

A cross-sectional population-based study on the association of personality traits with anxiety and psychological stress: Joint modeling of mixed outcomes using shared random effects approach

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Background: Previous studies have showed some evidences about the relationship between personality traits particularly neuroticism and extroversion, separately, with psychological stress and anxiety. In the current study, we clarified the magnitude of joint interdependence (co-morbidity) of anxiety (continuous) and Psychological stress (dichotomous) as dependent variables of mixed type with five-factor personality traits as independent variables. **Materials and Methods:** Data from 3180 participants who attended in the cross-sectional population-based “study on the epidemiology of psychological, alimentary health and nutrition” and completed self-administered questionnaires about demographic and life style, gastrointestinal disorders, personality traits, perceived intensity of stress, social support, and psychological outcome was analyzed using shared random effect approach in R Free software. **Results:** The results indicated high scores of neuroticism increase the chance of high psychological stress (odds ratio [OR] = 5.1; $P < 0.001$) and anxiety score ($B = 1.73$; $P < 0.001$) after adjustment for the probable confounders. In contrast, those who had higher scores of extraversion and conscientiousness experienced lower levels of anxiety score ($B = -0.54$ and -0.23 , respectively, $P < 0.001$) and psychological stress (OR = 0.36 and 0.65, respectively, $P < 0.001$). Furthermore, higher score of agreeableness had significant negative relationship with anxiety ($B = -0.32$, $P < 0.001$). **Conclusion:** The present study indicated that the scores of neuroticism, extraversion, agreeableness and conscientiousness strongly predict both anxiety and psychological stress in Iranian adult population. Due to likely mechanism of genetic and environmental factors on the relationships between personality traits and psychological disorders, it is suggested to perform longitudinal studies focusing on both genetic and environmental factors in Iranian population.

Key words: Anxiety, psychological stress, personality traits, shared random effect model, mixed outcomes

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INTRODUCTION

Mental illness has an impact on every aspect of life, including physical health and risk behavior.^[1] Anxiety disorders are the most prevalent among all mental illnesses.^[2,3] General somatic symptoms that occur with anxiety are fatigue and loss of energy, feeling slowed up or agitated impaired physical, role functioning and restless.^[4,5] In Iranian normal population, the prevalence of anxiety is 20.8% among urban and rural dwellers in age group 15 years above.^[6]

There is evidence to suggest that stress is related to impoverished mental health.^[7] Stress is also one of the leading predisposing factors in the development of mental disorders.^[8] The prevalence of stress is high in

both developing and developed countries and varied with age and job for both men and women.^[7,9] In general, 28-39% of Iranian adult population suffered from possible psychological stress as measured by the General Health Questionnaire (GHQ)-12.^[10]

Over the past 60 years, there has been increasing interest in normal personality traits and their relationship to “neurosis.”^[11] Personality traits are dimensions of individual differences that can affect a wide range of behaviors across many situations.^[12] In the past 20 years, a growing consensus has supported the five-factor model (FFM) as a reasonably comprehensive yet manageable taxonomy of personality traits. The FFM is a hierarchical model that organizes personality traits into five broad or higher-order factors of neuroticism,

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extraversion, agreeableness, conscientiousness and openness to experience.^[13] Neuroticism reflects one's tendency to experience negative emotions and cope poorly, extraversion indicates one's tendency to be sociable and active, agreeableness, one's orientation toward others; conscientiousness, one's organization, motivation and persistence in achieving goals and openness to experience reflects one's appreciation of experience for its own sake.^[14]

There are evidences establishing that the personality traits particularly neuroticism and extraversion have important links to psychopathology and are also important vulnerability factors for anxiety disorders that at least partly responsible for the co-morbidity among mental disorders. Available evidence suggested these two domains (personality and psychopathology) are intrinsically inter-correlated, such that neither can be fully appreciated without the other.^[15] Stress and anxiety scores were significantly and positively correlated with neuroticism scores and were also negatively correlated with extraversion scores in both men and women in the general population. The personality characteristic of neuroticism was a predisposing factor for stress and anxiety.^[7,14] Neuroticism and introversion are associated with greater prevalence of anxiety disorders.^[14,16] Also, there is evidence that lower-order dimensions of agreeableness and facets of conscientiousness have been linked to some anxiety disorders.^[14,17] Personality traits of patients with a mental disorder differ significantly from the general population.^[18] Individual with higher neuroticism and lower extraversion scores experience higher stress and anxiety scores^[7,19]

The relation between personality traits and mental problems could be affected by unhealthy lifestyle factors including inadequate physical activity, smoking and some physical illness such as functional gastrointestinal disorders (FGIDs).^[20-22] In this regard, also, the key role of some other background confounders such as educational level,^[23,24] marital status,^[25] age,^[6,10,26] sex,^[14,27,28] Perceived intensity of stress^[10,29] and obesity^[30] can be considered.

