of reproductive age, are at higher risk of TMDs.[6,7] TMDs can negatively affect both the quality of sleep and life.[8,9] The multifactorial etiology of TMDs and their adherence to the "biopsychosocial model of illness" has been confirmed by various studies.[10,11] Among the psychologic variables implicated are somatization, psychologic distress, personality, and coping.[11–15]

High prevalence and levels of somatization (expression of psychologic distress through somatic symptoms), depression, anxiety, and stress were observed in clinical

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and nonclinical samples with TMDs.[12–14,16,17] The importance of psychologic distress in the etiology of TMDs, as well as the strong correlation between TMDs and somatic symptoms, has led some to posit that TMDs are a type of "central sensitization syndrome" that encompass conditions such as fibromyalgia, chronic fatigue, and irritable bowel syndromes.[18,19] East and Southeast Asians appear to be more susceptible to somatization due to the stigma, interpersonal sensitivity, and low social support accompanying mental illness.[17,20,21]

In addition to psychologic distress, personality and coping have also been linked to TMDs and somatization.[15,22,23] Personality is the set of traits and distinctive patterns of thoughts, feelings, and behaviors that makes a person unique, whereas coping is the set of predictable strategies that a person uses to minimize stress and reduce negative emotions. Personality traits and coping styles have independent and interactive effects on the way psychologic distress is controlled and relieved.[24] People with TMDs were reported to have "distressed" and "neurotic" (propensity toward negative affect and self-doubt) personality traits.[15,25,26] Furthermore, they had also been found to employ more dysfunctional coping behaviors.[15,27,28] Nevertheless, studies in this area are infrequent, and only one addressed all three interrelated psychologic variables concurrently in a small cohort of TMD patients.[15]

With these premises, the present study's objectives were to analyze the association of TMD and somatic symptoms with the psychologic variables of personality, coping, and distress in a nonclinical community-based sample of young adults. Physical and psychologic correlates were also explored along with the psychologic predictors of TMDs and somatization. The research hypotheses were: *(a)* young adults with TMD and somatic symptoms have certain personality traits and dispositional coping styles as well as higher levels of psychologic distress, *(b)* the various physical and psychologic variables are correlated, and *(c)* the presence of TMDs and somatization are associated with specific psychologic risk factors.

MATERIALS AND METHODS

Study Design and Participants

Approval for this study was granted by the ethics committee of the Faculty of Dentistry, Universitas Trisakti (project number: 013/S3/KEPK/FKG/9/2021). Potential participants were recruited from young adults attending a local university either via public internet postings or in-person invitations. A nonprobabilistic voluntary sampling method was applied. The inclusion criteria were individuals aged 18 to 24 years old and proficient in the English language. The exclusion criteria were individuals with prior orofacial trauma/orthognathic surgery, uncontrolled autoimmune or metabolic diseases, major psychiatric disorders, and drug/substance abuse. At least 363 participants were required for the study based on an estimated TMD prevalence of 60%, 95% CI level, 5% margin of error, and a student enrollment of 20,638 students.[16] All potential participants were provided with the study information and informed consent was obtained from eligible individuals. An online survey comprising demographic information; the Short-form Fonseca Anamnestic Index (SFAI); Patient Health Questionnaire-15 (PHQ-15); Big Five Personality Inventory-10 (BFI-10); brief-COPE (Coping Orientations to Problems Experienced) Inventory (BCI); and Depression, Anxiety, Stress-Scales-21 (DASS-21) were subsequently administered.[29–33] Participants were given the survey link and completed the questionnaires independently.

Physical Symptom Measures

The presence of TMDs was determined with the SFAI, which contains two pain (TMJ and masticatory muscle pain) and three function-related (TMJ sounds, opening, and side-movement difficulties) items. The SFAI demonstrated high accuracy (AUC 0.97–0.99), sensitivity (91% to 98%), and specificity (93% to 97%) for pain and/or intra-articular conditions when referenced to the DC/TMD standard.[29] Recently, its reliability and validity for identifying people with TMDs (as determined by the DC/TMD) were independently confirmed.[34] The items are scored using the following response scale: "no" = 0 points, "sometimes" = 5 points, and "yes" = 10 points. Total SFAI scores ≥ 15 points indicate the presence of TMDs with higher scores suggesting greater TMD symptom severity.

