



## Cross-Sectional Study

## Relationship between Psychological Distress and Physical Activity among Medical Students: A Cross-Sectional Study

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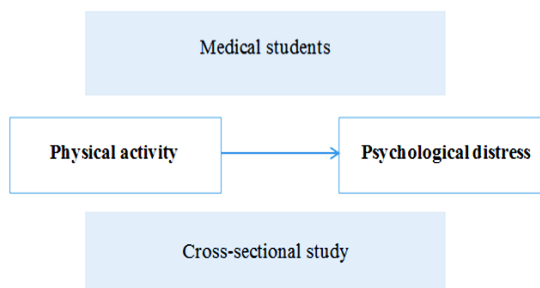
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## ABSTRACT

Medical studies are known to be a source of psychological distress and radical changes in medical students' behaviors and attitudes. We carried out this study to assess the prevalence of psychological distress and physical activity among medical students in Morocco and to analyze the association between these two variables. A cross-sectional study was conducted among 855 Moroccan medical students. Physical activity and psychological distress were assessed using the International Physical Activity Questionnaire (IPAQ) and the Kessler Psychological Distress Scale (K10), respectively. Regression analysis models were used to identify factors associated with psychological distress and the association between physical activity and psychological distress levels. The median age was 20 [19-21] years old, 55,1% of participants were women and 42,6% lived on the university campus. The prevalence of low physical activity levels was 25,1%, with 30,4% among women and 18,8% among men. The overall prevalence of psychological distress was 48,1% with a high level of 14,7%. Females were found to have higher levels of psychological distress compared to males ( $p < 0,001$ ). Multivariate logistic regression showed that feminine (OR=1,49 [1,12-1,99];  $p = 0,007$ ) and lower levels of physical activity (OR=2,98 [1,95;4,54];  $p < 0,001$ ) were significantly associated with psychological distress. Psychological distress and low physical activity appear to have increased in Moroccan medical students. These results underlined the importance of promoting physical activity as an effective strategy to reduce and prevent psychological distress.

## GRAPHICAL ABSTRACT



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## Introduction

Psychological distress, defined as an unpleasant subjective state associated with symptoms from the anxiety-depression spectrum that leads to poor mental health and impact level of functioning [1], is one of the most common indicators of the populations at risk of mental illness that could be targeted for prevention or intervention programs [2]. Physical activity promotion may be a key strategy for improving mental health and reducing psychological distress worldwide, given the strong and growing evidence that physical activity has well-being and mental health benefits clinical and non-clinical populations [3]. According to the World Health Organization (WHO), adults should be at least 150 minutes of moderate-intensity physical activity, or at least 75 minutes of vigorous-intensive physical activity throughout the week or an equivalent combination of moderate and vigorous-intensity physical activity. However, despite this recommendation, increasing levels of physical inactivity are seen worldwide and contribute to 5 million deaths each year [4]. However, Globally 1 in 4 individuals do not achieve these guidelines. [5]. Several mechanisms have been reported to explain the link between exercise and mental health, including biochemical mechanisms that include endorphin release, and increased serotonin and norepinephrine [6, 7]. Moreover, regular exercise increases self-esteem, reduces emotional strain, provides social interaction, promotes social support, and serves as a buffer against stressful events [8].

Among university medical students, poor physical activity and mental illness have been found to be prevalent [9]. High levels of psychological distress were observed in medical students in Australia [10], Norway [11], and Sweden [12], as well as, physical activity has been shown to be low among medical students, as reported in Turkey and Thailand [13, 14]

Medical studies may have significantly negative effects on medical students [15]. The rigors of the medical curriculum, the availability of extracurricular activities and the academic outcomes may play an important role in the prevalence of depression and anxiety for students

during their medical education [16]. In general, before starting medical education, the proportion of medical students suffering from psychological distress is similar to that in the general population; however, this proportion may double by the end of the first year [17, 18]. Furthermore, Dyrbye et al., reported that the majority of US medical students experience at least one event of distress, such as depression, decreased mental quality of life; and those distressed students are more likely to drop out of medical career and suicide [19].

