AMERICAN UNIVERSITY OF BEIRUT

PREDICTORS OF MENTAL WELLBEING DURING THE COVID-19 PANDEMIC CONFINEMENT: A COMPARATIVE STUDY BETWEEN ADULT ARABS OF THE LEVANT AND THE GULF

by
JANELLE ELIZABETH ZAKOUR

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By

JANELLE ELIZABETH ZAKOUR

Approved by: Signature

Dr. Omar Obeid, Professor/Chairperson — Advisor
Department of Nutrition and Food Sciences

Signature

Dr. Samer Kharroubi, Associate Professor — Co-Advisor
Department of Nutrition and Food Sciences

Signature

Dr. Hashem Kilani, Professor — Member of Committee
Department of Kinesiology, University of Jordan

Signature

Dr. Mo'ath Bataineh, Associate Professor — Member of Committee
Department of Sport Rehabilitation, The Hashemite University

Date of thesis defense: April 30, 2022

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ABSTRACT
OF THE THESIS OF

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Title: Predictors of Mental Wellbeing during the COVID-19 Pandemic Confinement: A Comparative Study between Adult Arabs of the Levant and the Gulf

The Levant and the Gulf are both members of the Middle East and North Africa (MENA) territory, however even though these regions are in close proximity and share similar cultures and values, they could not be more different from each other. The Gulf states boasts of stable political and economic landscapes whereas the Levant is fraught with civic unrest and uncertainty. This study compares the influence of home confinement during the COVID-19 pandemic lockdowns on mental health, sociodemographic and lifestyle factors between the Levant and Gulf regions and identifies if these factors influence mental wellbeing in their respective countries.

A snowball non-discriminate sampling procedure was conducted to collect data from 2754 people attending or working at higher institutions in the MENA region and an online multi-categorical questionnaire was administered to collect demographic information along with the following tools: Food Frequency Questionnaire (FFQ), International Physical Activity Questionnaire (IPAQ), WHO-5 wellbeing score, and Pittsburgh Sleep Quality Index (PSQI).

Mental wellbeing scores were higher in those who engaged in medium and high physical activity (PA) ($p<0.001$) and in those with sound sleep ($p<0.001$) and there were associations found between both PA and sleep scores with region ($p<0.001$). High PA and quality sleep are protective against mental illness in both Levant and Gulf regions ($p<0.001$). Diet played a role in guarding mental health in the Levant ($p=0.027$) but not the Gulf ($p=0.887$).

The factors PA, quality of sleep, age, residential area, chronic disease and overall health status are major determinants of mental wellbeing in Levantine and Gulf Arab adults during COVID-19 confinement. Sleep and PA were shown to be significant influencers of mental wellbeing in both the Levant and the Gulf, however diet quality was not a significant variable in the Gulf. There were significant differences found between dietary intakes and sleeping habits between the Levant and the Gulf but no differences were found between PA patterns and region.

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ABBREVIATIONS

AOR: Adjusted Odds Ratio

BMI: Body Mass Index

CI: Confidence Interval

COVID-19: Coronavirus Disease 2019

DCI: Demographic and Cultural Information

FFQ: Food Frequency Questionnaire

GCC: Gulf Cooperation Council

GDP: Gross Domestic Product

IPAQ: International Physical Activity

IPAQ-SF: International Physical Activity – Short Form

KSA: Kingdom of Saudi Arabia

MENA: Middle Eastern and North Africa

MET: Metabolic Equivalents

OR: Odds Ratio

PA: Physical Activity

PTSD: Post-Traumatic Stress Disorder

SARS: Severe Acute Respiratory Syndrome

PSQI: Pittsburgh Sleep Quality Index

UAE: United Arab Emirates

WHO: World Health Organization

WHO-5: World Health Organization-Five Well-Being Index

CHAPTER I

INTRODUCTION

The Middle East and North Africa (MENA) region is one that is divided beyond borders. There are cultural, economic, and historical factors that distinctively separate this region into three parts, namely the Levant, the Gulf, and North Africa. The Levant is east of the Mediterranean Sea and includes Lebanon, Syria, Jordan and Palestine. The Gulf, specifically the Gulf Cooperation Council (GCC), is comprised of Bahrain, Qatar, Kuwait, Oman, the Kingdom of Saudi Arabia (KSA) and the United Arab Emirates (UAE). It is important to note here that the World Bank has classified the oil-rich Gulf countries, namely UAE, Saudi Arabia and Oman as high income countries and the Levantine countries of Syria, Lebanon and the West Bank and Gaza (Palestine) as low income. Jordan is listed as high-middle income; however it experiences spill-over from fellow Levantine countries [1].

Economically, the Gulf has proved to be the most unwavering power in the MENA with its consistent political stability coupled with vast hydrocarbon reserves and the creation of millions of jobs for foreign workers over the years predominantly from neighbouring Arab countries. However, even the most solid economies across the world including the Gulf have suffered under the effects of SARS CoV-2 (severe acute respiratory syndrome coronavirus 2) also known as COVID-19. A 2020 World Bank report identified that apart from human statistics, the virus targeted MENA regional economies via four channels: public health deterioration, falls in domestic supply and demand, a global decline for regional goods and services and dropping oil prices [2]. The report further highlighted that the MENA region scored as the second-lowest overall among all regions in the Global Health Security Index while ranking last in both 'epidemiological workforce' and 'emergency preparedness and response planning' [2]. The pandemic has already inflicted devastating effects in global economic activity with the virus replicating into numerous strains since its onset and prolonging restrictions on public gatherings and business activities. Lack of data and transparency in this region weakens MENA credibility and obstructs constructive policy-making and without effective policies in place to bounce back from the economic blow, the entirety of the MENA region can suffer from political instability and potentially generate terror groups [3]. This occurrence is prevalent in the Levant region where these countries tend to be conflict-burdened and involve political divides which puts them at a serious disadvantage in responding to crises [3]. The most recent example of this is when the world bore witness to the poor governance in Lebanon which lay waste to the civilian population and prompted the October 2019 '*thawra*' or revolution, a two-week period of violence and largescale public protests. With the absence of a fully functional government and few health policies in place coupled with a severely mismanaged economy, there was little that could have been done to combat the pandemic's inception just five months after the *thawra* [3,4]. The virus further exacerbated pre-existing vulnerabilities in a country already reeling from electricity, medical and fuel shortages and infrastructure either previously lacking or destroyed in the 2020 Beirut explosion. Other countries such as Jordan, Palestine, Egypt, and Tunisia are also experiencing encumbered capabilities and the difficulties worsened by the pandemic may lead to a vicious cycle of economic tragedy [2].