The presence of somatization was ascertained with the PHQ-15 which comprises the 15 most common "DSM-IV somatization disorder" somatic symptoms.[30,35] The psychometric properties of the PHQ-15 are well recognized, and it has been incorporated into Axis II of the DC/TMD.[5,36] The items are scored using the following three-point Likert scale: "not bothered at all" = 0 points, "bothered a little" = 1 point, and "bothered a lot" = 2 points. Total PHQ-15 scores of 5, 10, and 15 points indicate low, medium, and high somatic symptom severity respectively.[30] Participants were then dichotomized into "no TMDs" (NT) and with TMDs" (WT) in addition to "no-to-low" (NL) and "medium-to-high" (MH) somatization groups. Both SFAI and PHQ-15 were appraised over 30 days.

Psychologic Measures

Personality was evaluated with the BFI-10, which consists of two items for each of the "big five" personality dimensions, namely, openness, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN).[31] The BFI-10 has been validated for investigating both

Table 1 Demographic Characteristics of the Study Sample

		Age			Gender		
Variable	n (%)	Mean (SD)	Median (IQR)	*P**	Male n (%)	Female n (%)	*P***
Total	455 (100)	22.5 (1.2)	22.0 (2)	–	66 (14.5)	389 (85.5)	–
TMDs: SFAI							
NT	372 (81.8)	22.5 (1.2)	23.0 (2)	.409	55 (14.8)	317 (85.2)	.863
WT	83 (18.2)	22.4 (1.2)	22.0 (3)		11 (13.3)	72 (86.7)	
Somatization: PHQ-15							
NL	429 (94.3)	22.5 (1.2)	23.0 (2)	< .001	61 (14.2)	368 (85.8)	.563
MH	26 (5.7)	21.5 (1.5)	21.0 (2)		5 (19.2)	21 (80.8)	

*Indicates Mann-Whitney *U* tests $P < .05$.
**Indicates chi-square test $P < .05$.

between-person traits and within-person processes.[37] The items are scored using a five-point Likert scale ranging from "disagree strongly" = 1 point to "agree strongly" = 5 points, with an item in each dimension assessed in reverse. Dimension scores are calculated with higher scores indicating greater partiality toward the specific trait.

Dispositional coping styles were explored with BCI, which has two items for each of the fourteen coping strategies employed in response to daily life stresses.[32] The BCI is widely used for measuring coping and attempts to condense it has yielded contentious factor structures.[38] The items are scored using a four-point Likert scale ranging from "I haven't been doing this at all" = 1 point to "I've been doing this a lot" = 4 points. The different strategies are categorized into the following three coping styles: problem-focused coping (active coping, instrumental support, and planning), emotion-focused (acceptance, emotional support, humor, positive reframing, and religion), and dysfunctional coping (behavioral disengagement, denial, self-distraction, self-blame, substance use, and venting).[32,39] Coping style scores are derived by totaling the respective strategy scores. Higher coping style scores indicate more extensive use of functional (problem and emotion-focused) and dysfunctional coping strategies.

Psychologic distress was examined with the DASS-21, which includes seven items for each of the emotional subscales, namely, depression, anxiety, and stress.[33] The good measurement properties of the DASS-21 are also well-established. Additionally, the DASS-21 has been shown to have a bifactor structure consisting of a general factor for distress (negative affect) and the three subscales.[40] The items are scored using a four-point Likert scale ranging from "did not apply to me at all" = 0 points to "applied to me very much, or most of the time" = 3 points. Total and subscale DASS-21 scores are calculated with greater scores indicating higher levels of general distress (total DASS-21), depressive, anxiety, and stress symptoms. The cut-off points for the various subscale severity classification (normal to extremely severe) are presented in the DASS manual.[33]