Due to the scarce consistent data regarding the association between physical activity and mental health (depression, anxiety and stress) in Morocco, especially among medical students, the present study was carried out to determine the prevalence of psychological distress and physical activity in medical students and to evaluate the association between these two variables.

## Materials and Methods

### *Study Design and Sampling Method*

A cross-sectional survey was conducted among Moroccan medical students affiliated to the faculty of Medicine and Pharmacy of Rabat-Morocco and the faculty of medicine and pharmacy of Tangier-Morocco a sample of 900 medical students was included. The sample size was calculated using the formula with the following assumptions: 95% confidence level, 1.96 ( $Z_{\alpha/2}$ ), 50% proportion, and 5% degree of precision (d) [20].

The investigation was conducted in January-February 2020, during a period far away from the exams' period, to avoid the effect of additional stressful factors. Inclusion criteria were male and female medical students, aged between 18 and 30 years old. Exclusion criterion was having any type of physical or mental illness. Participation in the research was voluntary and informed consent was obtained from all participants before starting this cross-sectional non-interventional study.

### *Data collection and instruments*

The students were interviewed using a self-administered questionnaire, consisting of three sections, each section included several questions to assess the following items:

1- The socio-demographic characteristics of the respondents (age, sex, body mass index, residence);

2- Evaluation of physical activity levels using the International Physical Activity Questionnaire (IPAQ) short form. The International Physical Activity Questionnaire (IPAQ) is a self-reported questionnaire that was developed and reported to be a validated and reliable tool for the assessment of physical activity. According to the IPAQ, PA is categorized into three levels [21, 22]:

- **Low Physical activity category:** No activity or some activity is reported but not enough to meet the following categories:

- **Moderate Physical activity category:** 3 or more days of vigorous activity for at least 20 min. per day, or 5 or more days of moderate-intensity activity or walking for at least 30 min. per day, or 5 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum of 600 METmin. week-1.

- **High Physical activity category:** 3 or more days of vigorous activity accumulating at least 1500 METmin·week-1 or 7 days of any combination of walking, moderate or vigorous-intensity activities achieving a minimum of 3000 METmin·week-1.

3- Evaluation of the level of psychological distress using the Kessler Psychological Distress Scale (K10), a self-reported questionnaire on depression and general mental disorders. The score range for responses to the questionnaire is 10–50 points, and a higher score represents more psychological distress with an optimal cut-point of 24 for a psychological disorder. According to the scores, the following thresholds are created to determine levels of psychological distress: 10 - 19 (likely to be well), 20–24 (mild stress), 25–29 (moderate stress) and  $\geq 30$  (severe stress), applied

to provide a measure of symptoms among the participants [23].

#### Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 20.0 (SPSS, Chicago, IL, USA). The results on continuous variables were presented in median (IQR) and categorical data were presented in frequency (%).

Comparisons between stressed students and unstressed groups (defined by K10 score  $\geq 20$  and  $< 20$ , respectively) were carried out by using the Mann-Whitney test for quantitative variables, and the Pearson Chi-square test for qualitative variables.

