Mentally Active and Passive Sedentary Behaviors: Associations with Mental Health Among Adults in Saudi Arabia

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ABSTRACT

The aim of this study was to examine the association between sedentary behavior (SB), having mentally active and passive SB and its assertion with individuals' psychological status among the public aged 18 and above in Saudi Arabia. This is an online cross-sectional survey study that was conducted in Saudi Arabia between June and July 2023. The Sedentary Behavior Questionnaire (SBQ) was used to measure participants' mentally active and passive sedentary behaviors. The Depression Anxiety Stress Scale-21 (DASS-21) was used to assess the psychological status. A total of 617 participants were involved in this study. The median number of SB hours per day was 7.0 (IQR: 4.6-10.1). Depression was prevalent among 65.0% of the study participants. This was followed by anxiety and stress where 18.9% and 11.3% of the study participants demonstrated severe to extremely severe anxiety and severe stress, respectively. Participants who possessed longer sedentary behavior hours per day (7 hours per day and above) and those who possessed longer mentally passive sedentary behavior hours per day (2.0 hours per day and above) were more likely to have higher psychological issues as measured by DASS-21 compared to others ($p<0.05$). Mental health issues, such as depression, anxiety, and stress, are common among the population under investigation. Spending more time being inactive and engaging in intellectually unstimulating activities for longer periods each day are factors that contribute to an increased likelihood of experiencing psychological problems, such as anxiety and depression. The high prevalence of these conditions emphasizes the urgent requirement for specific therapies and support measures.

Keywords: anxiety, depression, mental health, sedentary behavior, Saudi Arabia

INTRODUCTION

Annually, around 32.1 million Disability-Adjusted Life Years (DALYs) and 3.2 million deaths worldwide are attributed to inadequate physical activity[1]. Sedentary behavior (SB), poor physical disorder, and physical inactivity individuals are an increasing global public health situation[2,3]. Any waking behavior with minimal energy expenditure (equal to or less than 1.5 metabolic equivalents), including reclining or sitting, is described as SB[4].

Sedentary behavior is a critical yet often overlooked public health challenge[5,6]. Worldwide, in both developed and developing countries, SB affects approximately 60% to 85% of the population and contributes to many chronic lifestyle-related disorders [6]. Several studies have shown that, regardless of physical activity levels[7,8] and body weight[9-11], the effect of increased sedentary behavior on the risk of chronic diseases persists. Moreover, high time spent in SB has been linked to increased mortality risk from all causes and unfavorable health consequences[12,13], even among grown-ups who adhere to physical activity guidelines[14]. The latest WHO 2020 global guidelines on physical activity and sedentary behavior[15] have incorporated sedentary behavior.

Sedentary behavior has also been associated with poor mental health. It minimizes physical activities, which are very necessary in controlling mood; instead, it heightens anxiety, depression, and stress. Besides, sedentary behavior may promote social isolation, which further deteriorates mental health. Previous studies in Saudi Arabia and other nearby countries demonstrated the prevalence of anxiety, depression, and other psychiatric disorders among different populations including university students, the general public, and even healthcare professionals[16-22]. The correlation between various mental disorders and unhealthy behaviors[23] underscores the critical yet frequently overlooked role of lifestyle as a psychopathologies risk factor[23]. Furthermore, prolonged sedentary behavior has been associated with increased susceptibility to schizophrenia, bipolar disorder, and depression emphasizing its significance in mental health[24-28]. In Saudi Arabia, motorization and urbanization have led to fast socio-economic change, accompanied by a negative shift in the lifestyle of Saudi individuals towards more SBs in recent decades[29]. A previous study found a considerable prevalence of sedentary behavior among Saudi residents[30]. However, in Saudi Arabia, the research field in sedentary behavior is still to be entirely examined, as it is moderately recent in the medical field[31].

Due to the lack of research investigating the association between sedentary behavior and mental health among the public in Saudi Arabia, the present study aims to fill this gap by performing a cross-sectional study to examine the association between sedentary behavior and psychological status among the public aged 18 and above in Saudi Arabia. In addition, this study aimed to examine the association between having mentally active and passive sedentary behavior and its assertion with individuals' psychological status. Findings from this study could declare the development of targeted interventions and public health policies that could enhance mental health outcomes and promote active lifestyles in Saudi Arabia.