Statistical Assessment

Statistical evaluations were carried out using the Statistical Package for the Social Sciences software version 27.0 (IBM) with a significance level of .05. Categorical data were presented as frequencies with percentages and analyzed using chi-square tests. Numerical data were presented as means/medians with SDs/interquartile ranges (IQRs) and analyzed for normality using Kolmogorov-Smirnov test. Because non-normal distributions were observed, numerical data were assessed using Mann-Whitney *U* tests and Spearman rank-order correlation. Correlation coefficients (rs) of 0.1, 0.4, and 0.7 indicate weak, moderate, and strong associations between the various variables.[41] Univariate and multivariate logistic regression analyses were conducted to identify the risk factors for the presence of TMDs and medium-to-high somatization. A step-wise variable selection procedure was employed with a threshold of $P < .10$ for removing insignificant ones. Outcomes were presented as odds ratios (ORs) together with 95% CIs.

RESULTS

Out of a total of 487 young adults who signed up for the study, 32 were declined because they met the exclusion criteria. The mean age of the remaining 455 participants was 22.7 ± 1.2 years and 85.5% were women. TMDs and medium-to-high somatization were present in 18.2% and 5.7% of the study sample respectively. While age and gender distribution between the NT and WT groups did not vary considerably, the NL group was considerably older than the MH group (Table 1).

Table 2 Physical and Psychologic Variable Scores for NT and WT Groups

Physical/psychologic variable		NT	WT	*P**	Differences
Somatization	PHQ-15 scores				
	Mean	3.9 (3.1)	5.7 (4.1)		
	Median	4.0 (4)	5.0 (4)	**< .001**	**WT > NT**
Personality	Openness				
	Mean	6.3 (1.4)	6.5 (1.5)		
	Median	6.0 (2)	6.0 (2)	.478	
	Conscientiousness				
	Mean	6.7 (1.4)	6.4 (1.2)		
	Median	7.0 (2)	6.0 (1)	.064	
	Extraversion				
	Mean	6.9 (1.7)	6.8 (1.6)		
	Median	7.0 (2)	7.0 (2)	.794	
	Agreeableness				
	Mean	7.1 (1.4)	7.0 (1.4)		
	Median	7.0 (2)	7.0 (2)	.463	
	Neuroticism				
	Mean	6.7 (1.7)	7.01 (1.7)		
	Median	7.0 (2)	7.0 (2)	.082	
Coping styles	Problem-focused				
	Mean	17.9 (3.2)	17.4 (3.7)		
	Median	18.0 (4)	18.0 (5)	.360	
	Emotion-focused				
	Mean	28.1 (4.7)	27.8 (5.1)		
	Median	28.0 (6)	28.0 (6)	.708	
	Dysfunctional				
	Mean	23.6 (4.3)	24.5 (4.6)		
	Median	23.0 (6)	25.0 (7)	.080	
Psychologic distress	General				
	Mean	13.8 (9.9)	17.5 (10.1)		
	Median	12.0 (14)	16.0 (13)	**.001**	**WT > NT**
	Depression				
	Mean	3.2 (3.5)	3.8 (3.5)		
	Median	2.0 (4)	3.0 (4)	**.045**	**WT > NT**
	Anxiety				
	Mean	4.4 (3.4)	6.1 (3.6)		
	Median	4.0 (4)	6.0 (5)	**< .001**	**WT > NT**
	Stress				
	Mean	6.3 (4.3)	7.5 (4.2)		
	Median	6.0 (6)	7.0 (7)	**.012**	**WT > NT**

Values are expressed as means (SD) and medians (IQR). Bold indicates $P < .05$.
*Mann-Whitney *U* test.

Tables 2 and 3 show the mean and median physical and psychologic variable scores for the different groups. The WT group had substantially greater PHQ-15 scores than the NT group. While variations in personality dimension and coping style scores were insignificant, the WT group exhibited considerably higher general distress, depression, anxiety, and stress scores than the NT group.