Investigation of relations between personality traits and high-prevalence mental problems can provide important information on the dimensional measures of psychopathology and screen for psychological factors in the primary care settings. Such researches can provide a somewhat clear prospective on the relationship between personality traits and psychopathology and finally will enhance our knowledge about psychological problems and lead to improvement in mental and physical health. Majority of previous studies on the relationships between personality traits and mental problems, in one hand, have focused only one problem, and in the other hand, have emphasized only two of the five higher-order factors, that

is, neuroticism and extraversion. Additionally, these studies have been limited to some specific population such as patients and college students and hence that it is unclear to what extent their findings are applicable to the general population. On the other hand, majority of the conducted previous studies have used simple statistical methods, and they did not adjust the impacts of possible confounders.

The main objective of current study was to investigate the relationships between psychological stress and anxiety with five-factor personality traits controlling for the impacts of some important possible confounders including sex, age, marital status, education level, body mass index (BMI), perceived intensity of stress, social support, smoking behavior, physical activity, number of FGIDs using a comprehensive statistical method in a large sample of Iranian adults.

MATERIALS AND METHODS

Study population and setting

The current study is a part of the "study on the epidemiology of psychological, alimentary health and nutrition" (SEPAHAN).^[20] In this cross-sectional study, the studied sample was selected using multistage cluster sampling and convenience sampling in the last stage among 4 million people in 20 cities across Isfahan province. In SEPAHAN study, data were collected in two separate phases to increase the accuracy as well as the response rate. In the first phase, all participants were asked to complete a self-administered questionnaire about demographic and lifestyle factors including nutritional habits and dietary intakes. In the second phase, further information on gastrointestinal functions and different aspects of psychological variables were collected using another bunch of self-administered questionnaires (response rate: 86.16%). In the current analysis, we used data from 4,763 adults who had completed data on demographic data, personality traits, perceived intensity of stress, social support, and psychological outcome such as stress and anxiety. The protocol of the study was clarified for all the participants, and a written informed consent was obtained from all participants. The ethics committee of Isfahan University of medical sciences approved the study. Finally, the information from 3180 people who provided complete information on all studied variables in the current study was included in analyses.

Assessment of psychological variables

Psychological stress

Psychological stress was measured by a self-administered 12-item GHQ-12, a well-established screening and diagnostic tool to detect nonpsychotic psychiatric disorders and assessing psychological stress.^[31,32] GHQ-12

is a consistent and reliable instrument for using in general population studies and medical settings.^[33] Participants report having experienced a particular feeling or type of behavior 'less than usual, no more than usual, fairly more than usual, or much more than usual' in the past few weeks. A participant could score between 0 and 12 points, and a threshold score of 4 or more was used to identify a participant with high-stress level.^[25] The internal consistency of GHQ-12 calculated with Cronbach's alpha coefficient was found 0.87. Convergent validity indicated a significant negative correlation between the GHQ-12 and global quality of life scores as $r = -0.56$, $P < 0.0001$ in Iranian population.^[33]

Hospital Anxiety and Depression Scale

Hospital Anxiety and Depression Scale is a standardized, valid, and reliable self-report rating scale. HADS has been extensively tested and has well-established psychometric properties. It consists of 14 items: Seven for anxiety (HADS-anxiety). It was answered using a 4-point Likert scale ranging from 0 (not present) to 3 (considerable). The anxiety score is the summation of the particular seven items (ranging from 0 to 21). The ranges of anxiety score for cases are 0-7 normal, 8-21 mild, moderate or severe disorder. Internal consistency as measured by Cronbach's alpha has been found to be 0.78 for HADS anxiety sub-scale in Iranian population.^[34]

Assessment of personality traits

As earlier indicated the FFM has been increasingly recognized as a comprehensive, robust and parsimonious model of normal personality traits and had strong external empirical support.^[16] Among the available instruments for measuring five-factors, the NEO Five-Factor Inventory (NEO-FFI) and the NEO Personality Inventory Revised (NEO-PI-R) are the most widely used. NEO-FFI was a shortened version of the NEO-PI-R (240-items). The NEO-FFI results in a profile of the personality of the subject and consists of 60 self-descriptive statements about the personality that measuring five dimensions of the normal personality (i.e., neuroticism, extraversion, openness, agreeableness and conscientiousness) and consisting 12 item/dimension. Respondents indicate the degree to which they agree or disagree with each of the statement using a five-point Likert-type scale (0 = strongly disagree, 4 = strongly agree). Eight items required reverse scoring. Individual subscale values were determined by summing the 12 items.^[18] Evidences suggested that the shortened tool of NEO-FFI is exactly compatible with its complete form namely NEO-PI-R so that correlations between the NEO-FFI and the longer NEO PI-R domains were 0.92, 0.90, 0.91, 0.77, and 0.87 for N, E, O, A, and C, respectively. Internal consistency coefficients for the NEO-FFI scales calculated with Cronbach's alpha coefficient

were found 0.86, 0.77, 0.73, 0.68, and 0.81 for N, E, O, A and C, respectively.^[35] In Iranian population, Cronbach's alpha is shown for neuroticism, extraversion, openness, agreeableness and conscientiousness as 0.76, 0.65, 0.59, 0.48 and 0.75, respectively.^[36]