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METHODS

Study design: This is an online cross-sectional survey study that was conducted in Saudi Arabia between June and July 2023.

Sampling technique: This study employed the convenience sampling technique to recruit the study participants. The questionnaire link was distributed through social media websites (X, Instagram, and WhatsApp). The survey link was circulated across different social media pages through group posting to ensure the diversity in the study sample. The study included adults aged 18 years and older who live in Saudi Arabia. Any participants who did not meet the inclusion criteria were not included in the study. The study inclusion criteria were adults aged 18 years and older who live in Saudi Arabia, and it was mentioned in the invitation letter. Participants who met the inclusion criteria were invited and requested to participate in the study. In order to avoid duplicate responses, the survey link allowed one response per IP address.

Data collection tools:

Sedentary Behavior Questionnaire

This study utilized the Sedentary Behavior Questionnaire (SBQ) to measure participants' sedentary behaviour and specifically mentally active and mentally passive behaviors[32]. This questionnaire was adapted based on previously developed tool[33]. The assessment was created to measure the duration of time engaged in 9 specific activities, including watching television, playing computer/video games, listening to music while sitting, talking on the phone while sitting, doing paperwork or office work, reading while sitting, playing a musical instrument, doing arts and crafts, and driving/riding in a car, bus, or train while sitting. The 9 items were completed individually for weekdays and weekends. The question for weekday reporting was: "On a typical weekday, how much time do you spend (from waking up to going to bed) doing the following?" The phrasing remained same over the weekend, with the only change being the substitution of "weekday" with "weekend day." The response choices included: none, 15 minutes or less, 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, or 6 hours or more.

Each behavior's duration was translated to hours, for example, 15 minutes was recorded as 0.25 hours. The overall scores for sedentary behavior were calculated by summing the hours per day for each item separately for weekdays and weekends. To calculate weekly estimates, weekday hours were multiplied by 5 and weekend hours were multiplied by 2, then added together to get the total hours per week. Responses exceeding 24 hours/day for the summary variables of total hours/day spent in sedentary activities (weekday and weekend) and total sedentary hours/week were adjusted to 24 hours/day.

The SBQ evaluates a range of sedentary behavior s, encompassing both mentally active and mentally passive subsets. Engaging in activities that stimulate the mind while remaining sedentary, such as studying, working, or utilizing a computer for educational or professional objectives, constitutes mentally active SB. Conversely, mentally passive sedentary behavior pertains to pursuits that do not require substantial cognitive involvement or stimulation. Examples of such activities include perusing social media or viewing television without actively engaging with the content or interacting with it[34]. In the SBQ, questions number 1 and 3 estimate mentally passive sedentary behavior, while the remaining questions estimate mentally active sedentary behavior.

The reliability of the Arabic SBQ was deemed adequate, as evidenced by the correlation between the total sitting time of the Arabic SBQ and times calculated using alternative methods, as well as the English SBQ versions. Therefore, in subsequent epidemiologic and clinical efforts, the Arabic SBQ may be utilized to assess sedentary behavior among Arab adults[32].

Depression Anxiety Stress Scale-21 (DASS-21)

The second questionnaire tool used in this study is Depression Anxiety Stress Scale-21 (DASS-21). The DASS-21 questionnaire, in its Arabic, short form, was employed to assess the present psychological state of adult individuals in Saudi Arabia[35,36]. This measure is an effective and dependable tool that evaluates three adverse emotional conditions, namely depression, anxiety, and stress[35,37]. This questionnaire comprises 21 items, with a subset of seven items specifically designed to assess a single psychological state[37]. Put simply, seven pertinent items are used to assess each psychological state. The scoring system assigns a range of 0 to 3 points for each item, and the overall score for each scale is obtained by multiplying the sum of these items by 2. Therefore, the score for each scale can range from 0 to 14[36,37]. The psychometric characteristics study for the DASS-21 states that the total score is multiplied by 2 in order to ensure comparability with the original long-version DASS (DASS-42)[38]. Each individual's psychological symptoms can be classified into severity labels such as normal, mild, moderate, severe, or extremely severe based on the overall score for each scale[37,38].