Table 3 Physical and Psychologic Variable Scores for the NL and MH Somatization Groups

Physical/psychologic variable		NL	MH	*P**	Differences
TMD	SFAI scores				
	Mean	6.1 (8)	11.2 (8.9)	**.001**	**MH > NL**
	Median	5.0 (10)	10.0 (10)		
Personality	Openness				
	Mean	6.3 (1.5)	6.7 (1.2)		
	Median	6.0 (2)	7.0 (1)	.101	
	Conscientiousness				
	Mean	6.6 (1.4)	5.9 (0.9)		
	Median	7.0 (2)	6.0 (1)	**.001**	**NL > MH**
	Extraversion				
	Mean	6.9 (1.7)	6.2 (1.3)		
	Median	7.0 (2)	6.0 (2)	**.022**	**NL > MH**
	Agreeableness				
	Mean	7.1 (1.4)	6.8 (1.4)		
	Median	7.0 (2)	7.0 (3)	.211	
	Neuroticism				
	Mean	6.7 (1.7)	7.2 (1.3)		
	Median	7.0 (2)	7.0 (2)	.158	
Coping styles	Problem-focused				
	Mean	17.8 (3.3)	16.9 (3.3)		
	Median	18.0 (4)	17.5 (5)	.156	
	Emotion-focused				
	Mean	28.2 (4.8)	26.7 (5.2)		
	Median	28.0 (6)	26.0 (8)	.089	
	Dysfunctional				
	Mean	23.7 (4.4)	24.7 (3.9)		
	Median	23.0 (7)	25.0 (7)	.220	
Psychologic distress	General				
	Mean	14.2 (1.0)	19.7 (10.3)		
	Median	13.0 (13)	19.0 (12)	**.004**	**MH > NL**
	Depression				
	Mean	3.2 (3.5)	4.9 (3.4)		
	Median	2.0 (4)	5.0 (5)	**.004**	**MH > NL**
	Anxiety				
	Mean	4.6 (3.4)	6.7 (4.1)		
	Median	4.0 (4)	6.0 (5)	**.005**	**MH > NL**
	Stress				
	Mean	6.4 (4.3)	8.2 (3.8)		
	Median	6.0 (6)	7.5 (4)	**.022**	**MH > NL**

Values are expressed as means (SD) and medians (IQR). Bold indicates $P < .05$.
*Mann-Whitney *U* test.

Table 4 Correlations Between Physical and Psychologic Variables

Variable	SFAI	PHQ-15	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
SFAI	-	-	-	-	-	-	-
PHQ-15	0.21*	-	-	-	-	-	-
Openness	0.05	0.02	-	-	-	-	-
Conscientiousness	–0.13*	–0.15*	–0.23**	-	-	-	-
Extraversion	–0.05	–0.08	–0.15**	0.18**	-	-	-
Agreeableness	–0.06	–0.11*	0.03	0.01	0.09	-	-
Neuroticism	0.11*	0.14**	0.22**	–0.21**	–0.28**	–0.01	-
Problem-focused	–0.04	–0.07	–0.06	0.17**	0.13**	0.04	–0.10**
Emotion-focused	–0.02	–0.05	–0.09	0.09	0.19**	0.11*	–0.15**
Dysfunction	0.08	0.18**	0.16**	–0.18**	–0.06	–0.10*	0.24**
General	0.15*	0.26**	0.27**	–0.26**	–0.29**	–0.04	**0.59****
Depression	0.10*	0.22**	0.25**	–0.26**	–0.34**	–0.08	**0.46****
Anxiety	0.18**	0.27**	0.23**	–0.22**	–0.19**	0.01	**0.51****
Stress	0.13*	0.26**	0.24**	–0.22**	–0.24**	–0.05	**0.62****

Variable	Problem-focused	Emotion-focused	Dysfunctional	General	Depression	Anxiety
SFAI	-	-	-	-	-	-
PHQ-15	-	-	-	-	-	-
Openness	-	-	-	-	-	-
Conscientiousness	-	-	-	-	-	-
Extraversion	-	-	-	-	-	-
Agreeableness	-	-			-	-
Neuroticism	-	-	-	-	-	-
Problem-focused	-	-	-	-	-	-
Emotion-focused	**0.73****	-	-	-	-	-
Dysfunction	0.36**	0.32**	-	-	-	-
General	0.02	–0.03	**0.50****	-	-	-
Depression	–0.10*	–0.10*	**0.45****	**0.84****	-	-
Anxiety	0.08	0.04	**0.44****	**0.88****	**0.60****	-
Stress	0.05	–0.01	**0.47****	**0.95****	**0.71****	**0.79****

Results of Spearman correlation. Bold indicates correlation coefficient > 0.4.
*$P < .05$.
**$P < .01$.

