Medicine

The relationship between walking and depression, anxiety, and stress among a sample from Jazan, Saudi Arabia

A cross-sectional investigation

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Abstract

This study is aiming to investigate the association between walking and depression, anxiety and stress among adults from Jazan, Saudi Arabia. This study was a cross-sectional investigation where data was collected via an online self-administered questionnaire. The questionnaire had 4 components that measured demographics of the sample, presence of depression, anxiety and stress, and walking history. Differences in median scores of depression, anxiety, and stress according to the measured characteristics were tested via the Mann–Whitney U test. Multivariable logistic regression was performed to estimate odds of reporting depression, anxiety, and stress according to the measured characteristics. A total of 472 adult subjects participated in the current study. The median age of the participants was 23 years, and 52% were males. Half of the participants had variable degrees of depression and anxiety while 39% of the participants had variable degrees of stress. Gender appeared to have the strongest influence on level of depression, anxiety, and stress among the recruited sample (odds ratio 1.8, 2.1, 1.6 respectively (P values < .01). Upon stratifying the sample according to gender, marital status seems to have an association with depression, anxiety, and stress among females (P values < .05). Among males, only walking more than 3 days was associated with the reduction of anxiety (P value .005) and depression (P value .06). This study identified gender difference where walking was not associated with mental health among women but relatively associated among males.

Abbreviation: OR = odds ratio.

Keywords: anxiety, depression, mental health, Saudi Arabia, stress, walking

1. Introduction

The World Health Organization has defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Mental health is an important component in the state of well-being because it influences a person's ability to cope with stressful events in life.[1] Mental illness can have several causes, including biological factors, experiences related to adverse life events, and drug abuse.[2] Furthermore, there are several types of mental illness, including depression, anxiety, and stress.[3]

Adverse events and experiences can be a major contributor to mental illness. One of the major adverse events occurring in recent years is the COVID-19 pandemic. The nature of the disease and its fast transmission and related clinical manifestations and complications have led to the application of preventive measures, including social isolation and curfews, in many countries. Several investigations have indicated a higher incidence of mental illnesses during the COVID-19 pandemic.[4,5]

One of the factors that has been reported to have a beneficial impact on mental health well-being is physical activity. In a systematic review and meta-analysis including 15 studies with a total sample of 191,130 participants, adults who achieve the recommended volume of physical activity per week had a 25% (95% confidence Interval 18%–32%) lower risk of depression in comparison with those who were not reporting any physical activity.[6] Similarly, a more recent review by Marconcin et al, which involved a total of 31 studies, suggested that a higher physical activity level was associated with fewer depressive symptoms, lower anxiety, and less stress while controlling for age.[7]

In addition to the influence of physical activity on mental health, several reports indicated the importance of a moderate level of physical activity in improving mental health. For example, in a large U.S. study involving a sample of 1.2 million

adult subjects, it was reported that the influence of physical activity on mental health can be variable according to the type, intensity, and duration of the exercise, concluding that excessive exercise is not necessarily beneficial for mental health.[8] Similarly, another nationwide study conducted in Saudi Arabia that involved a sample of 8333 Saudis and assessed the association between physical activity level and generalized anxiety disorder and major depressive disorder revealed a lower risk of mental disorders among male subjects with moderate levels of physical activity but not among subjects with vigorous levels of physical activity.[9]

The current evidence suggests that a moderate level of physical activity can be beneficial in the improvement of mental health. It can be argued that walking, as a type of moderate level of physical activity, can be associated with an improvement in mental health. This notion is supported by the findings in a study by Chen et al, which recruited a sample of 1255 adults aged 65 or older in Taiwan. Chen et al revealed that light- to moderate-intensity walking was associated with a significant improvement in mental health[10] Furthermore, a similar study conducted on 4737 adults from California who were older than 65 indicated that older subjects can benefit from moderate or vigorous walking as such activity enhances mental health.[11] Nonetheless, a review by Kelly et al that involved 5 systematic reviews and 50 articles that assessed the influence of physical activity, including walking, on mental health indicated limited evidence of the influence of walking on mental health.[10] The current study aims to investigate the association between walking and depression, anxiety, and stress among a sample of adults from Jazan, Saudi Arabia, and to assess demographic and clinical variables influencing the potential association.