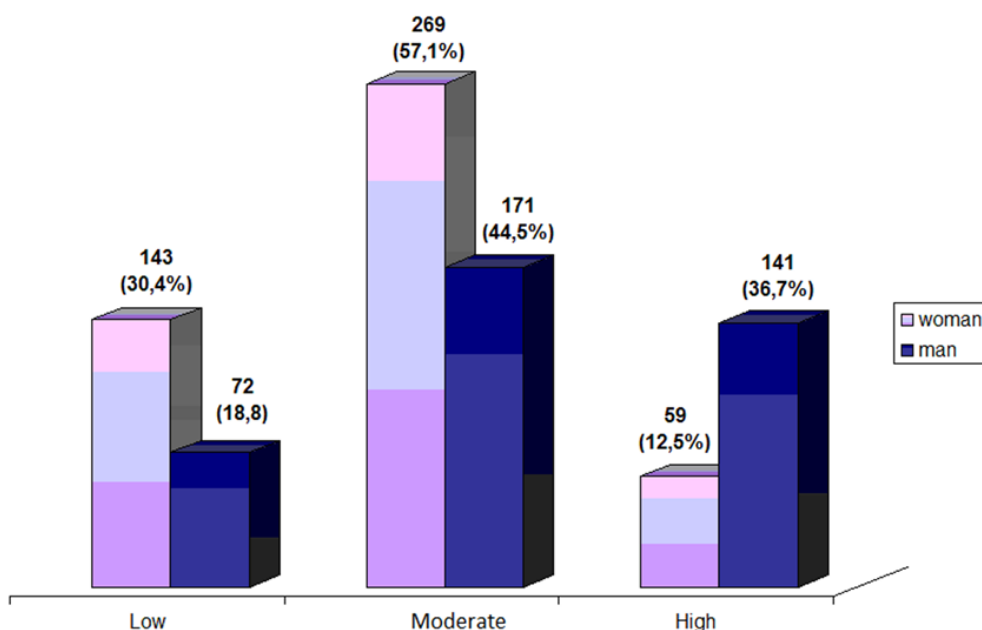
Univariate and multivariate logistic regression models were employed to identify factors associated with psychological distress. The 95% confidence intervals (CIs) were provided. Statistical significance was set at 0.05.

#### Results

The survey included 855 medical university students randomly recruited from the faculties of Medicine and Pharmacy of Rabat and Tangier, Morocco. The response rate was 95%.

Among all participants, 55,1% were women. The median age of the included students was 20 and the median BMI was 21,05 [19,35-23,4] Kg/m<sup>2</sup>, with 9,7% being overweight. As for the residential area, 42,6% of included students were living in the university campus.

The analysis of IPAQ responses showed that 76,6 % of students had low to moderate physical activity levels and females were less active compared to males (Figure 1). As for psychological distress levels, 48,1% of students presented symptoms of depression and anxiety while 14,7% of students had severe distress.



**Figure 1:** Level of physical activity among the study population according to the gender

Results of the comparison between the two groups “students with psychological distress” and “students without psychological distress”, showed a statistically significant difference based on sex, with a p value < 0,001, i.e. women developed more

stress than men, and on physical activity with a p value <0,001, low level of physical activity was more prevalent in the psychological distress group (Table1).

**Table 1:** Comparison between the two groups “unstressed students” and “stressed students” of the study population

Variable	Group “Students without psychological distress ” (n1=444)	Group “Students with psychological distress” (n2=411)	P value
Age(years)*	20 [19; 21]	19 [19; 21]	<b>0,001</b>
BMI (kg/m <sup>2</sup> )*	21,1 [19,4; 23,3]	21 [19,3; 23,4]	0,93
<b>Gender**</b>			<b>&lt;0,001</b>
Male	231 (52%)	153 (37,2%)	
Female	213 (48%)	258 (62,8%)	
<b>Residence**</b>			0,27
Parental	247(55,6%)	244 (59,4%)	
University residence	197(44,4%)	167 (40,6%)	
<b>Physical activity**</b>			<b>&lt;0,001</b>
High	131(29,5%)	69 (6,8%)	
Moderate	233 (52,5%)	207 (50,4%)	
Low	80 (18%)	135 (32,8%)	

\* Presented as median [IQR]

\*\* Presented as frequency (%)

Adjusted regression analysis showed that female sex (OR=1,49; 95% IC=1,12-1,99; P=0,007), moderate level of physical activity (OR=1,58; 95% IC=1,1-2,29; P=0,014) and low level of physical

activity (OR=2,98; 95% IC=1,95-4,54; P<0,001) were positively associated with increased psychological distress (Tables 2 and 3).