Assessment of other variables

Self-administered standard questionnaires were distributed to collect information on age (years), gender (male/female), marital status (married, single), self-reported weight (kg), height (cm), smoking (none, former and current smokers). BMI was calculated by dividing weight in kilograms by height in meters squared. Educational attainments categorized into three categories as lower than diploma (12 years formal education), diploma and more than diploma (including bachelor, master and doctorate). Self-reported history of major FGIDs including gastroesophageal acid reflux disease (GERD), functional dyspepsia (FD), functional constipation (FC) and irritable bowel syndrome (IBS) was explored. The Rome III questionnaire in its complete form and additional questions from the Talley Bowel Disease Questionnaire were used to diagnose and classify FGIDs. Face validation of this questionnaire indicated that most participants could not discriminate the difference between the rating scales used in Rome III. Therefore, rating scales were modified to a 4-item – rating scale (never or rarely, sometimes, often, always) for each question. Details of some changes in Rome III were described in former publications.^[20] In the current study, the number of FGIDs was considered (Ranging from 0 to 4). Perceived intensity of stress was measured using a self-administered stressful life events questionnaire (SLE). The questionnaire has 46 items having 11 various dimensions including home life, financial problems, social relation, personal conflicts, job conflicts, educational concerns, job security, loss and separation, sexual life, daily life, and health concerns. Each domain was assessed with a specific number of items using a five-point response scale ("strongly disagree – strongly agree"). SLE questionnaire has been validated in an Iranian general population.^[37] Perceived social support was measured using Multidimensional Scale of Perceived Social Support (MSPSS) that consisted of 12 specific questions and 3 sources of support: Family, friends, and significant other.^[38] In the current study, the rescoring form of MSPSS has been used; in which, each item scored from 0 (disagree and neutral) to 1 (agree), led to a total score between 0 and 12. Higher score represents higher social support. Validity and reliability of the scale has been evaluated in Iran.^[39] General Practice Physical Activity Questionnaire (GPPAQ) was used to assess an individual's current physical activity status. The GPPAQ consists of work and leisure time physical activity. It generates simple, 4-level Physical Activity Index categorizing subjects as: Active, moderately active, moderately inactive, and inactive.^[40]

In the current analysis, participants were classified into two categories namely inactive (including inactive and moderately inactive) and active (including moderately active and active as earlier indicates).

Statistical analysis

Data were analyzed by R Free Statistical Software version 2.15.1. Results were presented as mean \pm standard deviation (SD) for quantitative variables and were summarized by absolute frequencies and percentages for qualitative variables. Independent *t*-student test and one-way analysis of variance or Kruskal-Wallis test (when assumptions including normality or homogeneity of variance were not hold) were used to compare mean differences of quantitative variables between two and multiple groups, respectively. Distribution of study participants in terms of qualitative variables across different categories of other variables was compared using the Chi-square test. The associations between anxiety score and quantitative variables were tested by Spearman rank correlations coefficient. Multivariate generalized linear mixed model was performed for joint modeling of anxiety score (continuous) and psychological stress (dichotomous) as mixed dependent variables and personality traits as independent variables using shared random effect models. Adjusted odds ratio (OR) and regression coefficients (95% confidence intervals [CI]) for psychological stress and anxiety score are presented in 5 different models. First, we adjusted for demographic variables including age, sex, marital status, educational levels. We further controlled for lifestyle variables including smoking, BMI, physical activity in the second model. Additional adjustments were made for a number of FGIDs in the third model. Fourth adjusted model was further controlled for perceived intensity of stress. In the final model, a further adjustment was made for social support. In all models, the category of low stress of psychological stress was considered as the reference categories. $P < 0.05$ were considered as statistically significant.

RESULTS

The average (SD) age of the 3180 was 35.91 (7.76) years. 60.5% of the sample were female. 61.4% of the study participants had a college education. About 16% of subjects were current or past smokers. 46.5% participated in regular physical activity. About 45.6% of subjects suffer from overweight or obesity, and approximately 53% of the respondents reported experiencing some FGIDs including GERD, FD, FC and IBS. Altogether 23.9% ($n = 761$) of participants based on the GHQ, had high psychological stress. Data on the prevalence psychological stress in terms of gender, marital status, education, ever smoke, physical activity and number of FGIDs are presented in Table 1. The percentage of women with high-stress levels was significantly higher than the