The MH group had substantially greater SFAI scores than the NL group. Significant differences in conscientiousness and extraversion scores, but not coping style scores, were discerned. The MH group had considerably higher general distress, depression, anxiety, and stress scores than the NL group.

Tables 4 and 5 display the outcomes of correlational and regression analyses. The correlation between SFAI and PHQ-15 scores, although significant, was weak (rs = 0.21) as with their associations with general distress, depression, anxiety, and stress (rs = 0.13–0.27). Neuroticism and dysfunctional coping style were moderately associated with general distress, depression, anxiety, and stress (rs = 0.44–0.62).

Strong correlations were noted between the two functional coping styles (problem and emotion-focused coping), as well as between general distress and all three DASS-21 subscales (rs = 0.73–0.95). While univariate exploration showed that TMDs were related to general distress, anxiety, and stress, multivariate analysis indicated that only anxiety (OR = 1.15; 95% CI = 1.07–1.22) was a risk factor for the presence of TMDs. Conscientiousness, extraversion, general distress, depression, anxiety, and stress were all related to somatic symptoms with the univariate model. However, multivariate analysis indicated that conscientiousness (OR = 0.70; 95% CI = 0.51–0.95) and anxiety (OR = 1.13; 95% CI = 1.02–1.26) were protective and risk

Table 5 Risk Factors for the Presence of TMDs and Medium-to-High Somatization

		Univariate		Multivariate	
Risk factor		OR (95% CI)	*P**	OR (95% CI)	*P***
Presence of TMDs					
Gender	Male	Reference			
	Female	1.14 (0.57–2.28)	.720		
Personality	Openness	1.10 (0.93–1.30)	.273		
	Conscientiousness	0.86 (0.71–1.02)	.081		
	Extraversion	0.98 (0.84–1.13)	.739		
	Agreeableness	0.95 (0.81–1.14)	.601		
	Neuroticism	1.13 (0.98–1.31)	.091		
Coping	Problem-focused	0.89 (0.72–1.10)	.299		
	Emotion-focused	0.93 (0.73–1.19)	.932		
	Dysfunctional	1.34 (0.97–1.85)	.077		
Psychologic distress	General	1.04 (1.01–1.06)	**.003**		
	Depression	1.05 (0.99–1.12)	.131		
	Anxiety	1.15 (1.07–1.22)	**< .001**	**1.15 (1.07–1.22)**	**< .001**
	Stress	1.07 (1.01–1.12)	**.014**		
Presence of MH somatization					
Gender	Male	Reference			
	Female	0.70 (0.25–1.92)	.696		
Personality	Openness	1.23 (0.94–1.61)	.140		
	Conscientiousness	**0.64 (0.47–0.87)**	**.004**	**0.70 (0.51–0.95)**	**.021**
	Extraversion	**0.76 (0.59–0.97)**	**.030**		
	Agreeableness	0.83 (0.62–1.11)	.209		
	Neuroticism	1.20 (0.94–1.53)	.150		
Coping	Problem-focused	0.80 (0.56–1.13)	.197		
	Emotion-focused	0.73 (0.48–1.09)	.122		
	Dysfunctional	1.35 (0.80–2.29)	.263		
Distress	General	**1.05 (1.01–1.09)**	**.007**		
	Depression	**1.12 (1.02–1.23)**	**.018**		
	Anxiety	**1.16 (1.05–1.28)**	**.003**	**1.13 (1.02–1.26)**	**.021**
	Stress	**1.09 (1.00–1.19)**	**.043**		

Results of univariate and multivariate logistic regression analyses. Bold indicates $P < .05$.

factors for the presence of medium-to-high somatization correspondingly.