2. Methods

2.1. Study settings and participants

This study was a cross-sectional investigation conducted from September to October 2021 in Jazan, Saudi Arabia. Data was collected via online settings. This investigation targeted adults in Jazan. Ethical approval to conducted the investigation was granted via The Jazan Health Ethics Committee, Ministry of Health, Saudi Arabia (Approval number 2163 dated 28/08/2021). Informed consent was obtained from the subjects before participation and the study was conducted in accordance with the Declaration of Helsinki.

2.2. Data collection tool

Data was collected via an online self-administered questionnaire. The questionnaire had 4 components that measured the demographic characteristics of the sample, the presence of depression, anxiety and stress, and walking history. Assessment of the demographics included asking about gender, age, education level, family income, area of residence, marital status, smoking status, and history of COVID-19 diagnosis at the time of participation. Assessment of depression, anxiety, and stress was performed via the validated Arabic version of the Depression, Anxiety and Stress Scale 21. The nature of the scale, its components, and its validation are explained elsewhere.[12] The fourth section was pertaining to walking behavior, where participants were asked about their walking frequency as exercise during the preceding week.

2.3. Data collection process

Participants were included if they were adults and residing in Jazan and were excluded if they were younger than 18. An online version of the questionnaire was generated to enable online data collection. The online version was piloted on a sample of 10 participants to test the clarity of the questionnaire in its online format and the time needed to complete the questionnaire. A web link was generated to enable easier access to the questionnaire, followed by promotion of the questionnaire in social media to reach the targeted population. Convenient, nonrandom sampling was utilized to reach the study sample.

At the time of conducting the study, there were no available reports concerning the association between walking and mental health. Therefore, the sample size calculation was based on the study by Althumiri et al that assessed the association between physical activity and the risk of mental health disorders in Saudi Arabian adults.[9] Althumiri et al concluded that those who were adherent to the recommended level of moderate-intensity aerobic physical activity had a lower mean generalized anxiety disorder score in comparison with those who were not adherent (3.95 vs 4.33). The difference in means (0.38) was used to calculate the required sample to identify the potential association between walking and mental health. Using G*Power software, a total sample of 302 subjects was estimated based on the mean difference of 0.38, a type one error of 0.05, and 95% power to detect the difference.

2.4. Data analysis

Data analysis was conducted via Statistical Package for the Social Sciences software, version 24. Descriptive statistics were used to summarize the findings of the study; frequencies and percentages were used to summarize binary and categorical data. Due to the abnormal distribution of the continuous data, medians and interquartile ranges were used to summarize the continuous data.

The analysis of depression, anxiety, and stress was based on the standard analysis methods described elsewhere.[13] Application of the standard analysis method resulted in a score for each subscale, where the total scale score ranged between 0 and 42. The severity levels of each subscale were provided and ranged from mild to extremely severe. To enable a comparison between the study groups, subjects were grouped into those who were having either depression, anxiety, or stress and those who were not. Subjects were labeled as having depression if their sub-score for depression was above 9. Subjects were labeled as having anxiety if their sub-score for anxiety was above 7. Subjects were labeled as having stress if their sub-score for stress was above 14. Assessment of walking practice was performed by calculating the number of days per week subjects reported walking. The median number of days where walking was performed was used as a cutoff point to dichotomize the sample.

Due to the nature of the data, nonparametric testing was used to measure differences in the median scores of depression, anxiety, and stress according to the measured characteristics via the Mann–Whitney U test. Characteristics with statistically significant differences in the medians (P values of .05 or less) were further used in the multivariable logistic regression. The odds of reporting depression, anxiety, and stress were calculated in 2 steps. The first steps involved the whole sample, where gender was noted to have the strongest influence on levels of depression, anxiety, and stress. Therefore, the multivariable logistic regression was further performed while the sample was stratified according to gender. Calculated odds ratios (OR) were presumed statistically significant if they were 0.05 or less.