percentage of men with high stress level that is, 27.7% versus 18.8% ($P < 0.001$). The prevalence of GHQ's score 4 and higher was 34.4%, 24.1% and 21.9% in individuals with 0-12, 12 and more than 12 years of education, respectively ($P < 0.001$). In general, in the studied population, 26.5% of inactive and 21.0% of active subjects had GHQ score 4 and higher ($P < 0.001$). Suffering from a different number of FGIDs was associated with an increased prevalence of high psychological stress among study subjects. In the other words, the prevalence of high stress across people suffering from a different number of FGIDs (0-4) was 14% to 48.9%, respectively ($P < 0.001$). The participants with high stress were more likely to report a lack of social supports and more perceived intensity of stress ($P < 0.001$). Table 1 also showed the anxiety score in different levels of the basic characteristics of study participants. The mean anxiety scores were statistically different in gender and educational levels ($P < 0.001$). Similarly, significant differences were found among people who were in different smoking levels and physical activity groups as well as number of FGIDs in terms of anxiety scores (all are significant at $P < 0.01$). There were significant relationship between the social support and perceived intensity of stress with anxiety scores ($P < 0.001$) but no significant correlations were detected among age and BMI with anxiety score. Personality traits (neuroticism, extraversion, openness, agreeableness and conscientiousness) were categorized based on their median scores. The frequencies of personality trait groups in different levels of the basic characteristics of study participants are also presented in Table 1. Individuals in the high-neuroticism and low extraversion scores were female ($P < 0.001$) and tended to have lower physical activity ($P < 0.001$) and education level ($P < 0.001$), lower social support ($P < 0.001$), higher perceived intensity of stress ($P < 0.001$) and were more likely to have more number of FGIDs ($P < 0.001$) as compared to those in the low-neuroticism and high extraversion scores. The comparisons of stress level and anxiety score in personality trait groups were provided in Table 2. Higher significant psychological stress was found among those people who were in the above median category of neuroticism than below median. In contrast, subjects in the high-stress group were significantly more likely to be in the category of below median of extraversion, openness, agreeableness and conscientiousness score compared with subjects in the above median category. Furthermore, among participants who were in the category of above median of neuroticism, anxiety score were significantly more than others (5.42 ± 3.99 vs. 1.76 ± 2.09 , $P < 0.001$). As Table 2 shows, more participants in the category of below median of extraversion, openness, agreeableness and conscientiousness were also found to be suffering from possible anxiety than those who were in the category of above median of studied traits (all, $P < 0.001$). Joint modeling of anxiety score (continuous) and Psychological stress (dichotomous) as the response variables on the different categories of personality traits as the predictor

Table 1: The comparison of anxiety score, psychological stress and categories of personality traits in different levels of demographic variables