Like the rest of the world, the MENA region adopted strict measures to combat the spread of the virus and protect human lives [5] including individual actions (such as hand washing, use of sanitizers and face masks), identification of disease clusters (contact tracing), regulatory actions (such as lockdowns and curfews), border closures, travel restrictions and enforced quarantine. The goal of these measures was to delay and flatten the epidemic curve, prevent health care systems from becoming overwhelmed, and protect high-risk individuals until safe and effective treatments became available. While measures such as these have historically contained the spread of infectious diseases and maintained some societal structure in the absence of pharmaceutical interventions, these preventive though restrictive measures have led MENA economies to feel the effects of harsh shocks with supply and demand for goods and services as these countries are among those paying the price for underinvesting in public health over the decades. It was forecasted by the World Bank and International Monetary Fund (IMF) that MENA economies would experience a sharp economic fallout in 2020 by a contraction in Gross Domestic Product (GDP) by 4.2% and 4.7% respectively. [6,7] However there is substantial uncertainty surrounding this projection and the overall economic outlook in the region is dependent on the assumption that the pandemic will soon end and that geopolitical tensions do not continue to escalate.

In parts of the MENA, there are challenges faced by pandemic measures that can potentially exacerbate poverty in crisis-stricken countries, widen the inequality gap and limit access to basic human rights, including healthcare. The uncertainty about the real economic impact of the pandemic, however, has complicated the policy response. Many of these economies have limited fiscal and external debt capacities, with Lebanon by far exceeding other countries in the MENA region [8,9].

These economies had already been fighting high poverty rates, political instability and civic unrest, along with poor healthcare infrastructure, hence the historic economic downturn provoked by the COVID-19 pandemic will worsen existing economic and humanitarian challenges. Food security has become a substantial problem with a 2019 World Bank consensus showing that 55 million people in the MENA region are acutely food insecure, not including already food insecure populations in Syria, the West Bank and Gaza [1]. Food prices have significantly increased most notably in Lebanon, Syria and Yemen due to supply and demand issues. In Lebanon, 73% of Syrian refugees have already reduced their food consumption and are a particularly vulnerable group [1]. Jaspal et al (2020) analysed that Lebanese individuals in particular are at increased risk of poor health given the psychological stressors faced during the past few years, and that suicide rates have notably increased [10].

During lockdowns and periods of quarantine, worldwide changes in health as well as socioeconomic status have been reported [11]. These drastic stay-at-home measures have indisputably affected the social and mental health of individuals [12]. The World Health Organization (WHO) definition of health does not simply mean the absence of disease; it encompasses physical, mental, social and spiritual integration [13]. Limiting or removing one or more of these elements of health can promote unhealthy lifestyles. A 2011 WHO report states that poor mental health is related to poverty, periods of deprivation, inequality and other socioeconomic determinants of health. Therefore, populations of countries that experience economic crises are at high risk of suffering from variations in mental health issues [14] as it is an established fact that persons with low socioeconomic status have poorer mental health compared to persons with high socioeconomic status [15].

These lockdown mandates are a life-altering ordeal and require massive social restructuring. Typically, after conventional life-changing experiences such as with natural disasters or intentional acts of mass destruction, many people show themselves to be resilient and do not succumb to psychopathologies such as post-traumatic stress disorder (PTSD) arising from such trauma [16]. While a pandemic may not meet the criteria necessary for a PTSD diagnosis, other disorders such as clinical depression and anxiety may result [17].

Other negative consequences related to quarantine restraints in the adult population include increases in stress, limited to no physical activity (PA), emotional eating and other diet changes [18]. These consequences were accompanied with higher food intake, sleeping disorders, and weight changes [19]. A Tunisian study found that women were a particularly vulnerable group when it came to exhibiting symptoms of mental distress during the COVID-19 pandemic [20]. Previous studies have shown that on a global scale, women tend to be more susceptible to depression than men for a several reasons [21, 22]. Women are more likely to experience sexual and physical abuse, a greater dependence and higher emotional reliance on social support and an increased willingness to report symptoms [22]. Lack of awareness, limited education and culture can also exacerbate episodes of depression [23]. According to a 2020 review on depression in GCC countries, it was revealed that the available published scientific literature is currently scant and lacking in depth [24]. Conversely, in the Levant, specifically in Lebanon, there is a current epidemic of poor mental health due to the impact of cumulative adversities [25]. Generally, countries in the MENA region do not have a depression rate exceeding the global ratio of 4:1 and although the reported rates of depression are significantly higher for women than for men, they usually do not deviate greatly from international averages [26].

Physical activity (PA) is a lifestyle variable that was shown to be significant in the initial study by Kilani et al [27] and is defined as any movement carried out by human skeletal muscle, whereas exercise is a deliberate, structured and controlled movement; therefore, exercise counts as PA but they are not one and the same. Aerobic exercises in particular, including swimming, walking and gardening, have been shown to reduce anxiety and depression [28]. PA boosts mental health by reducing depressive symptoms, anxiety and low mood, while improving self-esteem and cognitive function thus helping to alleviate symptoms that could cause social withdrawal [29,30]. Other proposed hypotheses to explain the beneficial effects of PA on mental health include distraction, self-efficacy, and social interaction [31,32]. A Brazilian cross-sectional study (n = 2140) that compared levels of PA prior and during the pandemic found that PA levels were significantly lower during periods of confinement and that this was significantly associated with a risk of depression and anxiety [33]. There are potentially many factors that could affect the ability to be physically active during periods of confinements including having a knowledge deficit of PA, the lack of accountability, type of housing and environmental temperatures. In fact, environmental temperatures can affect PA especially in areas where intense heat can be a problem. Persons who are indoors for hot periods such as those in Gulf states may find it difficult to acquire the motivation to participate in PA as these environments may not be conducive for it.

This leads to the notion that the type of housing may also be a factor in influencing mental wellbeing. Housing in the Levant varies from apartment style buildings in urban areas to more relaxed villa-style housing in neighbouring towns and villages. For example, one will see swathes of tall apartment buildings in Beirut, Lebanon whereas in neighbouring Jounieh, traditional housing is more widespread. As a large chunk of the Levantine population is concentrated in the capitals where there are more apartment complexes, this factor makes home confinement much more challenging. The Gulf on the other hand, is home to large houses, villas and mansions, built to provide refuge to the hot climate. The location of residence whether it is urban or rural has been shown to have an impact on PA during the pandemic. Studies have shown that the decline in PA during the pandemic was smaller among children living in rural areas, in houses with more space and those with more family members around [34]. We can infer from this that there will be a significant difference in the frequency and intensity of PA between urban and rural dwellers. Additionally, the Levantine climate is also substantially different from the Gulf. The Levant experiences a mild Mediterranean climate with seasonal changes whereas the Gulf experiences hot weather and desert climates year-round. The problem with urbanization in hotter countries is that it is associated with a 'heat island' effect where built-up areas are hotter than the surrounding rural areas and is especially common in large cities. Urbanization and the accompanying heat island effect can cause the ambient temperature to increase as much as 10^{o}C than rural areas [35-37]. This can make indoor attempts at PA quite difficult.