DISCUSSION

The present study is the first to establish the association of TMD and somatic symptoms with the psychologic variables of personality, coping, and distress in nonclinical community-based young adults. All three research hypotheses were partly supported because participants with TMD/somatic symptoms exhibited particular personality traits or greater psychologic distress, certain psychologic variables were moderate to strongly correlated, and anxiety was a risk factor for both TMDs and somatization. Young adults were chosen because they represented the bulk of TMD patients and the peak age for the occurrence of TMD symptoms.[2,42] In addition, university students were identified because they have high levels of life, social, and academic stress as well as high rates of psychologic distress.[43] Because somatic symptoms are frequently experienced by the general population, participants were dichotomized into no-to-low and medium-to-high somatization groups.[44,45] Personality and coping can play both independent and interactive roles in influencing physical and psychologic symptoms and thus were analyzed synchronously together with general distress, depression, anxiety, and stress.[46]

TMDs and Psychologic Variables

The prevalence of TMDs observed with the SFAI was consistent with that reported for the general population when established with protocolized diagnostic criteria.[3] While personality dimension and coping style scores were statistically insignificant, participants with TMDs had substantially higher total and subscale DASS-21 scores than their peers without TMDs. Therefore, personality and coping may not have much bearing on the manifestation of TMD symptoms when compared to psychologic distress. Stress is the feeling of emotional or physical tension in response to pressure or adversity, whereas anxiety and depression are the persistent feelings of unease or apprehension and low mood and despair, respectively. Although significant differences in all psychologic distress variables were discerned between the WT and NT groups, the univariate model indicated that only general distress, anxiety, and stress were associated with TMDs. This result can be attributed to the largely normal level of depression (0 to 4 points) detected in the young adults examined.

The few studies conducted in clinical samples yielded disparate results with TMD patients having more "neurotic" personalities and dysfunctional or maladaptive coping styles.[15,26–28] Ferrando et al,[15] who explored all three psychologic variables concurrently, found that neuroticism (the tendency to experience negative emotions) and depression featured predominantly in TMD patients with muscle disorders, whereas conscientiousness was present in those with joint disorders. Furthermore, patients with muscle disorders also used functional coping strategies less regularly than the control group. The discrepancy in findings could be ascribed in part to the greater prevalence and severity of depression and anxiety among TMD patients, which is thought to be closely related to personality traits and mediated by dispositional coping.[12–14,24] In addition to normal levels of depression, the nonclinical young adults with TMDs presented only moderate anxiety (6 to 7 points) and mild stress (8 to 9 points).

Somatization and Psychologic Variables

About 6% of the participants reported medium-to-high somatic symptoms, which was comparable to the estimated 8% prevalence of somatic symptom disorder in general practice.[47] Though substantial variations in conscientiousness (the tendency to be self-disciplined, well-organized, and goal-oriented), extraversion (the tendency to be friendly and outgoing), total, and subscale DASS-21 scores were noted between the NL and MH groups, no significant differences in coping style scores were perceived. The univariate analysis yielded similar results. Hence, dispositional coping styles may play a lesser role in the manifestation of somatic symptoms. Participants with medium-to-high somatization were found to be less conscientious/extroverted and had considerably higher levels of general distress, depression, anxiety, as well as stress. Because individuals with more somatic symptoms have greater psychologic distress, they may not be in the best mental state to work hard or socialize. However, Rokvić et al,[23] in their initial investigation, stated that neuroticism and anxiety were most closely related to somatization in the general population. Notwithstanding, studies on the relationship of TMDs/somatization to personality and dispositional coping styles remain scant and further cross-cultural research in this area is warranted.