3. Results

A total of 472 adult subjects participated in the current study. The total number of participants exceeded the required number due to the online nature of the data collection process, which can be influenced by easier accessibility in comparison to other data collection methods. The demographic characteristics of the participants are explained in Table 1, where the median age of the

Demographic characteristics of 472 adult participants from Jazan, Saudi Arabia.

Measured variables	
Age: median (IQR)	23 [21–26]
Sex	
Female	226/472 (48%)
Male	246/472 (52%)
Education attainment	
Less than university education	144/472 (31%)
University education	328/472 (69%)
Salary	
0 to 4999 SAR	291/472 (62%)
5000 to 9999 SAR	65/472 (14%)
10,000 to 15,000 SAR	51/472 (11%)
>15,000 SAR	65/472 (14%)
Residence	
Urban	222/472 (47%)
Rural	250/472 (53%)
Marital status	
Single	357/472 (76%)
Married	103/472 (22%)
Divorced	10/472 (2.1%)
Widowed	2/472 (0.4%)
Smoking status	
Current	56/472 (12%)
Ex-smoker	15/472 (3.2%)
Never	401/472 (85%)

IQR = interquartile range, SAR = Saudi Arabian Riyal.

participants was 23 years, more than half of them (52%) were males, and the majority (69%) had a university education. When the participants were asked about average monthly income, the majority of the respondents (62%) indicated that their monthly income was <5000 Saudi Arabian Riyal. Additionally, more than half of the sample (53%) reported living in rural areas. Finally, the majority of the sample were single (76%) and never smokers (85%).

Table 2 illustrates levels of depression, anxiety, and stress as well as history of COVID-19 infection and the measured walking practice among the recruited sample. The median scores of depression, anxiety, and stress were 8, 6, and 12, respectively. Classification of the sample according to severity levels indicates that half of the participants had variable degrees of depression and anxiety while 39% of the participants had variable degrees of stress. When the participants were asked their history of COVID-19 diagnosis, only 1 quarter of them reported having contracted the disease. Finally, the median number of days spent performing walking was 3 days per week, where 87 members (18.4%) of the sample reported not performing any walking activity as an exercise.

Differences in levels of depression, anxiety, and stress according to the measured characteristics are displayed in Table 3. Higher levels of depression, anxiety, and stress were detected among younger subjects, females, and those with a history of COVID-19 infection. Higher levels of stress were more frequent among those with a university education and those who were married. Those with a lower monthly income showed higher levels of depression and stress. The remaining differences in median scores of depression, anxiety, and stress, including differences according to the reported walking practice, were not statistically significant.

Figure 1 is a visual illustration of differences in the depression, anxiety, and stress median scores according to walking practice. It is stratified according to gender and age groups. One can note that younger males who walk more than 3 days as a form of exercise tend to have lower median scores of depression, anxiety, and stress in comparison with younger females. Similarly, older males with more walking as exercise also tend

to have lower median scores of depression, anxiety, and stress. Furthermore, older male subjects tended to have lower median scores in comparison with other strata, with a visually notable reduction in scores of depression, anxiety, and stress when walking is more frequent. Finally, among older females, while depression median scores tend to increase with higher walking frequency, stress and anxiety median scores tend to decrease slightly when the number of days per week performing walking is higher.

The multivariate logistic regression displayed in Table 4 suggests a strong influence of gender on the presence of depression, anxiety, and stress. ORs of reporting depression, anxiety, and stress were statistically significant according to gender, suggesting a higher risk among females. Furthermore, the OR of stress according to education level was 0.6, suggesting lower stress levels among those with lower education levels. Finally, walking was not associated with any of the measured mental conditions in the whole sample analysis.