There are other lifestyle factors that are affected by these lockdown mandates and in turn, could potentially affect mental wellbeing. In particular, we will explore dietary habits and sleep etiquette as these everyday behaviors have undoubtedly been influenced by stay-at-home orders. According to Kilani et al [27], it was found that dietary habits and quality of sleep were identified to have a significant impact on mental wellbeing. A recent Saudi Arabian cross-sectional study (n=2255) which assessed how COVID-19 lockdowns affected physical activity and dietary intake habits reinforced these findings where a change in dietary patterns including an increase in snacking frequency, choosing high carbohydrate 'comfort foods' and low levels of PA led to weight gain during quarantine periods [38]. Higher food intakes during global lockdowns were also reported in Italy, Poland and the United Kingdom [39-41]. As Saudi Arabia is a member of the MENA region and of whom shares similar cultural, dietary and habitual behaviors with neighboring countries, this study lends insight into the potential for public health reforms to prevent the onset of non-communicable diseases. The interruption of a routine caused by lockdowns and quarantines can result in boredom and this in turn, has been associated with a greater energy intake [42]. In addition to this, the stress from being reminded of the pandemic can lead to comfort- and binge-eating especially foods rich in simple carbohydrates which have a positive effect on mood as they influence the production of serotonin [43]. While this seems like an encouraging strategy to boost the mental wellbeing, these simple carbohydrates are usually high on the glycemic index (GI) scale and are associated with increasing the risk of obesity and other non-communicable diseases [44]. Consumption of high GI food has been previously associated with mood alterations including symptoms of depression [45]. The evidence is clear that underlying co-morbidities including obesity and having a chronic disease increases the risk for severe complications if infected with the COVID-19 virus [46].

Sleep is a crucial factor for physical and psychosocial well-being in both children and adults [46]. The home-confinement measures implemented during the pandemic resulted in major changes to daily routines, increased exposure to blue light due to over-reliance of mobile phones, televisions and computers [47] to alleviate boredom and attend to work or school. Other factors shown to negatively impact sleep quality include a decrease in sunlight exposure especially in those who live in apartment buildings, a subsequent risk of potential Vitamin D deficiency, higher anxiety levels, changes in diet and reduced PA [48,49]. In the Middle East, it has been discovered that a large majority of UAE residents lack proper sleep and this can be attributed to excessive smart phone use [50]. A 2020 study conducted by Voitsidis et al showed that 37.6% of Greek adults suffered from insomnia during the COVID-19 pandemic [52] which is significantly greater than the 10% pre-pandemic worldwide insomnia prevalence [53]. Insomnia is a disorder that is associated with poor mental health, increased risk of chronic illness, cognitive decline and physical limitations [54]. An Italian study showed that sleep timing during home confinement was significantly changed and sleep quality was reported lower with increased sleep difficulties in persons with depression and anxiety [55]. In high-conflict countries such as Palestine, sleep quality is expected to be adversely affected due to the devastating political and military conflicts as well as future insecurities and threats of poverty [56-58]. We can expect similar sleep statistics from Syria and more recently, Lebanon. Jordan is considered relatively stable for a Levantine country and may be exempt from this. Whereas Gulf states may experience insomnia from overuse of blue screens, certain parts of the Levant may experience this from general trauma.

It is no secret that better mental health is associated with higher levels of productivity and overall quality of life [58] which is why it is so important to identify the factors that could potentially affect mental health. It can therefore be hypothesized that economic stability is a factor in assessing mental wellbeing in the MENA region. Even though both regions are undergoing hardships inflicted by the pandemic, the Gulf region still has a level of political and financial consistency that the war-ravaged Levant has not been afforded. Therefore, we can expect there to be significant differences in mental wellbeing scores between the Levant and the Gulf.

A. Thesis Objectives

The aim of this study is to build on the initial study by Kilani et al [27], to compare the self-reported effects of the mandated lockdowns between Levantine and Gulf states and to identify if these geographic locations contributed in any way in affecting mental wellbeing and other lifestyle factors in adult participants. The results derived from this study will aid in providing insight about lifestyle behaviors that can improve mental wellbeing among adults in the MENA region.

CHAPTER II

MATERIALS AND METHODS

A. Study Design

The study design was a cross-sectional and comparable in design which employed the use of a snowball non-discriminatory sampling technique during the study period of 17th to 24th April 2020. An online Arabic questionnaire was sent to universities in the MENA region specifically Lebanon, Syria, Palestine and Jordan for the Levant, and Bahrain, Iraq, Kuwait, KSA, Qatar, UAE, and Oman for the Gulf.

B. Procedure and Participants

Recruitment was electronically conducted among consenting Arab adults between the ages of 18 to 65 years who complied with governmental guidelines of home confinement and isolation. The 10-minute questionnaire was created using a Google form to collect information about demographic, dietary, sleep, physical activity and mental wellbeing variables and the link to this questionnaire was circulated via email, WhatsApp and social media (Facebook, Twitter, LinkedIn). Participants were informed of study objectives and only those who submitted an informed consent form were able to complete the questionnaire and submit this online. The questionnaire did not ask for personal information (name, email, date of birth) that could be used for identification purposes, thus enabling their submission to remain anonymous. All consented participants who voluntarily filed the online questionnaire were not offered compensation. Ethical approval conforming to the Declaration of Helsinki was obtained from the Human Research Ethics Committee of the University of Jordan and the

Hashemite University. The online questionnaire was tested on 63 pilot participants who completed the survey on two occasions separated by a period ranging from one to two weeks to test for internal and external reliability and question clarity and the data from this pilot group was not included in final analyses. The questionnaire had an adequate internal reliability (Cronbach $\alpha>0.70$) and an external reliability (Intraclass Correlation Coefficient >0.70) for total and all the individual scales.

C. Measures and Scales

Sociodemographic data (including age, gender, marital status, height, weight, country, area of residence, education level, smoking status, health status, and presence of chronic diseases) were collected through a self-completed DCI (Demographic and Cultural Information).

To evaluate mental wellbeing, the World Health Organization Five Well-being Index (WHO-5) was implemented which was a questionnaire comprising of five questions [60]. The WHO-5 scoring scale ranges from 0 to 25 with a score of >13 indicating good mental wellbeing and a score of <13 signalling poor mental health status [60].

The Pittsburgh Sleep Quality Index (PSQI) was used to assess quality of sleep [61]. This questionnaire consisted of 19 questions of which seven components were generated with each component being scored on a scale of zero to three. These sub-scores were tallied thus creating a global score ranging from zero to maximum 21. Lower scores indicated a better quality of sleep with participants obtaining a global score of <5 being considered to have ‘good’ sleep quality. On the other hand, the higher the global score, the worse the quality of sleep with a score of 21 suggesting severely poor sleep [62].