Demographic variables	Anxiety score	Psychological stress		Neuroticism		Extraversion		Openness		Agreeableness		Conscientiousness	
		Low stress (%)	High stress (%)	<median (%)	≥ median (%)	<median (%)	≥ median (%)	<median (%)	≥ median (%)	<median (%)	≥ median (%)	<median (%)	≥ median (%)
Sex													
Male	2.93±3.29	1027 (81.8)	229 (18.2)	706 (56.2)	550 (43.8)	522 (41.6)	734 (58.4)	519 (41.3)	737 (58.7)	641 (51.0)	615 (49.0)	562 (44.7)	694 (55.3)
Female	4.05±3.85	1392 (72.3)	532 (27.7)	867 (45.1)	1057 (54.9)	1058 (55.0)	866 (45.0)	773 (40.2)	1151 (59.8)	834 (43.3)	1090 (56.7)	862 (44.8)	1062 (55.2)
P	<0.001	<0.001		<0.001		<0.001		0.52		<0.001		0.97	
Marital status													
Married	3.63±3.72	1986 (76.4)	613 (23.6)	1284 (49.4)	1315 (50.6)	1285 (49.4)	1314 (50.6)	1094 (42.1)	1505 (57.9)	1205 (46.4)	1394 (53.6)	1182 (45.5)	1417 (54.5)
Single	3.54±3.49	433 (74.5)	148 (25.5)	289 (49.7)	292 (50.3)	295 (50.8)	286 (49.2)	198 (34.1)	383 (65.9)	270 (46.5)	311 (53.5)	242 (41.7)	339 (58.3)
P	0.59	0.33		0.88		0.56		<0.001		0.96		0.09	
Education level													
<12 years	4.63±4.34	244 (65.6)	128 (34.4)	130 (34.9)	242 (65.1)	218 (58.6)	154 (41.4)	238 (64.0)	134 (36.0)	211 (56.7)	161 (43.3)	193 (51.9)	179 (48.1)
12	3.95±3.98	648 (75.9)	206 (24.1)	398 (46.6)	456 (53.4)	416 (48.7)	438 (51.3)	375 (43.9)	479 (56.1)	412 (48.2)	442 (51.8)	369 (43.2)	485 (56.8)
>12 years	3.27±3.35	1527 (78.1)	427 (21.9)	1045 (53.5)	909 (46.5)	946 (48.4)	1008 (51.6)	679 (34.7)	1275 (65.3)	852 (43.6)	1102 (56.4)	862 (44.1)	1092 (55.9)
P	<0.001	<0.001		<0.001		0.001		<0.001		<0.001		0.012	
Ever smoke													
Never	3.53±3.65	2044 (76.4)	630 (23.6)	1338 (50.04)	1336 (49.96)	1322 (49.4)	1352 (50.6)	1066 (39.9)	1608 (60.1)	1213 (45.4)	1461 (54.6)	1173 (43.9)	1501 (56.1)
Past and current	4.02±3.83	375 (74.1)	131 (25.9)	235 (46.4)	271 (53.6)	258 (51.0)	248 (49.0)	226 (44.7)	280 (55.3)	262 (51.8)	244 (48.2)	251 (49.6)	255 (50.4)
P	0.007	0.26		0.14		0.52		0.044		0.008		0.017	
Physical activity													
Inactive	3.89±3.78	1251 (73.5)	451 (26.5)	773 (45.4)	929 (54.6)	933 (54.8)	769 (45.2)	718 (42.2)	984 (57.8)	816 (47.9)	886 (52.1)	833 (48.9)	869 (51.1)
Active	3.28±3.54	1168 (79.0)	310 (21.0)	800 (54.1)	678 (45.9)	647 (43.8)	831 (56.2)	574 (38.8)	904 (61.2)	659 (44.6)	819 (55.4)	591 (40.0)	887 (60.0)
P	<0.001	<0.001		<0.001		<0.001		0.055		0.058		<0.001	
Number of FGIDs													
0	2.26±2.70	1286 (86.0)	209 (14.0)	918 (61.4)	577 (38.6)	621 (41.5)	874 (58.5)	590 (39.5)	905 (60.5)	630 (42.1)	865 (57.9)	584 (39.1)	911 (60.9)
1	3.89±3.59	647 (72.9)	240 (27.1)	405 (45.7)	482 (54.3)	464 (52.3)	423 (47.7)	357 (40.2)	530 (59.8)	421 (47.5)	466 (52.5)	413 (46.6)	474 (53.4)
2	5.42±4.05	322 (63.5)	185 (36.5)	169 (33.3)	338 (66.7)	309 (60.9)	198 (39.1)	223 (44.0)	284 (56.0)	263 (51.9)	244 (48.1)	270 (53.3)	237 (46.7)
3	6.52±4.49	141 (57.3)	105 (42.7)	70 (28.5)	176 (71.5)	155 (63.0)	91 (37.0)	101 (41.1)	145 (58.9)	139 (56.5)	107 (43.5)	136 (55.3)	110 (44.7)
4	6.73±3.66	23 (51.1)	22 (48.9)	11 (24.4)	34 (75.6)	31 (68.9)	14 (31.1)	21 (46.7)	24 (53.3)	22 (48.9)	23 (51.1)	21 (46.7)	24 (53.3)
P	<0.001	<0.001		<0.001		<0.001		0.41		<0.001		<0.001	
Age (years)	-0.02 ¹	36.06±7.85	35.41±7.45	36.17±7.87	35.65±7.65	36.04±7.51	35.78±7.99	36.81±7.81	35.29±7.67	36.10±7.74	35.75±7.78	35.71±7.57	36.07±7.91
P	0.23	0.038		0.06		0.35		<0.001		0.20		0.19	
Social support	-0.34 ¹	8.26±3.37	5.65±3.81	8.77±3.14	6.53±3.78	6.42±3.77	8.84±3.09	7.08±3.68	8.02±3.58	6.79±3.77	8.37±3.38	6.82±3.77	8.31±3.41
P	<0.001	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
Perceived intensity of stress	0.49 ¹	24.59±16.53	42.05±21.29	21.74±14.75	35.65±20.67	32.56±20.44	25.02±17.28	29.29±19.63	28.40±19.04	33.32±20.9	24.82±16.8	31.16±20.16	26.83±18.3
P	<0.001	<0.001		<0.001		<0.001		0.20		<0.001		<0.001	
BMI	0.004 ¹	24.93±3.81	24.74±4.03	24.95±3.73	24.82±3.98	24.79±3.98	24.97±3.74	25.16±3.93	24.69±3.80	25.11±3.93	24.69±3.79	25.01±3.91	24.78±3.82
P	0.84	0.23		0.36		0.21		0.001		0.003		0.09	

¹Correlation coefficient; BMI = Body mass index; FGIDs = Functional gastrointestinal disorders including; GERD = Gastro Esophageal acid Reflux Disease; FD = Functional Dyspepsia; FC = Functional Constipation; IBS = Irritable Bowel Syndrome

variables in different models were given in Table 3. In all fitted models, the category of below median of personality traits (in predictor variables) and low level of psychological stress were defined as the reference category. Adding shared random effect to joint modeling of anxiety score (continuous) and Psychological stress (dichotomous) is a way to account