Table 5 shows the findings of the multivariable regression analysis when the sample was stratified according to gender. The difference in the influence of demographic factors on levels of depression, anxiety, and stress can be noted. Among females, marital status seems to have a stronger influence, in that married females were less likely to have depression, anxiety, and stress in comparison with single females (P values <.05). Females with lower education levels were more likely to have a lower stress level in comparison with females with a higher education level. Finally, walking did not seem to be associated with depression and anxiety among females and was adversely associated with stress levels where walking 3 days or less per week was associated with a lower risk of having stress (0.04).

The multivariate regression analysis among males provided different findings in comparison to females. Marital status did not seem to be associated with levels of depression, anxiety, or stress. Only walking more than 3 days per week was associated with anxiety levels, suggesting the positive influence of walking on anxiety

Table 2

Level of stress, anxiety, and depression, number of days spent walking per week, and distribution of history of COVID-19 infection among 472 adult participants from Jazan, Saudi Arabia.

| Characteristics	
Depression severity	
Normal	237/472 (50%)
Mild	45/472 (9.5%)
Moderate	86/472 (18%)
Severe	35/472 (7.4%)
Extremely severe	69/472 (15%)
Depression score: median [IQR]	8 [2–19]
Anxiety severity	
Normal	238/472 (50%)
Mild	31/472 (6.6%)
Moderate	74/472 (16%)
Severe	33/472 (7.0%)
Extremely severe	96/472 (20%)
Anxiety score: median [IQR]	6 [2–16]
Stress severity	
Normal	290/472 (61%)
Mild	43/472 (9.1%)
Moderate	50/472 (11%)
Severe	51/472 (11%)
Extremely severe	38/472 (8.1%)
Stress score: median [IQR]	12 [4–22]
History of COVID-19 diagnosis	
No	354/472 (75%)
Yes	118/472 (25%)
Days of performing walking as exercise: median [IQR]	3 [1–6]

IQR = interquartile range.

Variation of median scores (IQR) of anxiety, stress, and depression according to measured demographics, lifestyle characteristics, and COVID-19 infection among 472 adult participants from Jazan, Saudi Arabia.

	Depression	Anxiety	Stress
Age			
23 yr or loss	10 [4–24]*	8 [2–18]*	14 [4–24]*
More than 23 yr	8 [2–17.5]	6 [2–14]	8 [2–20]
Gender			
Males	8 [2–16]*	6 [0–12]*	10 [2–18]*
Females	12 [2–22]	10 [2–20]	14 [4–24]
Education			
Less than University education	9 [2–18]	8 [2–16]	8 [2–18]*
University education	8 [2–22]	6 [2–16]	12 [4–22]
Salary			
Less than 5000 SAR	10 [4–22]*	8 [2–18]	12 [4–22]*
5000 SAR or more	8 [1–16]	6 [2–14]	10 [2–20]
Residence			
Urban	8 [2–20]	6 [0–16]	10 [3.5–20]
Rural	9 [2–18.5]	7 [2–16]	12 [4–22]
Marital status			
Married	6 [2–14]*	6 [2–14]	8 [2–18]*
Non-married	10 [2–20]	8 [2–18]	12 [4–22]
COVID-19 infection			
Yes	12 [4–26]*	10 [4–22]*	14 [5–26]*
No	8 [2–18]	6 [0–14]	10 [2–20]
Smoking			
Never smoker	10 [2–20]	6 [2–16]	12 [4–22]
Ever smoker	8 [2–18]	6 [2–16]	10 [2–22]
Walking			
3 days or less	10 [2–18]	8 [2–16]	10 [4–22]
More than 3 days	8 [2–20]	6 [2–16]	12 [4–22]

IQR = interquartile range, SAR = Saudi Arabian Riyal.