The short form of the International Physical Activity Questionnaire (IPAQ-SF) was implemented to gauge health-related physical activity levels. The IPAQ-SF contained seven items which allowed for the collection of comparable estimates of PA on four intensity levels: 1) vigorous PA (such as aerobics), 2) moderate PA (such as cycling), 3) walking and 4) sitting. These were classified based on metabolic equivalent (MET) minutes per week and following this, PA was then further grouped into low, moderate and high [63].

And finally, an 11-question qualitative food frequency questionnaire (FFQ) was employed to assess dietary quality. A scoring scale of zero to four was used to rate dietary behaviour which included the following categories of consumption: fruits, vegetables, dairy, nuts, herbs, sugar-sweetened beverages, fried and preserved foods, energy drinks and sweets. It also included the category of breakfast. A maximum score of 44 was derived from totalling the individual items and this was used to categorise scores into a low group and a high group.

D. Data analysis

All analyses were conducted using SPSS Statistics version 21 (IBM, Chicago, IL, USA). Data from continuous variables are presented as means (standard deviation) and data from categorical variables are presented as percentages. Significant differences were identified using independent sample t-tests for continuous variables and chi-squared tests for the categorical variables. Logistic regressions were also performed to assess the association of mental wellbeing (dependent variable) with both sociodemographic and lifestyle variables, followed by a multiple logistic regression on the significant variables only. Results from the logistic regression analyses were expressed as odds ratios (OR) or adjusted odds ratio (AOR) with 95% CI. A p-value <0.05 was considered statistically significant in all analyses.

CHAPTER III

RESULTS

A. Descriptive results

As this is a comparative study in nature, the objective was to compare the Levant with the Gulf and identify if there were any variable differences between the regions. As per Table 1, which investigated sociodemographic characteristics based on geographical location, we are able to identify differences between Levantine and Gulf countries. As tabulated, there was a total of 2754 participants with 54.4% originating from the Levant, the remainder were from the Gulf, and the overall ratio of males to females between the regions were very similar. There were significant differences (χ^2 = 87.701, p <0.0001) between body mass index (BMI kg/m^2) between the Levant and Gulf with the higher percentage of overweight and obesity (70.0% and 85.7% respectively) hailing from Gulf states. With regards to age groups (χ^2 = 243.172, p <0.0001), the average age of participants from the Levant was 30.41±11.98, whereas in the Gulf, the mean age was higher at 35.67±10.88. Overall, the majority of younger contributors came from the Levant and older participants emanated from the Gulf. There was a significant difference between the Levant and Gulf with respect to education levels (χ^2 = 99.603, p <0.0001) with most participants overall holding at least a Bachelor's degree. However, we can observe that there were more Levantine participants with basic education levels (63.0%, 62.0%) as versus 60.6% of graduate-educated stemming from the Gulf. 85.2% persons in this study lived in densely populated urban areas (χ^2 = 101.551, p <0.0001) and the majority of the remaining rural dwellers came from Levantine countries (77.4%). There were significantly noticeable differences in smoking levels (χ^2 = 53.286, p <0.0001) with most participants opting for non-smoking lifestyles (72.1%). It should be noted that most smokers (65.6%) were of Levantine origin.

Table 1. Significance of sociodemographic characteristics of study sample based on geographic location

		Region		
	Total n(%)	***Levant* n(%)**	***Gulf* n(%)**	**Significance**
Participants	2754(100.0)	1499(54.4)	1255(45.6)	
Gender				χ^2 = 0.945, p = 0.175
Male	1305(47.4)	723(48.2)	582(46.4)	
Female	1449(52.6)	776(51.8)	673(53.6)	
Body Mass Index (BMI kg/m^2)				
		24.20±4.26	26.84±5.51	**p <0.001** **χ^2 = 87.701, p <0.0001**
Underweight	119(4.3)	25(37.3)	42(62.7)	
Normal	1180(42.8)	244(48.3)	261(51.7)	
Overweight	937(34.0)	134(30.0)	313(70.0)	
Obese	518(18.9)	33(14.3)	197(85.7)	
Age group(years)				
		30.41±11.98	35.67±10.88	**p <0.001** **χ^2 = 243.172, p <0.0001**
18-22 (25 percentile)	723(26.3)	553(76.5)	170(23.5)	
23-31 (26-50 percentile)	741(26.9)	422(60.0)	319(40.0)	
32-41 (51-75 percentile)	632(22.9)	252(39.9)	380(60.1)	
>41 (>75)	658(23.9)	272(41.3)	386(58.7)	
Education level				**χ^2 = 99.603, p <0.0001**
School	81(2.9)	51(63.0)	30(37.0)	
High school	376(13.7)	233(62.0)	143(38.0)	
Community college	225(8.2)	89(39.6)	136(60.4)	
Bachelor	1518(55.1)	908(59.8)	610(40.2)	
Graduate degree	554(20.1)	218(39.4)	336(60.6)	
Housing				**χ^2 = 101.551, p <0.0001**

Urban	2347(85.2)	1184(50.4)	1163(49.6)	
Rural	407(14.8)	315(77.4)	92(22.6)	
Smoking				**χ^2 = 53.286, p <0.0001**
No	1987(72.1)	996(50.1)	991(49.9)	
Yes	767(27.9)	503(65.6)	264(34.4)	
Chronic disease				χ^2 = 2.695, p = 0.109
No	2180(79.2)	1204(55.2)	976(44.8)	
Yes	574(20.8)	295(51.4)	279(48.6)	
Health status				**χ^2 = 6.967, p = 0.031**
Poor/Fair	206(7.5)	118(57.3)	88(42.7)	
Good	656(23.8)	383(58.3)	273(41.7)	
V.Good/Excellent	1892(68.7)	998(52.7)	894(47.3)	
Marital status				**χ^2 = 201.335, p <0.0001**
Single	1274(46.3)	875(68.7)	399(31.3)	
Married	1378(50.0)	585(42.5)	793(57.5)	
Divorced	92(3.3)	39(42.4)	53(57.6)	
Widow	10(0.4)		10(0.7)	

SD[a]: Standard Deviation. Continuous variables are presented as means with their SD, whereas categorical variables are reported as frequencies and proportions (i.e. n%)

Rates of chronic disease were not significantly different between the Levant and the Gulf and even though most self-reported health statuses were ‘very good to excellent’, tests resulted in a p value of 0.031 (χ^2 = 6.967) meaning that there were noticeable differences between the regions. As for marital status, exactly 50.0% of contributing subjects overall were married. The most single persons were Levantine (68.7%) and the most divorced (57.6%) and all widowed (0.4%) participants were from the Gulf.