for correlation and co-morbidity between mixed outcomes. In crude models, we reached a joint significant positive association among stress level and anxiety score with high-neuroticism score (OR: 9.21; 95% CI: 6.96-12.06 and β : 3.05; 95% CI: 2.80-3.29). On the contrary, we found joint inverse associations between stress level and anxiety score with high extraversion score (OR: 0.28; 95% CI: 0.22-0.36 and β : -1.04; 95% CI: -1.29--0.79). Likewise, there were inverse significant relationships between high-stress level and high conscientiousness (OR: 0.71; 95% CI: 0.56-0.91), but no significant association between high conscientiousness and anxiety scores. Furthermore, we resulted negative significant relationship between anxiety score and high-agreeableness score (β : -0.59; 95% CI: -0.83--0.35). After adjusting for a wide range of potential confounding variables such as age, sex, marital status, education level, ever smoke, BMI, physical activity, number of FIGDs, Perceived intensity of stress and social supports, the same finding was also found in high-stress level and anxiety score with some personality traits except for conscientiousness and anxiety score. In full adjusted model, there was the inverse significant association between anxiety score and high-conscientiousness score (β : -0.23; 95% CI: -0.45--0.02). More details on the relationship between psychological stress and anxiety with personality traits in different models can be found in Table 3.

Table 2: The comparison of psychological stress and anxiety score in categories of personality traits

Personality traits	Psychological stress			Anxiety score	P
	Low stress (%)	High stress (%)	P		
Neuroticism					
<Median	1483 (94.3)	90 (5.7)	<0.001	1.76±2.09	<0.001
□Median	936 (58.2)	671 (41.8)		5.42±3.99	
Extraversion					
<Median	977 (61.8)	603 (38.2)	<0.001	4.80±4.08	<0.001
□Median	1442 (90.1)	158 (9.9)		2.43±2.79	
Openness					
<Median	938 (72.6)	354 (27.4)	<0.001	3.89±3.83	<0.001
□Median	1481 (78.4)	407 (21.6)		3.42±3.56	
Agreeableness					
<Median	993 (67.3)	482 (32.7)	<0.001	4.62±3.97	<0.001
□Median	1426 (83.6)	279 (16.4)		2.73±3.17	
Conscientiousness					
<Median	940 (66.0)	484 (34.0)	<0.001	4.50±3.98	<0.001
□Median	1479 (84.2)	277 (15.8)		2.88±3.25	

Table 3: Table 3: Crude and adjusted odds ratio (OR) and regression coefficients (95% CI for ORs and coefficients) resulted from joint modeling of anxiety score and psychological stress as dependent variables and five-factors personality traits as independent variables

Dependent variables	Independent variables				
	Neuroticism ²	Extraversion ²	Openness ²	Agreeableness ²	Conscientiousness ²
Crude					
Psychological stress ^{1a}	9.21 (6.96, 12.06)*	0.28 (0.22, 0.36)*	1.08 (0.86,1.35)	0.90 (0.70, 1.13)	0.71 (0.56, 0.91)*
Anxiety score ^b	3.05 (2.80, 3.29)*	-1.04 (-1.29, -0.79)*	0.19 (-0.03, 0.42)	-0.59 (-0.83, -0.35)*	-0.21 (-0.45, 0.04)
Model 1					
Psychological stress ^{1a}	8.67 (6.62, 11.36)*	0.30 (0.23, 0.38)*	1.09 (0.88,1.39)	0.86 (0.68, 1.09)	0.70 (0.55, 0.89)*
Anxiety score ^b	2.88 (2.64, 3.12)*	-0.95 (-1.19, -0.69)*	0.29 (0.06, 0.52)*	-0.68 (-0.92, -0.44)*	-0.24 (-0.48, 0.01)
Model 2					
Psychological stress ^{1a}	8.67 (6.55, 11.36)*	0.30 (0.23, 0.38)*	1.09 (0.88,1.38)	0.86 (0.68, 1.09)	0.70 (0.55, 0.89)*
Anxiety score ^b	2.88 (2.63, 3.12)*	-0.95 (-1.20, -0.71)*	0.29 (0.06, 0.52)*	-0.67 (-0.91, -0.42)*	-0.21 (-0.46, 0.03)
Model 3					
Psychological stress ^{1a}	7.77 (5.87, 10.28)*	0.30 (0.24, 0.39)*	1.08 (0.86, 1.36)	0.86 (0.68, 1.09)	0.71 (0.56, 0.91)*
Anxiety score ^b	2.50 (2.26, 2.73)*	-0.82 (-1.06, -0.58)*	0.24 (0.02, 0.45)*	-0.65 (-0.88, -0.42)*	-0.15 (-0.39, 0.08)
Model 4					
Psychological stress ^{1a}	5.47 (4.10, 7.32)*	0.31 (0.24, 0.41)*	0.98 (0.77, 1.25)	1.02 (0.79, 1.31)	0.64 (0.50,0.82)*
Anxiety score ^b	1.81 (1.58, 2.03)*	-0.67 (-0.89, -0.45)*	0.09 (-0.11, 0.29)	-0.36 (-0.57, -0.15)*	-0.27 (-0.48, -0.05)*
Model 5					
Psychological stress ^{1a}	5.10 (3.82, 6.82)*	0.36 (0.28, 0.47)*	1.02 (0.8, 1.31)	1.05 (0.83, 1.36)	0.65 (0.51, 0.84)*
Anxiety score ^b	1.73 (1.50, 1.95)*	-0.54 (-0.76,-0.32)*	0.12 (-0.08, 0.32)	-0.32 (-0.53,-0.11)*	-0.23 (-0.45,-0.02)*