*P value < .05. All applied tests are Mann–Whitney U test.
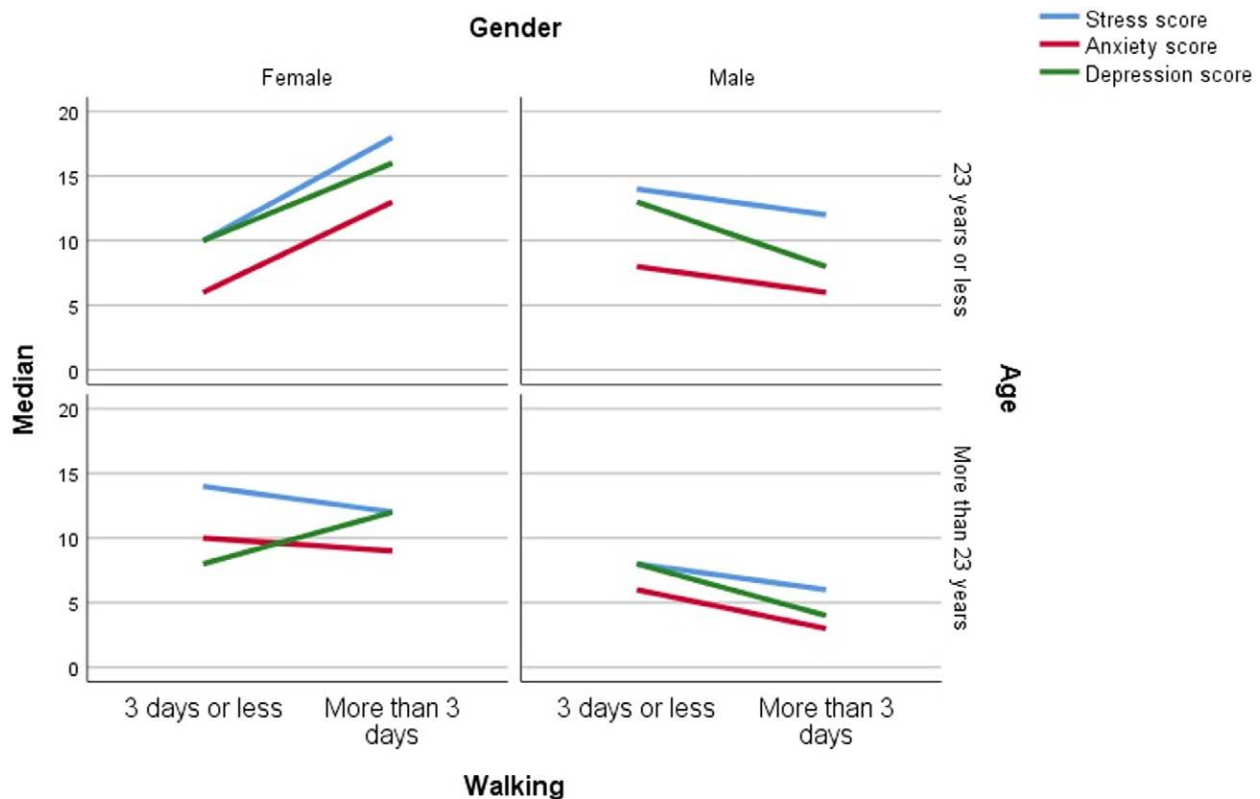
Figure 1. Distribution of medians of stress, anxiety and depression according to number of days of performing walking and stratified according to age and gender among a sample of 472 adult participants from Jazan, Saudi Arabia.

Table 4

Multivariate logistic regression analysis of OR of reporting higher levels of anxiety, stress and depression among 472 adult participants from Jazan, Saudi Arabia.

Variables:(reference groups)	Depression OR [95% CI] P value	Anxiety OR [95% CI] P value	Stress OR [95% CI] P value
Age (23 P or less)	1.3 [0.8–1.9] .15	1.1 [0.71.7] .48	1.2 [0.8–1.8] .31
Gender (females)	**1.8 [1.2–2.7] .002**	**2.1 [1.4–3.2] <.01**	**1.6 [1.0–2.3] .01**
Education (less than university education)	0.9 [0.6–1.4] .76	0.8 [0.5–1.2] .42	**0.6 [0.4–0.9] .03**
Marital status (married)	0.6 [0.4–1.1] .12	0.8 [0.4–1.3] .39	0.6 [0.4–1.1] .63
Salary (less than 5000 SAR)	1.2 [0.8–1.9] .20	1.2 [0.8–1.8] .34	1.3 [0.8–2.0] .18
COVID-19 infection (no)	1.1 [0.76–1.6] .59	1.3 [0.8–2.1] .14	1.3 [0.8–2.0] .24
Walking (3 days or less)	1.1 [0.7–1.6] .59	1.3 [0.9–1.9] .12	0.9 [0.6–1.4] .85