Table 2 explored the association of the sociodemographic characteristics from out 2754 participants with mental wellbeing status, differentiated by poor (score of less than 13) and good (score of more than 13) ratings. Out of the total figure, 40.8% of participants had poor mental health scores and the remaining 59.2% had higher ‘good’ scores. Overall, BMI, education level and marital status played no role in influencing mental health.

Table 2. Association of sociodemographic characteristics of study sample with mental wellbeing status

	Total	**Mental Wellbeing Status**		**Significance**
		Poor (>13) n(%)	**Good (>13) n(%)**	
Participants	2754(100.0)	1123(40.8)	1631(59.2)	
Gender				**χ^2 = 13.977, p <0.0001**
Female	1449(52.6)	639(57.0)	810(49.7)	
Male	1305(47.4)	484(43.0)	821(50.3)	
Body Mass Index (BMI)				
		25.8±5.0	25.9±4.8	p = 0.737 χ^2 = 3.376, p = 0.337
Underweight	119(4.3)	55(4.9)	64(3.9)	
Normal	1180(42.8)	483(43.0)	697(42.7)	
Overweight	937(34.0)	365(32.5)	572(35.1)	
Obese	518(18.9)	220(19.6)	298(18.3)	
Age				
		32.5±12.1	33.0±11.6	p = 0.291 **χ^2 = 17.623, p = 0.001**
18-22 (25 percentile)	723(26.3)	331(29.5)	392(24.0)	
23-31 (26-50 percentile)	741(26.9)	292(26.0)	449(27.5)	
32-41 (51-75 percentile)	632(22.9)	221(19.7)	411(25.2)	
>41 (>75)	658(23.9)	279(24.8)	379(23.3)	
Education				χ^2 = 7.212, p = 0.125
School	81(2.9)	31(2.7)	50(3.1)	
High School	376(13.7)	146(13.0)	230(14.1)	
Community College	225(8.2)	95(8.5)	130(8.0)	
Bachelor	1518(55.1)	648(57.7)	870(53.3)	
Graduate Degree	554(20.1)	203(18.1)	351(21.5)	
Housing				**χ^2 = 8.047, p = 0.004**
Urban	2347(85.2)	983(87.5)	1364(83.6)	
Rural	407(14.8)	140(12.5)	267(16.4)	

Smoking				**χ^2 = 5.152, p = 0.025**
No	1987(72.1)	784(69.8)	1203(73.8)	
Yes	767(27.9)	339(30.2)	428(26.2)	
Chronic Disease				**χ^2 = 12.436, p <0.0001**
No	2180(79.2)	852(75.9)	1328(81.4)	
Yes	574(20.8)	271(24.1)	303(18.6)	
Health Status				**χ^2 = 110.893, p <0.0001**
Poor/Fair	206(7.5)	133(11.9)	73(4.5)	
Good	656(23.8)	338(30.1)	318(19.5)	
Very Good/Excellent	1892(68.7)	652(58.0)	1240(76.0)	
Marital Status				χ^2 = 2.346, p = 0.504
Single	1274(46.3)	526(46.8)	748(45.9)	
Married	1378(50.0)	555(49.4)	823(50.4)	
Divorced	92(3.3)	40(3.5)	52(3.2)	
Widowed	10(0.4)	2(0.3)	8(0.5)	
Region				**χ^2 = 13.823, p <0.0001**
Levant	1499(54.4)	659(44.0)	840(56.0)	
Gulf	1255(45.6)	464(37.0)	791(63.0)	

Continuous variables are presented as means with their SD, whereas categorical variables are reported as frequencies and proportions (i.e. n%)

B. Assessing predictors of mental wellbeing with region and general lifestyle scores

Table 3 presents the association between lifestyle factors and mental wellbeing scores with region. Based on the chi square test that was conducted, one can see that there is no association between sleep and whether a subject resides in the Levant or the Gulf ($p = 0.281$) as the reported scores are similar for both. On the other hand, there were significant associations between PA ($p < 0.0001$) and dietary scores ($p < 0.0001$) on region. The Levant boasted a higher percentage of high scores (18.9%) as well as the lowest percentage of low PA scores (47.1%). Conversely, the Gulf had the highest percentage of low PA scores (54.6%) as well as the lowest percentage of high PA scores

(13.1%). The moderate PA scores were similar for both. For dietary scores, the Gulf had the highest percentage of low dietary scores (55.3%) while the Levant claimed the highest percentage of high diet scores (51.1%). Overall, there was a definite association between mental wellbeing and region ($p < 0.0001$) where one can see obvious differences between the regions as the Gulf claimed the majority of good mental wellbeing scores (63.0%).

Table 3. Association of lifestyle factors with regional status of study sample

Region	Category			Significance
	Mental Wellbeing Scores			**$\chi^2 = 13.823$, p <0.0001**
	Poor <13	**Good >13**		
Levant	659 (44.0)	840 (56.0)		
Gulf	464 (37.0)	791(63.0)		
	Sleep Scores			$\chi^2 = 0.382$, p = 0.281
	Poor	**Good**		
Levant	900 (60.0)	599 (40.0)		
Gulf	768 (61.2)	487 (38.8)		
	Dietary Scores			**$\chi^2 = 11.205$, p <0.0001**
	Low	**High**		
Levant	733 (48.9)	766 (51.1)		
Gulf	694 (55.3)	561 (44.7)		
	Physical Activity Scores			**$\chi^2 = 22.246$, p <0.0001**
	Low	**Moderate**	**High**	
Levant	706 (47.1)	509 (34.0)	284 (18.9)	
Gulf	685 (54.6)	405 (32.3)	165 (13.1)	

Categorical variables are reported as frequencies and proportions (i.e. n%)

Figures 1, 2 and 3 however, confirmed the findings of the study conducted by Kilani et al (2020) [37] where healthy lifestyle behaviours were major predictors of mental wellbeing and all three were significant when tested independently using chi-square tests. There were significant associations ($p<0.0001$) between mental health scores with all lifestyle factors of diet, physical activity and sleep.