**Table 2:** Uivariate binary logistic regression analysis of factors associated with psychological distress among the study population

Variable	Group “Students without psychological distress ” (n1=444)	Group “Students with psychological distress” (n2=411)	Odds Ratio	Confidence interval 95%	P value
Age(years)*	20 [19-21]	19 [19-21]	0,87	[0,8-0,95]	0,001
BMI((Kg/m <sup>2</sup> )*	21,1 [19,4-23,3]	21 [19,3-23,4]	1,01	[0,99-1,04]	0,26
<b>Gender**</b>					
Male	231 (52%)	153 (37,2%)	1		
Female	213 (48%)	258 (62,8%)	<b>1,83</b>	[1,39;2,4]	<b>&lt;0,001</b>
<b>Residence**</b>					
Parental residence	247(55,6%)	244 (59,4%)	1		
University residence	197(44,4%)	167 (40,6%)	0,86	[0,65-1,13]	0,27
<b>Physical activity**</b>					
High	131 (29,5%)	69 (16,8%)	1		
Moderate	233 (52,5%)	207 (50,4%)	<b>1,68</b>	[1,19-2,38]	<b>0,003</b>
low	80 (18%)	135 (32,8%)	<b>3,2</b>	[2,14-4,79]	<b>&lt;0,001</b>

\* Presented as median [IQR]

\*\* Presented as percentage (%)

**Table 3:** Multivariate binary logistic regression analysis of factors associated with psychological distress among the study population

Variable	Group 1 “Students without psychological distress ” (n1=444)	Group 2 “Students with psychological distress” (n2=411)	Odds Ratio	Confidence interval 95%	P value
Age (years)*	20 [19;21]	19 [19-21]	0,87	[0,8-0,95]	0,002
BMI (Kg/m <sup>2</sup> )*	21,1 [19,4;23,3]	21 [19,3-23,4]	1,02	[0,99-1,05]	0,25
<b>Gender**</b>					
Male	231(52%)	153 (37,2%)	1		
Female	213 (48%)	258 (62,8%)	1,49	[1,12-1,99]	0,007
<b>Residence**</b>					
Parental residence	247 (55,6%)	244 (59,4%)	1		
University residence	197 (44,4%)	167 (40,6%)	0,91	[0,68;1,21]	0,52
<b>Physical activity**</b>					
High	131 (29,5%)	69 (16,8%)	1		
Moderate	233 (52,5%)	207 (50,4%)	1,58	[1,1-2,29]	0,014
low	80 (18%)	135 (32,8%)	2,98	[1,95-4,54]	<0,001

\* Presented as median [IQR]

\*\* Presented as frequency (%)

The conclusion of “the more physically active the student is, the less stressed he is” was consolidated by the results of multinomial logistic regression between psychological distress and physical activity levels showing that low physical

activity levels significantly increased the risk of psychological distress, regardless of its severity, with an OR for severe psychological distress of 1,99; 95% IC= 1,14-3,5; p=0,016 and 4,01; 95% IC= 2,2-7,4; p<0,001, respectively (Table 4).

**Table 4:** Adjusted odds ratio values obtained by multiple multinomial analysis of the association between physical activity and psychological distress levels

Variable		Level of psychological distress								
		Mild			Moderate			Severe		
		OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Level of physical activity	High	1			1					
	Moderate	<b>1,45</b>	[0,9-2,3]	0,102	<b>1,82</b>	[1,01-3,3]	0,045	1,99	[1,14-3,5]	0,016
	Low	<b>2,84</b>	[1,7-4,7]	<0,001	<b>3,08</b>	[1,6-5,9]	0,001	<b>4,01</b>	[2,2-7,4]	<0,001

OR: Odds Ratio

CI: Confidence Interval

### Discussion

Psychological distress, usually described as a non-specific mental health problem and characterized by depression and anxiety symptoms [2], has recently become a public health concern due to its high and increasing implication in several diseases and mortality risks[24].

The prevalence of psychological distress differs considerably according to the used tools for assessment, the time window of the survey and the cut-points applied to dichotomize the score of distress and to identify individuals with pathological distress [2]. It is approximately ranging from 13% to 35% in the general population [25]; but it can attain higher levels in some populations exposed to specific risk factors, such as medical students reaching 42-50% [10, 26]. Medical students have been reported in several studies that their medical training is a significant source of their high levels of stress [27]. In our study, 48,1% of the participants reported symptoms of psychological distress, and severe level, indicated by a score of 30 or more on the Kessler Psychological Distress Scale (K10) [23], was found in 14,7 % of medical students. This finding is in accordance with other studies' results; indeed the prevalence of psychological distress in medical students was 49,5 % among Iranian [28], 48 % in Turkish [29], and 63.8% in Saudi Arabia's students [30]. The difference between the prevalence found in each study compared with the others could be explained by the different instruments used, as mentioned above, or it could be due to the specificity of the medical studies and socio-demographic factors of each country [30].