The third section of the questionnaire asked the study participants about their demographic characteristics such as age, body mass index (BMI), gender, marital status, whether they are currently pregnant, breastfeeding status, whether they have children, number of children, educational level, employment status, years in current occupation, monthly income (in Saudi Arabia riyal (SAR)), region of residency, smoking status, whether they are diagnosed with chronic disease, and whether they are diagnosed with mental disorders.

Sample Size: Under the assumption of a 50% response rate, the minimum sample size required for this research was 377, with a 95% confidence level and a 5% margin of error.

Ethical approval: The protocol for this study was reviewed and approved by the Institutional Review Board at King Saud University (No. KSU-HE-23-075). Electronic consent was provided by all participants.

Statistical analysis: The data for this study was analyzed using the Statistical Package for Social Science Software, version 29. Categorical data were presented frequencies and percentages. Continuous data was presented as mean and standard deviation (SD) for normally distributed variables and as median and interquartile range (IQR) for not normally distributed data. The normality of the data was checked using histogram, skewness, and kurtosis measures. Predictors of having higher DASS-21 score and having longer sedentary behavior hours per day were identified using binary logistic regression analysis. The cut-off used to identify the dummy variable was the defined as the mean sedentary behavior hours per day for the study sample. The findings of the regression analysis were presented as odds ratio with 95% confidence interval. The significance level was identified as p-value less than 0.05.

RESULTS

Participants' demographic characteristics:

Table 1 below presents participants' demographic characteristics. A total of 617 participants were involved in this study. The mean age of

the study participants was 38.0 (SD: 10.6) years. The median BMI was 27.3 kg/m^2 (24.1-31.1). Around 60.1% of the study participants were males. The majority of the study participants (76.5%) were married. Around 3.7% of the females participated in the study reported that they are currently pregnant. Around 6.1% of the females participated in the study reported that they are currently practicing breastfeeding. A total of 88.5% of the study participants reported that they have children, with a median number of 2 (IQR: 0-4). More than half of the study participants (61.6%) reported that they have bachelor degree. Around 49.3% of the study participants reported that they are currently working in the governmental sector. Around one-third of the study participants (33.1%) had an experience of 11-15 years in their current occupation and with a monthly income of 10001-15000 SAR (32.2%). Around 79.2% of the study participants reported that they are currently living in the Western region of Saudi Arabia. Around one-quarter of the study participants (24.3%) reported that they are smokers. Around 17.2% of the study participants confirmed that they have chronic diseases and 7.8% have mental disorders.

Table 1. Participants' demographic characteristics

Variable	Frequency	Percentage
Mean age (SD) years	38.0 (10.6) years	
Median BMI (IQR) (kg/m^2)	27.3 (24.1-31.1)	
Gender		
Males	371	60.1%
Females	246	39.9%
Marital status		
Single	121	19.6%
Married	472	76.5%
Divorced	21	3.4%
Widowed	3	0.5%
Currently pregnant (yes)	9	3.7%
Breastfeeding (yes)	15	6.1%
Have children (n= 496)		
Yes	439	88.5%
Median number of children (IQR)	2 (0-4)	
Educational level		
High school or lower	79	12.8%
Diploma	39	6.3%
Bachelor degree	380	61.6%
Master degree	76	12.3%
PhD	43	7.0%
Employment status		
Working in the governmental sector	304	49.3%
Working in the private sector	114	18.5%
Unemployed	107	17.3%
Retired	46	7.5%
Student	46	7.5%
Years in current occupation (n= 418)		
Less than 5 years	73	17.3%
5-10 years	111	26.6%
11-15 years	140	33.6%
16 year and more	94	22.5%
Monthly income		
Less than 5000 SAR	163	26.4%
5001-10000 SAR	126	20.5%
10001-15000 SAR	199	32.2%
15001-20000 SAR	75	12.2%
20001 and above	54	8.7%
Region of residency		
Central region	87	14.1%
Western region	487	79.2%
Eastern region	17	2.8%
Southern region	13	2.1%
Northern region	13	2.1%
Smoking status (yes)	150	24.3%
Diagnosed with chronic disease(s) (yes)	106	17.2%
Diagnosed with mental disorder(s) (yes)	48	7.8%

SAR: Saudi Arabia riyal; SD: Standard deviation; IQR: Interquartile range

Sedentary behavior profile:

Table 2 below presents the median number of sedentary behaviors stratified by weekday. The median number of sedentary behavior hours per day was 7.0 (IQR: 4.6-10.1). The median number of sedentary behavior hours per day during the weekday 7.3 (IQR: 4.6-10.5) was longer than during the weekend 6.3 (IQR: 3.8-9.5). The median number of mentally active sedentary behavior hours per day was 4.8 (IQR: 2.6-7.2). Similarly, the median number of mentally active sedentary behavior hours per day during the weekday 5.0 (IQR: 2.5-7.5) was longer than during the weekend 4.0 (IQR: 2.0-6.5). The median number of mentally passive SB hours per day was 2.0 (IQR: 1.0-3.7). It was similar to that during the weekend and the weekday 2.0 (IQR: 1.0-4.0).

Table 2. Median number of sedentary behaviour hours including mentally active and passive sedentary behavior hours stratified by per day, weekday, and weekend

	Median number of hours	Interquartile range
Total sedentary behaviour per weekday	7.3	4.6-10.5
Total sedentary behaviour per weekend	6.3	3.8-9.5
Total sedentary behaviour per day	7.0	4.6-10.1
Mentally active sedentary behaviour per weekday	5.0	2.5-7.5
Mentally active sedentary behaviour per weekend	4.0	2.0-6.5
Mentally active sedentary behaviour per day	4.8	2.6-7.2
Mentally passive sedentary behaviour per weekday	2.0	1.0-4.0
Mentally passive sedentary behaviour per weekend	2.0	1.0-4.0
Mentally passive sedentary behaviour per day	2.0	1.0-3.7

Psychological profile of the study participants:

The median total DASS-21 score among the study participants was 30.0 (IQR: 16.0-46.0). The median depression score among the study participants was 10.0 (IQR: 4.0-16.0). The median anxiety score among the study participants was 8.0 (IQR: 2.0-12.0). The median stress score among the study participants was 12.0 (IQR: 6.0-18.0). Table 3 presents the median depression, anxiety, and stress scores for the study participants.

Table 3. Median depression, anxiety, and stress score for the study participants

	Median score	Interquartile range
Depression	10.0	4.0-16.0
Anxiety	8.0	2.0-12.0
Stress	12.0	6.0-18.0
Total DASS score	30.0	16.0-46.0

Table 4 presents the prevalence of depression, anxiety, and stress among the study participants stratified by severity. The most commonly observed psychological issue was depression were 65.0% of the study participants demonstrated severe to extremely severe depressive status. This was followed by anxiety which 18.9% of the study participants demonstrated severe to extremely severe anxiety status. On the other hand, 11.3% of the study participants demonstrated severe to extremely severe stress.

Table 4. Prevalence of depression, anxiety, and stress among the study participants stratified by severity.

	Normal	Mild	Moderate	Severe	Extremely severe
Depres-sion	8.3%	7.8%	19.0%	17.0%	48.0%
Anxiety	49.9%	9.1%	22.0%	9.2%	9.7%
Stress	61.3%	15.2%	12.2%	6.8%	4.5%

Predictors of having higher DASS score and having longer sedentary behavior hours:

Table 5 below shows the predictors of having higher DASS score and having longer sedentary behavior hours. Females, those who are currently pregnant or breastfeeding, those who don't have children, those who are unemployed or working in the private sector, those who are currently smokers, and those who are diagnosed with psychiatric disorder were more likely to have higher DASS score and psychological issues compared to others ($p<0.05$). On the other hand, younger population (aged 38.0 years or lower), females, those who have bachelor degree or PhD, those who are working in the private sector, those who are currently smokers, and those who are diagnosed with psychiatric disorder were more likely to have longer sedentary behavior hours compared to others ($p<0.05$). Males, those who are not currently pregnant, those who have higher education level, and those who have monthly income level 5001-20000 SAR were more likely to have longer mentally active sedentary behavior hours compared to others ($p<0.05$). Females, those who are currently pregnant, those who are breastfeeding, those who have children, and those who are unemployed were more likely to have longer mentally passive sedentary behavior hours compared to others ($p<0.05$).