Figure 1. Evaluation of the WHO-5 for Mental Wellbeing Criteria and Sleep Quality

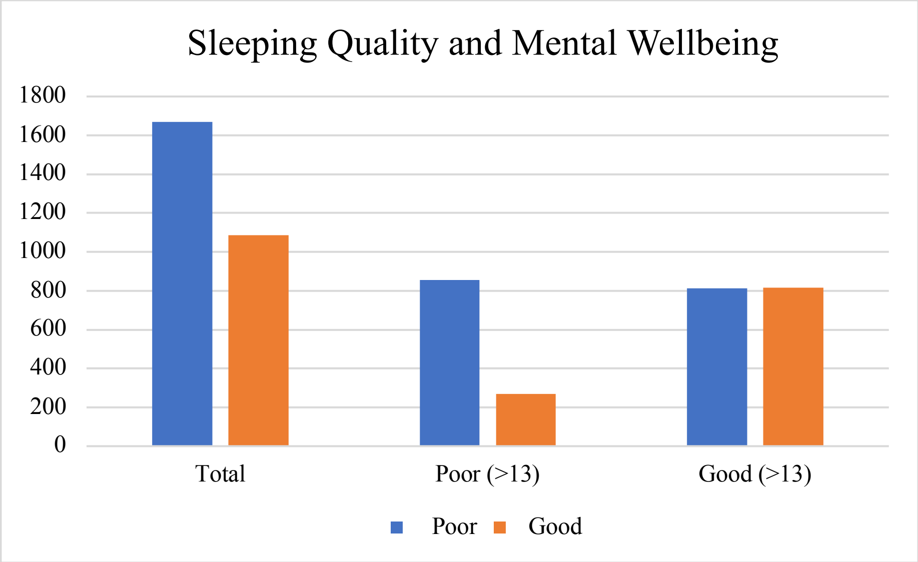

Figure 2. Evaluation of the WHO-5 for Mental Wellbeing Criteria and Physical Activity

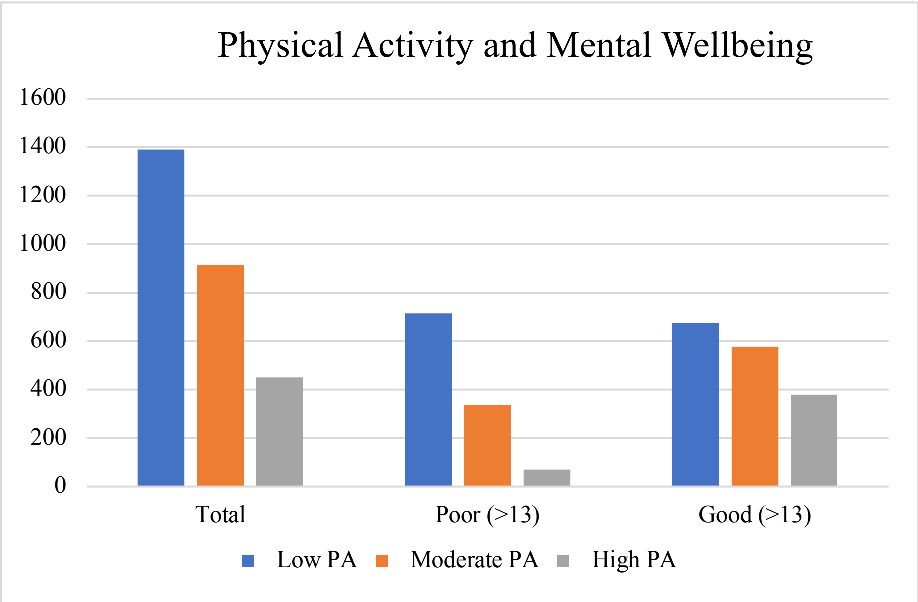

Figure 3. Evaluation of the WHO-5 for Mental Wellbeing Criteria and Diet Quality

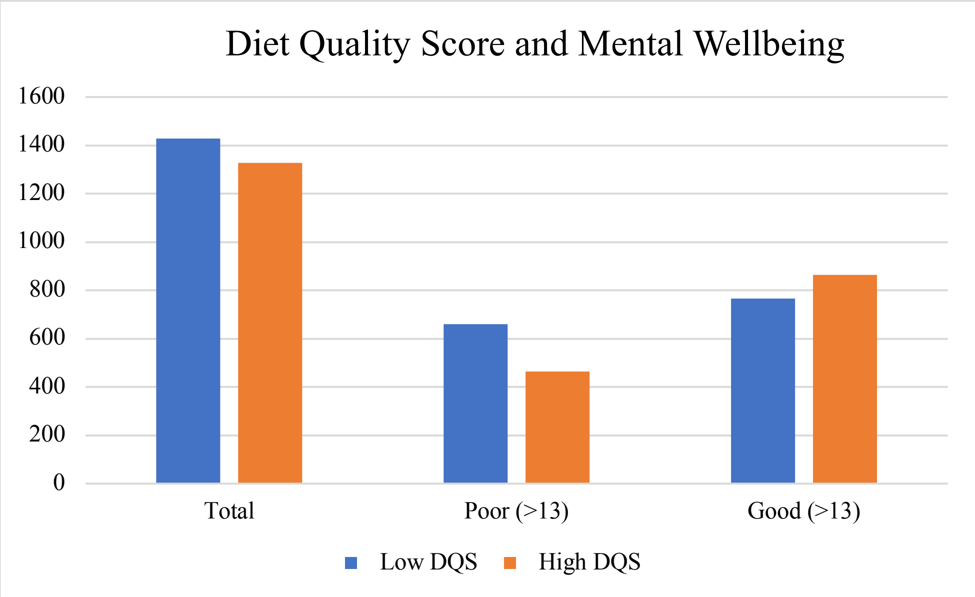

Fig 1 Mental health rating of participants with poor or good sleep quality score. **2.** Mental health rating of participants with varying levels of physical activity (low, moderate and high). **3.** Mental health rating of participants with low or high diet quality score (DQS).

A binary logistic regression was then carried out to assess the effect of sociodemographic and lifestyle variables on the likelihood of it influencing mental health. Each variable was first tested individually for its effect on mental health scores and then a multiple logistic regression was applied to those that were individually significant ($p<0.05$). Results from the logistic regression analyses were expressed in Table 4 as odds ratios (OR) or adjusted odds ratio (AOR). As we can see from the first regression, education and marital status had no effect on mental wellbeing. The variables gender, age, housing, smoking, chronic disease, health status, region, sleep quality, physical activity levels and dietary quality however, showed significance. Regarding gender, being a female increases the odds of having poor mental health than being male by 87% (OR: 1.3). A normal BMI decreases the risk of having poor mental wellbeing by 37.7% (OR: 0.891) and being overweight increases the risk by 85.62% (OR: 1.438). Similarly, obesity increases the risk by 85.69% (OR:1.431). When it comes to age, as age increases, the odds of having poor mental health also increases as evidenced by the increase in OR from 0.9 in the 18-22 age bracket to 1.4 for the 32-41 group. Having no chronic disease increases the odds of having sound mental health by 39.4% (OR: 1.4) and those with reported poor or merely good health status had respectively 71.1% and 50.5% (OR: 0.3, 0.5) lower odds of experiencing good mental health compared to those with very good or excellent health. Those living in rural areas had 37.4% increased odds of good mental wellbeing compared with the reference of urban housing and based on the first regression, living in the Levantine region decreases the odds of having good mental health compared to living in the Gulf states. When it comes to the lifestyle factors, sleep quality, physical activity and diet all play a role in determining mental health, as supported by the chi-square analysis in Table 2.