The prevalence of psychological distress in our study was significantly higher among the female students in comparison to their male counterparts (62,8 % Vs. 37,2 %). This finding is similar to that of the Egyptian [31] and Saudi studies [32]; whereas other studies have shown that the gender difference was not significant [33]. However, none of the studies reporting this difference provided explanations for the significant difference in psychological distress considering both sexes. On the other hand, studies suggested that the most likely explanation might be multifactorial, including personality traits, socio-cultural aspects, biological components, or combinations of some or all of these factors. Fawzy et al., have explained the high levels of psychological stress among females by the fact that female medical students are more competitive, and tend to be more concerned about their grades and performance, thus, they can display depressive symptoms more easily [31].

Recently, increasing attention is being paid to risk factors and determinants of psychological distress among university students to support this high-risk population in preventing and coping with stress [34, 35]. Therefore, in the present study, we analyzed the association between psychological distress and physical activity in medical students and found that low level of physical activity is one of the primary targets of the world health organization to reduce non-communicable diseases such as stress and depression [5, 36].

In a cross-sectional analysis of community-based data, the prevalence of physical activity across 46 low and middle-income countries was 29,2 % [4]. And recently, a worldwide activity inequality has been reported by large-scale physical activity data of 111 countries around the world ranging from

low physical activity countries (e.g. Saudi Arabia) to high physical activity level countries (e.g. Japan). Moreover, the authors identified lower physical activity sub-populations that could benefit most from interventions to promote physical activity [37].

In our survey, the results indicated that 25.1% of the medical students had a low level of physical activity, which is much higher than the finding related to the Moroccan population using comparable definitions of physical activity [22]. In contrast, other previous studies reported that medical students in several countries engage in more physical activity than general adult populations in their respective countries [38]. Different levels of physical activity among studies might reflect the individual characteristics of each medical school. For instance, unsupportive policies and a lack of physical activity-friendly facilities may explain the insufficient physical activity among medical students in developing countries, including Morocco [10].

An interesting finding in our study was that there is a statistically significant association between students' level of physical activity and their psychological distress levels: A lower level of physical activity is unequivocally related to a higher psychological distress level. These results are in accordance with previous studies' findings on the general population [39].

The putative mechanisms of the effects of physical activity on anxiety and depression symptoms are not completely elucidated. However, many recent studies have reported that regular physical activity promotes mental health through neurogenesis and angiogenesis [6], neutralizes the effects of psychological stressors on cardiac reactivity, dampens stressor-evoked increases in stress hormones [39], and also improves self-esteem and encourages positive self-viewing, which is commonly compromised in medical students with or without depressive symptoms [6]. However, the correlation between physical activity and mental health seems to be bidirectional and reciprocal [3]. Indeed, several studies have highlighted the negative impact of stress on physical activity, and consider

psychological distress as a factor that can reduce the level of physical activity [36].

Further, COVID-19 and associated lockdown, social distancing and transition to digital learning have already been supposed to have detrimental effects on mental health. Therefore, levels of psychological distress found in this study would be increased during the COVID-19 pandemic, and may serve as a great comparator to report the difference in stress and physical activity between the pre-COVID period and during the pandemic [40].

### Conclusion

Medical students are considered a vulnerable population to psychological distress. Therefore, it is believed that the current findings can support the need for psychological management strategies, including the promotion of the physical activity. Future research with a larger sample sizes, and longitudinal and experimental study designs are required to confirm these findings and determine how promoting physical activity promotes mental health in this high-risk population.

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### Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

### Conflict of Interest

The authors have no conflict of interest to declare.

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