The association between sedentary behavior hours and having higher DASS score:

Table 6 below displays the relationship between sedentary behavior hours including mentally active and passive sedentary behavior hours

Table 5. Predictors of having higher DASS score and having longer sedentary active and passive behaviour hours

Variable	**Odds ratio of having higher DASS score** (95% confidence interval)	**P-value**	**Odds ratio of having longer sedentary behaviour hours per day** (95% confidence interval)	**P-value**	**Odds ratio of having longer mentally active sedentary behaviour hours per day**	**P-value**	**Odds ratio of having longer mentally passive sedentary behaviour hours per day**	**P-value**
Mean age categories								
38.0 years or lower (Reference group)	1.00		1.00		1.00		1.00	
Above 38 years	0.8 (0.6-1.0)	0.085	0.6 (0.4-0.8)	<0.001	0.8 (0.6-1.1)	0.136	0.8 (0.6-1.1)	0.262
Median BMI categories								
27.3 kg/m^2 or lower (Reference group)	1.00		1.00		1.00		1.00	
Above 27.3 kg/m^2	1.2 (0.9-1.7)	0.212	1.1 (0.8-1.5)	0.546	1.1 (0.8-1.5)	0.494	1.1 (0.8-1.6)	0.397
Gender								
Males (Reference group)	1.00		1.00		1.00		1.00	
Females	1.8 (1.3-2.5)	<0.001	1.4 (1.0-2.0)	0.033*	0.6 (0.4-0.8)	<0.001	1.4 (1.0-2.0)	0.028*
Marital status								
Single (Reference group)	1.00		1.00		1.00		1.00	
Married	0.6 (0.4-0.9)	0.008**	0.4 (0.3-0.6)	<0.001	0.7 (0.4-1.0)	0.051	0.7 (0.5-1.1)	0.157
Divorced	0.6 (0.2-1.5)	0.248	0.7 (0.3-1.7)	0.385	1.0 (0.4-2.5)	0.952	0.5 (0.2-1.4)	0.206
Widowed	-	-	-	-	-	-	1.5 (0.1-16.5)	0.761
Currently pregnant								
No (Reference group)	1.00		1.00		1.00		1.00	
Yes	1.4 (1.2-1.6)	<0.001	0.9 (0.7-1.0)	0.051	0.6 (0.4-0.8)	<0.001	1.2 (1.0-1.4)	0.028*
Breastfeeding								
No (Reference group)	1.00		1.00		1.00		1.00	