On the other hand, when all of these significant variables were applied to the multiple regression which adjusted for the presence of confounders, only age, housing, chronic disease, overall health status, sleep quality and physical activity retained their impact and it can be said that these variables have the ability to significantly affect an individual's mental health status. The odds that poor sleep affect mental health increased from 70% to 76% (OR: 0.3, AOR: 2.4) and when it comes to PA, moderate activity levels decreased the risk of achieving good mental health by 86% (AOR: 1.4) when compared to the low PA reference. Similarly, high PA increases the odds of affecting mental health by 76% (AOR: 2.3). This goes to show that the higher the levels of physical activity along with better quality of sleep, the higher the chances of obtaining good mental health. Additionally, the older you get, the better your chances of having good mental health will be as those in the 32-41 age bracket had a 92% likelihood of having better mental wellbeing that their 18-22 age group counterparts (AOR: 1.8). Similarly, the better your overall health status and if you are free of chronic disease, you have better odds of obtaining sound mental wellbeing. And finally, area of residence can have an impact on mental health with rural areas having a 30% (AOR: 0.7) reduced risk of poor standing. Dietary habits, gender, BMI, smoking status and geographical location all failed to show significance ($p>0.05$).

Table 4. Logistic regression to assess predictors of mental wellbeing

		Odds Ratios (OR) (95% CI)	Adjusted Odds Ratio (AOR) (95% CI)
Gender	Females	Reference	Reference
	Males	**1.3 (1.148, 1.559), p < 0.0001**	0.9 (0.711, 1.253), p = 0.689
Body Mass Index (BMI)	Normal	Reference	
	Underweight	1.2 (0.849, 1.811),	
	Overweight	p = 0.265	
	Obese	2.3 (0.918, 1.976),	
		p = 0.128	
		0.6 (0.780, 1.737),	
		p = 0.457	
		p = 0.338	
Age group	18-22	Reference	Reference
	23-31	**1.3 (1.055, 1.598), p = 0.014**	1.2 (0.893, 1.697), p = 0.204
	32-41	**1.6 (1.261, 1.956), p < 0.0001**	**1.8 (1.253, 2.713), p = 0.002**
	>41	1.1 (0.927, 1.419), p = 0.207	1.4 (0.907, 2.218), p = 0.126
		p = 0.001	**p = 0.021**
Education level	School	Reference	
	High School	1.0 (0.596, 1.600), p = 0.925	
	Community College	0.8 (0.504, 1.428), p = 0.536	
	Bachelor's Degree	0.8 (0.526, 1.318), p = 0.434	

	Graduate Degree	1.1 (0.663, 1.733), p = 0.777 p = 0.126	
Housing	Rural	Reference	Reference
	Urban	**0.7 (0.584, 0.907), p = 0.005**	**0.7 (0.435, 0.970), p = 0.035**
Smoking	No	Reference	Reference
	Yes	**0.8 (0.695, 0.974), p = 0.023**	0.9 (0.652, 1.191), p = 0.411
Chronic disease	No	Reference	Reference
	Yes	**0.7 (0.596, 0.863), p < 0.0001**	**0.6 (0.404, 0.880), p = 0.009**
Health status	Poor	Reference	Reference
	Good	**1.7 (1.240, 2.370), p = 0.001**	**2.1 (1.163, 3.822), p = 0.014**
	Very good/ Excellent	**3.5 (2.565, 4.681), p < 0.0001** **p < 0.0001**	**3.0 (1.722, 5.259), p < 0.0001** **p < 0.0001**
Marital status	Single	Reference	
	Married	1.0 (0.893, 1.218), p = 0.596	
	Divorced	0.9 (0.596, 1.401), p = 0.680	
	Widow	2.8 (0.595, 13.299), p = 0.192 p = 0.532	
Region	Levant	Reference	Reference
	Gulf	**1.3 (1.147, 1.559), p < 0.0001**	1.2 (0.903, 1.601), p = 0.208
Sleep Quality	Poor	Reference	Reference
	Good	**0.3 (0.265, 0.371), p < 0.0001**	**2.4 (1.794, 3.203), p < 0.0001**
Physical Activity Levels	Low	Reference	Reference
	Moderate	**0.2 (0.135, 0.234), p < 0.0001**	**1.4 (1.076, 1.870), p = 0.013**
	High	**0.3 (0.241, 0.428), p < 0.0001** **p < 0.0001**	**2.3 (1.442, 3.692), p < 0.0001** **p = 0.001**
Dietary Quality	Low	Reference	Reference
	High	**1.6 (1.377, 1.872), p < 0.0001**	1.2 (0.936, 1.643), p = 0.134

Estimates shown in bold are those that are statistically significant at $p < 0.05$. Dependent Variable: Mental Wellbeing. Variables omitted for multiple logistic regression: Education, Marital Status

Table 5 provides the results for the logistic regression which was conducted using mental wellbeing scores as the dependent variable and splitting the data between regions. In the first regression, all of the lifestyle variables were significant (p < 0.0001) which means that each played a role in influencing mental health scores no matter if the participant was in the Levant or in the Gulf.

Table 5. Logistic regression to assess lifestyle factors by region on mental wellbeing

Region	Predictor		Odds Ratios (OR) (95% CI)	Adjusted Odds Ratio (AOR) (95% CI)
Levant	Sleep	Poor	Reference	Reference
		Good	**0.3 (0.219, 0.344)** **p < 0.0001**	**3.5 (2.739, 4.395)** **p < 0.0001**
Gulf	Sleep	Poor	Reference	Reference
		Good	**0.4 (0.283, 0.470)** **p < 0.0001**	**2.5 (1.946, 3.292)** **p < 0.0001**
Levant	Physical Activity	Low	Reference	Reference
		Moderate	**1.9(1.522, 2.417)** **p < 0.0001**	**1.8 (1.392, 2.267)** **p < 0.0001**
		High	**6.0 (4.286, 8.419)** **p < 0.0001** **p < 0.0001**	**5.7 (4.001, 8.071)** **p < 0.0001** **p < 0.0001**
Gulf	Physical Activity	Low	Reference	Reference
		Moderate	**1.8 (1.384, 2.315)** **p < 0.0001**	**1.6 (1.240, 2.116)** **p < 0.0001**
		High	**6.1 (3.755, 10.027)** **p < 0.0001** **p < 0.0001**	**5.6 (3.407, 0.286)** **p < 0.0001** **p < 0.0001**
Levant	Dietary Score	Low	Reference	Reference
		High	**1.8 (1.479, 2.234)** **p < 0.0001**	**1.3 (1.030, 1.620)** **p = 0.027**
Gulf	Dietary Score	Low	Reference	Reference
		High	**1.4 (1.145, 1.825)** **p < 0.0001**	1.0 (0.791, 1.311), p = 0.887

Estimates shown in bold are those that are statistically significant at p < 0.05.
Dependent Variable: Mental Wellbeing.