ORs of having lower levels of depression, anxiety and stress according to the measured characteristics.
CI = confidence interval, OR = odds ratio, SAR = Saudi Arabian Riyal.

Table 5

Multivariate logistic regression analysis of OR of reporting higher levels of anxiety, stress and depression among 472 adult participants from Jazan, Saudi Arabia and stratified according to gender.

	Depression OR [95% CI] P value	Anxiety OR [95% CI] P value	Stress OR [95% CI] P value
Females			
Age (23 yr or less)	1.0 [0.5–1.8] .88	0.9 [0.5–1.7] .99	0.8 [0.4–1.5] .67
Education (less than university education)	0.7 [0.4–1.4] .78	0.6 [0.3–1.2] .18	**0.4 [0.2–0.7] .006**
Marital status (married)	**0.4 [0.2–0.8] .01**	**0.4 [0.2–0.9] .02**	**0.4 [0.2–0.9] .04**
Salary (less than 5000 SAR)	1.3 [0.7–2.4] .30	1.3 [0.7–2.4] .28	1.2 [0.6–2.1] .50
COVID-19 infection (no)	1.5 [0.8–2.9] .17	1.5 [0.8–2.8] .16	1.6 [0.8–3.1] .10
Walking (3 days or less)	0.6 [0.4–1.2] .16	0.8 [0.4–1.3] .42	**0.5 [0.3–0.9] .04**
Males			
Age	1.8 [1.0–3.3] .39	1.5 [0.8–2.9] .17	1.8 [0.9–3.3] .059
Education (less than university education)	1.0 [0.5–1.8] .87	1.0 [0.5–1.8] .95	0.8 [0.4–1.6] .70
Marital status (married)	1.2 [0.5–2.7] .55	1.7 [0.7–4.0] .19	1.1 [0.5–2.7] .68
Salary (less than 5000 SAR)	1.4 [0.7–2.6] .27	1.3 [0.6–2.6] .44	1.6 [0.8–3.1] .16
COVID-19 infection (no)	1.1 [0.9–2.7] .57	1.1 [0.5–2.1] .77	0.9 [0.4–1.7] .81
Walking (3 days or less)	1.6 [0.9–2.7] .06	**2.3 [1.2–4.1] .005**	1.5 [0.8–2.6] .11

CI = confidence interval, OR = odds ratio, SAR = Saudi Arabian Riyal.

levels among males (P value .005). Additionally, a marginal significance level was detected concerning the association between walking and depression, suggesting the influence of walking on having lower depression levels among males (P value .06).

4. Discussion

This investigation was a cross-sectional study that recruited a sample of 472 adult participants from Jazan, Saudi Arabia. Nearly half of the participants had variable degrees of depression and anxiety, and 39% of them had variable stress levels. Depression, anxiety, and stress seem to be higher among females, younger subjects, those who are not married, those with a history of COVID-19 infection, those with higher education, and those with lower income. Performing walking as an exercise was relatively low, where, on average, participants performed walking during 3 days of the week only.

Gender appeared to have the strongest influence on levels of depression, anxiety, and stress among the recruited sample. Upon stratifying the sample according to gender, variation in the associations between the measured demographic factors and levels of depression, anxiety, and stress was noted. This includes the influence of walking on mental health, where the association between walking and better mental health was noted among males but not among females.