Yes	1.4 (1.2-1.6)	<0.001	0.9 (0.7-1.0)	0.073	0.8 (0.6-0.9)	0.001**	1.2 (1.0-1.4)	0.021*
Have children								
No (Reference group)	1.00		1.00		1.00		1.00	
Yes	0.7 (0.5-1.0)	0.045*	0.6 (0.4-0.8)	0.001**	1.3 (0.9-1.9)	0.105	1.5 (1.0-2.1)	0.038*
Median number of children categories								
2 or below (Reference group)	1.00		1.00		1.00		1.00	
More than 2 children	0.9 (0.6-1.2)	0.361	0.6 (0.4-0.8)	0.002**	0.8 (0.6-1.1)	0.109	0.8 (0.5-1.1)	0.097
Educational level								
High school or lower (Reference group)	1.00		1.00		1.00		1.00	
Diploma	0.8 (0.4-1.7)	0.556	1.3 (0.6-3.0)	0.468	1.1 (0.5-2.4)	0.854	1.0 (0.5-2.2)	0.944
Bachelor degree	0.5 (0.3-0.8)	0.006**	2.0 (1.2-3.3)	0.007**	2.0 (1.2-3.3)	0.008**	0.9 (0.5-1.4)	0.639
Master degree	0.5 (0.3-0.9)	0.032*	3.1 (1.6-6.0)	<0.001	3.3 (1.7-6.4)	<0.001	1.0 (0.5-1.9)	0.922
PhD	0.5 (0.2-1.1)	0.093	3.3 (1.5-7.0)	0.003**	2.9 (1.4-6.3)	0.006**	1.2 (0.6-2.6)	0.598
Employment status								
Working in the governmental sector (Reference group)	1.00		1.00		1.00		1.00	
Working in the private sector	1.6 (0.1-2.5)	0.032*	1.6 (1.0-2.6)	0.030*	1.3 (0.8-2.0)	0.255	1.4 (0.9-2.2)	0.125
Unemployed	1.9 (1.2-3.0)	0.006**	0.4 (0.3-0.7)	<0.001	0.3 (0.2-0.4)	<0.001	1.8 (1.2-2.9)	0.008**
Retired	0.6 (0.3-1.1)	0.090	0.3 (0.1-0.5)	<0.001	0.1 (0.1-0.3)	<0.001	1.1 (0.6-2.0)	0.771
Student	1.3 (0.7-2.4)	0.439	1.1 (0.6-2.1)	0.744	0.7 (0.4-1.4)	0.315	0.9 (0.5-1.7)	0.796
Years in current occupation								
Less than 5 years (Reference group)	1.00		1.00		1.00		1.00	
5-10 years	0.8 (0.4-1.4)	0.420	0.9 (0.5-1.7)	0.761	0.9 (0.5-1.6)	0.619	0.7 (0.4-1.3)	0.246
11-15 years	0.7 (0.4-1.2)	0.212	0.6 (0.3-1.1)	0.104	0.6 (0.3-1.1)	0.084	0.7 (0.4-1.3)	0.250
16 year and more	0.4 (0.2-0.8)	0.011*	0.5 (0.3-1.0)	0.050*	0.7 (0.4-1.3)	0.284	0.6 (0.3-1.1)	0.082
Monthly income								
Less than 5000 SAR (Reference group)	1.00		1.00		1.00		1.00	
5001-10000 SAR	0.7 (0.5-1.2)	0.212	1.4 (0.9-2.3)	0.132	2.2 (1.3-3.5)	0.002**	0.9 (0.5-1.4)	0.591
10001-15000 SAR	0.5 (0.4-0.8)	0.005**	1.5 (1.0-2.2)	0.080	2.2 (1.4-3.4)	<0.001	0.7 (0.5-1.1)	0.093
15001-20000 SAR	0.5 (0.3-0.8)	0.008**	1.2 (0.7-2.0)	0.603	1.8 (1.0-3.1)	0.047*	0.8 (0.4-1.3)	0.320
20001 and above	0.3 (0.2-0.6)	<0.001	1.4 (0.7-2.6)	0.323	1.7 (0.9-3.2)	0.086	1.1 (0.6-2.1)	0.716
Region of residency								
Central region (Reference group)	1.00		1.00		1.00		1.00	
Western region	1.0 (0.6-1.6)	0.992	0.8 (0.5-1.3)	0.457	0.8 (0.5-1.3)	0.457	0.9 (0.5-1.4)	0.533
Eastern region	0.9 (0.3-2.6)	0.858	0.6 (0.2-1.7)	0.335	0.5 (0.2-1.4)	0.164	0.9 (0.3-2.6)	0.866
Southern region	3.4 (0.9-13.2)	0.076	0.7 (0.2-2.3)	0.597	0.5 (0.2-1.8)	0.300	1.3 (0.4-4.3)	0.667
Northern region	3.4 (0.9-13.2)	0.076	1.4 (0.4-4.5)	0.612	1.0 (0.3-3.2)	0.990	0.5 (0.2-1.7)	0.266
Smoking status								
No (Reference group)	1.00		1.00		1.00		1.00	
Yes	1.5 (1.0-2.2)	0.033*	2.0 (1.4-2.9)	<0.001	0.5 (0.6-0.8)	<0.001	0.9 (0.6-1.3)	0.679
Diagnosed with chronic disease(s)								
No (Reference group)	1.00		1.00		1.00		1.00	
Yes	0.9 (0.6-1.4)	0.760	0.7 (0.5-1.1)	0.114	1.3 (0.8-1.9)	0.295	1.0 (0.6-1.5)	0.827
Diagnosed with psychiatric disorder (s)								
No (Reference group)	1.00		1.00		1.00		1.00	
Yes	4.1 (2.0-8.4)	<0.001	2.6 (1.3-4.9)	0.004**	0.8 (0.5-1.5)	0.540	0.4 (0.2-0.7)	0.003**

*p<0.05; **p<0.001

and having higher DASS score. Participants who possessed longer sedentary behavior hours per day (7 hours per day and above) and those who possessed longer mentally passive sedentary behavior hours per day (2.0 hours per day and above) were more likely to have higher DASS score and psychological issues compared to others ($p<0.05$). However, mentally active sedentary behavior did not significantly associate with higher DASS score.