*P < 0.05; ¹Low level of psychological stress were defined as reference category; ²Category of below median of personality traits were considered as reference category; ^aData were expressed as OR (95% CI); ^bData were expressed as regression coefficients (95% CI). Model 1: Adjusted for demographic variables (age, sex, marital status, education level); Model 2: Adjusted for demographic variables and lifestyle (ever smoke, BMI, physical activity); Model 3: Adjusted for demographic variables, lifestyle and number of FIGDs; Model 4: Adjusted for demographic variables, lifestyle, number of FIGDs and perceived intensity of stress; Model 5: Adjusted for demographic variables, lifestyle, number of FIGDs, perceived intensity of stress and social supports; OR = Odds ratio; CI = Confidence interval; FIGDs = Functional gastrointestinal disorders including; GERD = Gastro Esophageal acid Reflux Disease; FD = Functional Dyspepsia; FC = Functional Constipation; IBS = Irritable Bowel Syndrome; BMI = Body mass index

DISCUSSION

In this cross-sectional population-based study, association between some personality traits and psychological problems (anxiety and psychological stress) was largely supported by the data in Iranian adult population. Adding shared random effect to the joint model of anxiety scores (continuous) and Psychological stress (dichotomous) is one of the appropriate approaches to accounting for comorbidity and correlation between mixed outcomes. In fact, high scores of neuroticism compared with low scores, after controlling for all considered confounders such as age, sex, marital status, education level, ever smoke, BMI, physical activity, number of FGIDs, perceived intensity of stress and social supports “(full adjusted model)”, increased the chance of high psychological stress. Likewise, high scores of neuroticism compared with low scores had an additive impact on mean of anxiety score after control for a wide range of potential confounding variables. The association between neuroticism and both psychological stress and anxiety were of course as expected, because there is ample evidence in the literature indicating that people who had high levels of anxiety and stress are characterized by high neuroticism score. Also, neuroticism has been regarded as a predisposition to develop all kinds of psychopathology disorders.^[7,14,19] Further, in keeping with previous studies,^[7,14,17,19] results indicated that the high scores of extraversion and conscientiousness compared with low scores, after controlling for all confounding variables in the fully adjusted model, was associated with 64% and 35% lower chance of high psychological stress. Furthermore, it is expected that the high scores of extraversion, agreeableness and conscientiousness caused to reduce the mean of anxiety score. In the study of Newbury-Birch and Kamali the significant inverse relationships were seen between personality characteristics of neuroticism and both stress and anxiety without adjustment for established confounding variables amongst 109 juniors doctor in the north east of England. The study further revealed that women who had higher neuroticism and lower extraversion scores had higher stress and anxiety scores compared with the rest of the group.^[7] In another study, which was performed among 731 community subjects demonstrated that all of the lifetime disorders of interest, including anxiety and depression disorders were associated with high neuroticism and some anxiety disorders were associated with low extraversion. In this study, description of lower-order personality traits, particularly in anxiety disorders were further showed. They mentioned that lower-order dimensions (facets) of agreeableness and conscientiousness were also inversely associated with certain anxiety disorders.^[41] In this regard, similar results were observed in the current study. In the study of

Bienvenu *et al.* multivariate analysis of variance was used to compare those with particular disorders to those with none of the five disorders of interest (anxiety (including simple phobia, social phobia, agoraphobia, and panic disorder) and major depressive disorders). All five-factors were thus assessed simultaneously in single models. These results indicated that neuroticism, extraversion, and facets of agreeableness and conscientiousness are important constructs in understanding relationships between personality traits and anxiety and depressive conditions in the general population. Neuroticism is broadly associated with social phobia, agoraphobia, panic disorder, and major depression. Introversion is only broadly associated with social phobia and agoraphobia. Lower-order dimensions of agreeableness appear relevant to phobias, and those of conscientiousness appear relevant to phobic, panic and major depressive disorders.^[14] These results are concordant with our results demonstrating associations between Neuroticism, extraversion, agreeableness and conscientiousness with anxiety. In the study of Kotov *et al.* examination of the trait – symptom links using hierarchical multiple regression analyses demonstrated that neuroticism and negative emotionality had notable associations with all anxiety symptom disorders and showed an especially strong link to worry. Extraversion and positive emotionality accounted for substantial additional variance in social anxiety. In sum, the results of this study confirmed neuroticism as a general factor with all anxiety disorders. However, extraversion and positive emotionality have significant relations to some syndromes but emerged as a unique factor linked only to social anxiety. This study was based entirely on the responses of college students, who generally report relatively low levels of psychopathology. However, other personality traits were not considered in their study.^[17] People respond differently to stressful situations, and it appears that those who suffer least from mental problems do so by adopting appropriate coping strategies. The way individuals cope with stressful situations may also be related to their personality characteristics.^[7] In the other words, people with different personality traits show different coping methods and different levels of vulnerability in experiencing a stressful situation.^[42] This study further established that some participants might be more vulnerable to stress and anxiety as a result of their personality characteristics. Furthermore, Zautra *et al.* used the developed multilevel modeling methodology that can measure responses within individuals, across time, and still test for traditional between-individual differences. They used the dimensions of neuroticism and extraversion for the prediction of between-individual differences in their study. The study revealed that neuroticism predicted lower positive emotionality, higher negative affect and more negative and stressful events. They further found