Correlations and Protective/Risk Factors

Though the WT and MH groups had significantly higher PHQ-15 and SFAI scores than the NT and NL groups, the correlation between SFAI and PHQ-15 scores was weak. This relationship is anticipated to be stronger in TMD patient populations given their high prevalence of comorbid chronic pain conditions and medium-to-high somatization.[14,48] The normal levels of depression and lower severity of anxiety and stress explained the weak associations between SFAI/PHQ-15 and psychologic distress scores when compared to TMD patients.[49] Neuroticism and dysfunctional coping were found to be moderately correlated to general distress, depression, anxiety, and stress. Polygenic analysis has established the genetic connections between personality, particularly neurotic traits, and psychopathology.[50] Furthermore, it was found that personality and coping jointly accounted for up to 50% of the variance in psychopathology.[51]

Panayiotou et al[24] determined that neuroticism was related to dysfunctional coping, whereas conscientiousness and extraversion were associated with functional coping in a community sample. In the present study, the correlations between neuroticism and dysfunctional coping as well as conscientiousness and extraversion and functional coping were mostly significant albeit weak. The correlation between the two functional coping styles was strong, suggesting that individuals who employed problem-focused coping strategies also used emotion-focused ones. However, this relationship could be influenced by moderators such as type of illness, study design, and context, in addition to individual beliefs about coping and interventions.[52] The strong correlations between general distress and the depression, anxiety, and stress subscales provided additional support for the bifactor structure of the DASS-21.[40]

Multidimensional analysis of personality, coping, and distress with the multivariate model revealed that anxiety was the primary risk factor for the presence of TMDs and medium-to-high somatization, increasing their prospects by 15% and 13%, respectively. These findings corroborated other studies concerning nonclinical adolescent/young adult samples that showed anxiety (a

perceived stress response) and stress were predictors of TMDs and somatization.[17,53,54] Moreover, polymorphism in catechol-O-methyltransferase was associated with both TMDs and anxiety in young people.[55] Conscientiousness was found to be a protective factor for medium-to-high somatization reducing it by 30%. This result supported the inverse relationship between conscientiousness and somatic symptoms reported in a prior study on university students.[56] Conscientiousness and two of its facets, specifically order and industriousness, can influence health outcomes by modifying the effects of daily stressors.[57] Given the connection between TMDs/somatization and psychologic distress, positive psychologic interventions including mindfulness-based stress reduction and cognitive-behavioral therapies that reduce anxiety and stress and promote resilience could conceivably reduce the incidence of TMD/somatic symptoms in young people. They have also been shown to improve pain, depression, and anxiety symptoms as well as the quality of life of patients.[58,59]

Study Limitations

This observational study has its limitations. First, causal relationships among the various physical and psychologic variables cannot be established with the cross-sectional design employed. Longitudinal investigations are necessary to better explore causality and sequential interactions between the different factors. Second, the study sample involved only university students and consisted of more women. Other young, middle-aged, and older adult groups as well as more men must be incorporated in future work to allow for the generalization of findings and to minimize possible age-gender predilections. Third, only Asian young adults were studied, and results cannot be extrapolated to other racial and ethnic groups. Therefore, the study needs to be extended to other countries and cultures before absolute conclusions can be drawn. The research should also be repeated in TMD patient populations considering their probable variances in personality, coping, and distress when contrasted to nonclinical community samples. Lastly, as physical and psychologic variables were self-reported, they may be exposed to various information partialities including recall, social desirability, confirmation, and other biases.[60]

CONCLUSIONS

This study is the first to determine the relationship of TMD/somatic symptoms with personality, coping, and psychologic distress in nonclinical community–based young adults. TMDs and medium-to-high somatization were present in 18.2% and 5.7% of the study sample. Young adults with TMDs had substantially higher levels of general distress, depression, anxiety, and stress than their counterparts with no TMDs. Those with medium-to-high somatization were low in conscientiousness as well as extraversion and exhibited higher levels of psychologic distress compared to their peers with normal-to-low somatic symptoms. Neuroticism and dysfunctional coping style were found to be moderately correlated to general distress, depression, anxiety, and stress. Multivariate regression analysis determined that anxiety was the primary risk factor for the presence of TMDs and medium-to-high somatization and indicated that conscientiousness could be a protective factor for somatization in young adults. Because positive psychologic interventions were shown to be effective for managing both pain and psychologic symptoms, they hold promise as adjunctive therapies for various aspects of TMDs and somatization.

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