Table 6. The association between sedentary behavior, mentally active and passive sedentary behavior (hours) and having higher DASS score

	Odds ratio of having higher DASS score (95% confidence interval)	**P-value**
Median sedentary behaviour per day categories		
Less than 7 hours per day	1.00	
7 hours per day and above	1.6 (1.1-2.2)	0.006**
Median mentally active sedentary behaviour per day categories		
Less than 4.8 hours per day	1.00	
4.8 hours per day and above	1.4 (1.0-1.9)	0.059
Median mentally passive sedentary behaviour per day categories		
Less than 2.0 hours per day	1.00	
2.0 hours per day and above	1.8 (1.3-2.4)	<0.001

*p<0.05; **p<0.001

DISCUSSION

The results of the study indicate several influential patterns related to sedentary behavior among the public in Saudi Arabia, including the importance of these patterns for well-being and general health. Our investigation determined that the median number of SB hours per day was 7.0 (IQR: 4.6-10.1). Besides, the median number of SB differed significantly between weekdays and weekends; the median number of SB hours per day during the weekday was 7.3 (IQR: 4.6-10.5) longer than during the weekend, which was 6.3 (IQR: 3.8-9.5).

The findings of this study on median daily sedentary behavior duration are in line with a previous investigation among adults in Australia and New Zealand, which found that weekday SB was 7.9 hours[39]. Also, our observation on differences in the median duration of SB between weekdays and weekends is constant with a prior study among Dutch participants, which reported that the median duration of sedentary behavior was 9.1 during weekdays vs. 7.4 during weekends[40]. These results indicate that these sedentary behavior-related patterns are widespread among different populations globally. Therefore, comprehending these patterns aids in developing targeted interventions to diminish the adverse consequences of reported sedentary behavior-related patterns on individuals' health and well-being.

The current investigation found that the median number of mentally active sedentary behavior hours per day was 4.8 (IQR: 2.6-7.2). The median number of mentally active sedentary behavior hours per day during the weekday increased slightly to 5.0 (IQR: 2.5-7.5) and was longer than that during the weekend, which decreased to 4.0 (IQR: 2.0-6.5). Additionally, the median number of mentally passive sedentary behavior hours per day was 2.0 (IQR: 1.0-3.7). Still, the median number of mentally passive sedentary behavior hours was like that during the weekend and the weekday 2.0 (IQR: 1.0-4.0). These also accord with prior research in Saudi Arabia [41], which showed that adults spent more time in mentally active sedentary behavior than mentally passive sedentary behavior [(5.61 ± 4.57 hours) vs. (2.50 ± 3.25 hours)]. Also, the same prior research reported that mentally active sedentary behavior occurred more often on weekdays than weekends [(6.00 ± 5.00 hours) vs. (5.00 ± 5.00 hours)]. However, it did not report a significant difference for mentally passive sedentary behavior ($P> 0.05$)[41]. Furthermore, determining the mental SB-related mental problem risk is essential; a previous study concluded that the duration spent in mentally passive activities with SB is associated with the risk of depression and anxiety[42].

The prevalence of psychological problems among the participants in our study was high, and the most frequently observed psychological problem was depression, with 65.0% of the participants showing severe to extremely severe depression. It was followed by anxiety, with 18.9% of the participants showing severe to extremely severe anxiety. Still, 11.3% of the participants in the study showed severe to extremely severe stress. These findings are corroborated by previous research highlighting the association between sedentary behavior and mental health outcomes, which have shown that sedentary behavior is associated with increased mental health problems risk, including depression, anxiety, and stress[43-45]. In addition, a previous meta-analysis confirmed the existence of a correlation between passive mental sedentary behavior and the risk of depression[46]. These highlight the need for interventions to manage patterns of sedentary behavior as a risk factor for mental health issues.

In this investigation, the demographic and behavioral factors appeared to be associated with higher psychological distress levels among adults in Saudi Arabia as we found that females, those who are pregnant or breastfeeding currently, those who don't have children, those who are unemployed or working in the private sector, those who are smokers currently, and those who are diagnosed with a psychiatric disorder were more likely to have higher DASS score and psychological issues compared to others ($p<0.05$). These results agree with a broad range of literature, which has found that social networks[47,48], occupational status[49], lifestyles[50], and sociodemographic characteristics[51,52] influence mental health outcomes.