The findings of the current investigation can be compared with those of other national and international studies. There are multiple studies that reported variable degrees of depression, anxiety, and stress prevalence among populations of different Saudi Arabian cities. The prevalence of these conditions varied between

12.6% and 54% for depression, between 10% and 65.7% for anxiety, and between 12% and 39% for stress.[14–19] The variability of estimates of depression, anxiety, and stress in studies conducted in Saudi Arabia was due to methodological and demographic differences. For example, the study by Mirza et al reported a higher prevalence of depression, anxiety, and stress (54%, 53%, and 38%, respectively) as it included younger subjects (university students)[16] in comparison with another study, which targeted a general population of an older age (prevalence of depression, anxiety, and stress of 12.6%, 22.1%, and 7.5%, respectively).[14] This notion can be related to the findings of our investigation, where a higher prevalence of these conditions was detected given the higher proportion of younger subjects identified.

Studies that assessed the prevalence of depression, anxiety, and stress among Saudi communities suggested several factors increasing the risk of these conditions. The reported risk factors were related to gender, profession,[15] educational level, marital status,[17] family conflicts,[16] or lack of family support,[14] and khat abuse.[18] Similar to the findings of our investigation, other studies revealed that females and younger subjects,[15] and those who are not married were at higher risk.[17] However, a study assessing the prevalence of depression, anxiety, and stress among patients with diabetes suggested that lower education levels were associated with these conditions, contradicting the findings of our investigation, which indicated a higher prevalence among those with higher education levels.[17]

The stratified analysis of our study indicated that marital status is associated with mental health among women but not among men. This finding is different from that of Scott et al, who suggested that marriage is associated with a reduced risk of the first onset of

most mental disorders, regardless of gender, among a sample from 15 countries.[20] This notion may suggest differences in factors associated with mental health according to the studied populations. It is possible to argue that in communities such as the Saudi community, strict social norms favor the marriage of women at early ages in comparison with other international communities. This may partially explain why marriage was associated with mental health among women but not men in this Saudi sample.

Among the studies that assessed the prevalence of mental health disorders and their associated factors among Saudis, none of them assessed levels of depression, anxiety, and stress according to walking behavior. Furthermore, studies that assessed gender differences in the association between walking and mental health in other international settings are limited. Nonetheless, there are several investigations that assessed gender differences in the relationship between physical activity and mental health. A study by Muraki et al, which assessed the association between physical fitness and mental health among a sample of 25 adolescents, suggested that physical fitness was associated with better mental health among male adolescents while no such association was observed among females.[21] A similar notion was reported in a study assessing gender differences in the association between physical activity and health-related quality of life (including an assessment of mental state examination) among a sample of 188 elderly subjects. It concluded that older men with higher physical activity had a better health-related quality of life, but this was not the case among women. Nonetheless, another larger scale study by Halliday et al, which involved a sample of 1756 adolescents, provided contradictory findings that gender does not mediate the association between physical activity and mental health, but female adolescents, in general, tend to have lower participation in physical activity in comparison with male adolescents.[22]

Previous studies that measured the association between walking and mental health were limited to elderly subjects in American.[10,11] These studies detected a better influence of walking on mental health, regardless of gender. However, given the difference in age detected in these studies and the current investigation, it is possible to argue that our findings may provide a unique insight into the association between walking frequency and mental health among the younger Arab population.

4.1. Strengths and limitations

The current investigation had multiple areas of strength and weakness. The main strengths are related to the utilization of validated assessments of depression, anxiety, and stress among younger subjects with variable demographic characteristics. However, utilizing the online approach may have introduced selection bias as older and illiterate individuals were less likely to participate.

5. Conclusion

Levels of depression, anxiety, and stress detected in our investigation are similar to the levels of these conditions among similar Saudi populations. Nonetheless, our study identified a gender-based difference in the factors associated with the levels of these conditions, such as the influence of marital status among women and the influence of walking frequency among men. The findings of the current investigation suggest a need for more in-depth psychological and social studies to understand gender variation in the influence of walking on mental health, especially among Saudi populations.

Author contributions

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