neuroticism to aggravate the negative impact of negative events. However, Extraversion, on the other hand, predicted higher positive effect and more positive events.^[43] In addition, negative affectivity itself is related to negative health perceptions in people who were high in neuroticism. Individuals scoring high on some aspects of personality, including neuroticism may have a tendency to report more symptoms of medical and mental problems, negatively perceived health status, health worries, frequency of visits to the general physician and poorer mental health. Despite their greater health worries, neurotic people have also been found to show less sensible health behaviors.^[44,45] Neuroticism is the general trait that is common to all mental disorders and would be broadly associated with the development of mental disorders.^[17] Extraversion, on the other hand was found to predispose to the experience of most pleasurable events and more positive effects and emotionality. People with a high score on extraversion have been found to report fewer psychological and physical symptoms and was associated with a better-perceived health status, through its influence on well-being and positive affect which lessens health worries. Conscientiousness and agreeableness are associated with positive perceptions.^[15,19,44,45] In general practice settings, it is likely that understanding of personality aids practitioners in assessing and dealing with people they know reasonably well. However, in a hospital setting, there is often little opportunity for getting to know the personality of a patient in a busy clinic or ward. Inclusion of formal information on personality traits could be helpful. It is worthwhile that personality traits be taken into consideration when offering support and counseling. Most previous research focused on anxiety and stress as single risk indicators, and also characteristics of personality traits as single predictors of mental problems. These negative emotions and personality traits were investigated simultaneously in the present study. To the best of our knowledge, there has not been any report regarding the influence of personality traits on both stress and anxiety the shared random effects model. Although the proposed framework obviously needs further explication, it appears to be a useful guide for personality – psychopathology research. The strengths of this study include the use of a wide range of likely confounding variables, including sex, age, marital status, education level, BMI, Perceived intensity of stress, social support, ever smoke, physical activity and number of FGIDs, the reasonably comprehensive yet manageable measure of five-factor personality traits, NEO questionnaire, large and representative sample, comprehensive statistical method with a focus on correlation between mixed outcomes and considering five personality traits simultaneously in the all models. However, we should consider some limitation in interpretation of the results. It is difficult to assess causal

relationships between personality traits and mental problems with cross-sectional studies. Also, the current results are based entirely on the participants' self-ratings, and it obviously is important to consider other types of data as well. In this regard, it would be particularly informative to assess each of the underlying results in this study using multiple methods (e.g., self-ratings, clinicians' ratings, and peer-ratings). This multi-method design would permit powerful analyses of personality-psychopathology relations. Furthermore, we adopted a simple approach to handling missing data (complete-case), as our data were fairly complete. However, future studies may benefit from more sophisticated methods, such as multiple imputations. Further studies are required to confirm our findings.

CONCLUSION

Investigation of relations between personality traits and high-prevalence mental problems can provide important information on the dimensional measures of psychopathology and screen for psychological factors in the primary care settings. Such researches can provide a somewhat clear perspective on the relationship between personality traits and psychopathology and finally will enhance our knowledge about psychological problems and lead to improvement in mental and physical health. According to likely mechanism of genetic and environmental factors on the relationships between personality traits and psychological disorders,^[46,47] it is suggested to perform longitudinal studies focusing on both genetic and environmental factors in Iranian population.

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AUTHOR'S CONTRIBUTION

AF contributed in the conception and design of the work, manuscript preparation, drafting and revising the draft, conducting the study, approval of the final version of the manuscript, and agreed for all aspects of the work. AHK contributed in the conception and design of the work, drafting and revising the draft, conducting the study, approval of the final version of the manuscript, and agreed for all aspects of the work. FN contributed in the manuscript preparation, analysis, interpretation of data, drafting and revising the draft, conducting the study, approval of the final version of the manuscript, and agreed for all aspects of the work. HR contributed in the conception and design of the work, drafting and revising the draft, conducting the

study, approval of the final version of the manuscript, and agreed for all aspects of the work. PA contributed in the conception and design of the work, drafting and revising the draft, conducting the study, approval of the final version of the manuscript, and agreed for all aspects of the work.

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