Consistent with our results, previous research implies that women are at higher risk of experiencing mental health challenges than men[53,54]. Many factors were documented to impact gender disparities in mental health outcomes, such as experiences of violence[55], discrimination[56], and hormonal fluctuation[57]. The National Institutes of Health has underlined that identifying gender differences in health outcomes is significant[58-61]. In addition, studies have observed a strong association between nicotine use and mental health conditions, including depression, anxiety, and stress[62-64]. It also demonstrated that unemployment and prior work in housekeeping result in increased mental health disorders in the older population[65]. Accordingly, there is a need for targeted approaches that evaluate demographic and behavioral characteristics to handle the challenges among adults in Saudi Arabia.

Another important finding of our study is the association between demographic and behavioral factors, and the prolonged sedentary behavior behavior among participants, younger population (aged 38.0 years or lower), females, those who have bachelor's degrees or PhD, those who are working in the private sector, those who are smokers currently, and those who are diagnosed with a psychiatric disorder were more likely to have longer sedentary behavior hours compared to others ($p<0.05$). These results underscore the need to encourage healthy habits in addition to targeted strategies to overcome sedentary behavior.

The association between younger age and longer sedentary behavior hours observed in this study is inconsistent with a previous study that

found a positive association between sedentary behavior and age[66]. Still, it is consistent with another study that showed that younger individuals had a higher tendency for SB than older individuals[67]. It seems possible that these results may be due to the tendency of older individuals to maintain their health through physical activity[68,69] and prefer walking during travel and leisure[70,71]. On the other hand, younger individuals tend to use inactive means of travel[71].

The research investigation findings about the correlation between females and extended sedentary behavior hours are consistent with a previous study that found significant differences in the prevalence of inactivity between males and females, with men being more active[72]. This underscores the need to understand the factors associated with these differences between males and females and to consider these gaps when developing a program to address sedentary behavior. Furthermore, the remaining demographic and behavioral factors (an education level (bachelor's or doctoral), employment in the private sector, current smoking status, or having a mental disorder) that were associated with lengthy sedentary behavior hours may indicate a complicated connection between sedentary behavior patterns and these factors.

The study demonstrated that there was a significant association between the daily sedentary behavior length and the deterioration of mental health among the participants, those who possessed longer sedentary behavior hours per day (7 hours per day and above) and those who possessed longer mentally passive sedentary behavior hours per day (2.0 hours per day and above) were more likely to have a higher DASS score and psychological issues compared to others ($p<0.05$).

This study results are consistent with several previous research, where an earlier investigation among university students found that depression, anxiety, and stress levels were significantly higher because of increased sedentary behavior time[73]. These results strongly supported prior research among adults in Brazil, which compared individuals with lower sedentary behavior

levels to those with higher sedentary behavior levels and found that individuals with higher sedentary behavior levels had higher levels of depression, anxiety, and stress, spent more time in sedentary activities, and had lower levels of physical activity[74]. In line with the above results, another previous study found that mentally active SB has a protective effect against depression and that mentally passive sedentary behavior increases the risk of depression[75]. Finally, this evidence underscores the need to raise awareness about the risks of prolonged sedentary behavior and mental health and the requirement to implement strategies to promote daily activity, which improves the mental health and well-being of individuals and communities.

There are limitations to this study. The cross-sectional study design limited the capacity to investigate causality between independent variables and dependent variables. This study may have selection bias due to the use of convenience sampling technique to recruit the study sample. Furthermore, the effectiveness of self-administered questionnaires relies on the participants' honesty and ability to accurately remember information, which might be impeded by recall biases and the tendency to provide socially desirable responses. Furthermore, they may overlook nuanced reactions or neglect to offer chances for additional clarification of queries, leading to incomplete or inaccurate information. Unfortunately, this study did not estimate the response rate, as the number of participants who received the study link could not be estimated. Hence, it is imperative that we use caution when interpreting our findings.

CONCLUSION

The study's findings emphasize the significant prevalence of mental health issues, particularly depression, anxiety, and stress, among the general public in Saudi Arabia. Increased sedentary behavior and prolonged engagement in intellectually mentally passive activities are associated with a higher risk of developing psychological issues, such as anxiety and depression. The significant frequency of these psychological issues underscores the pressing need for targeted and supportive interventions.

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