However, when these variables were applied to the multiple regression, all remained significant except for dietary scores in the Gulf (p = 0.887) which suggests that diet does not play a role in influencing mental health in this particular region. On the other hand, diet scores were significant in the Levant ($p = 0.027$) and a high diet score was 87% more likely to affect mental health compared with low diet quality (AOR: 1.3). With good sleep quality, those in the Levant were 65% more likely to achieve better mental health (AOR: 3.469) and those in the Gulf had 74.7% better odds (AOR: 2.531). High PA in the Levant showed a likelihood of achieving good mental wellbeing scores of 5.7 times greater than if a Levantine participant had low PA (AOR: 5.682) and almost identically in the Gulf where high PA was 5.6 times greater (AOR: 5.625).

C. Cross tabulations to assess individual lifestyle factors on region

Tables 6 and 7 take a closer look at the questionnaires used in the data collection process. Table 6 looked at the questions in the Pittsburgh Sleep Quality Index (PSQI) and if there were differences between the answers provided by the different regions. While the answers were significantly different between the regions for all the questions, only three of them provided grounds to support the argument at hand. PSQI5a was one of the questions used to determine overall sleep latency scores in the PSQI component scoring and this question asked if a participant had problems being able to fall asleep within 30 minutes in the last month. What is interesting here is that the majority of persons in the Gulf experienced this phenomenon significantly more frequently than those in the Levant ($\chi^2 = 97.277$, $p < 0.0001$) as 63.4% encountered this event once or twice a week and 60.2% had problems falling asleep more than three times a week.

Table 6. Association of sleep quality and region – selected individual questions

	Frequency	Region: Levant n (%)	Region: Gulf n (%)	Significance
PSQI5a – Not being able to get to sleep in 30 minutes	None	886 (61.1)	565 (38.9)	
	< 1x a week	341 (56.7)	260 (43.3)	**χ^2 = 97.277,**
	1x or 2x a week	83 (36.6)	144 (63.4)	**p <0.0001**
	>3 times a week	189 (39.8)	286 (60.2)	
PSQI5g– Not sleeping because it was too hot	None	1327 (58.5)	943 (41.5)	
	< 1x a week	89 (32.0)	189 (68.0)	**χ^2 = 91.541,**
	1x or 2x a week	44 (34.9)	82 (65.1)	**p <0.0001**
	>3 times a week	39 (48.8)	41 (51.2)	
PSQI6 – Taking medication to fall asleep	None	1384 (54.9)	1138 (45.1)	
	< 1x a week	88 (57.9)	64 (42.1)	**χ^2 = 16.047,**
	1x or 2x a week	14 (41.2)	20 (58.8)	**p = 0.001**
	>3 times a week	13 (28.3)	33 (71.7)	

Estimates shown in bold are those that are statistically significant at p < 0.05.

PSQI 5g addressed hot environmental temperatures and if these played a role in inhibiting a person's ability to fall asleep and this was especially significant (χ^2 = 91.541, p <0.0001) as the majority of Gulf respondents reported that temperatures were too hot to fall asleep. In fact, 65.1% experienced this once or twice a week and over half (51.2%) found this occurring three or more times per week. Similarly, there were significantly more Gulf participants claiming that they had to use sleep aids to fall asleep (χ^2 = 16.047, p = 0.001) with 58.8% needing sleep medication once or twice a week and a whopping 71.7% needing it three or more times per week to be able to fall asleep.

Table 7. Association of diet scores and region

		Region		Significance
		Levant	Gulf	
	Frequency	n (%)	n (%)	
Breakfast Score	None	221 (49.7)	224 (50.3)	
	1–2x week	234 (45.9)	276 (54.1)	**χ2 = 35.980,**
	3–4x week	234 (52.9)	208 (47.1)	**p <0.0001**
	5–6x week	172 (56.8)	131 (43.2)	
	>7x week	638 (60.5)	416 (39.5)	
Vegetable Score	None	26 (27.1)	60 (72.9)	**X**
	1–2x week	161 (39.1)	251 (60.9)	**2 = 64.617, p**
	3–4x week	470 (55.6)	375 (44.4)	**<0.0001**
	5–6x week	332 (59.2)	229 (40.8)	
	>7x week	500 (59.5)	340 (40.5)	
Fruit Score	None	74 (45.4)	89 (54.6)	
	1–2x week	330 (48.0)	358 (52.0)	**χ2 = 27.216,**
	3–4x week	477 (56.0)	375 (44.0)	**p <0.0001**
	5–6x week	288 (60.8)	186 (39.2)	
	>7x week	330 (57.2)	247 (42.8)	
Dairy Score	None	78 (48.8)	82 (51.2)	
	1–2x week	247 (45.6)	294 (54.4)	**χ2 = 45.223,**
	3–4x week	401 (51.5)	377 (48.5)	**p <0.0001**
	5–6x week	348 (63.9)	197 (36.1)	
	>7x week	425 (58.2)	305 (41.8)	
Nuts Score	None	198 (45.6)	235 (54.4)	
	1–2x week	622 (55.7)	494 (44.3)	**χ2 = 18.324,**
	3–4x week	430 (58.0)	311 (42.0)	**p = 0.001**
	5–6x week	148 (53.4)	129 (46.6)	
	>7x week	101 (54.3)	85 (45.7)	
Herbs Score	None	349 (44.7)	432 (55.3)	
	1–2x week	440 (53.9)	376 (46.1)	**χ2 = 67.873,**
	3–4x week	294 (55.3)	238 (44.7)	**p <0.0001**
	5–6x week	174 (64.7)	95 (35.3)	
	>7x week	242 (68.0)	114 (32.0)	
Sweet Drinks Score	None	221 (69.7)	96 (30.3)	
	1–2x week	134 (61.2)	85 (38.8)	**χ2 = 47.035,**
	3–4x week	292 (55.1)	238 (44.9)	**p <0.0001**
	5–6x week	461 (52.3)	421 (47.7)	
	>7x week	391 (48.5)	415 (51.5)	
Preserves Score	None	44 (45.4)	53 (54.6)	
	1–2x week	93 (54.1)	79 (45.9)	**χ2 = 20.716,**
	3–4x week	410 (60.7)	265 (39.3)	**p <0.0001**
	5–6x week	661 (54.3)	557 (45.7)	
	>7x week	291 (49.2)	301 (50.8)	
Sweets Score	None	248 (60.0)	165 (40.0)	
	1–2x week	235 (58.6)	166 (41.4)	**χ2 = 22.159,**
	3–4x week	467 (55.7)	371 (44.3)	**p <0.0001**

	5–6x week	466 (51.2)	444 (48.8)	
	>7x week	83 (43.2)	109 (56.8)	
Energy Drinks Score	None	17 (65.3)	9 (34.7)	
	1–2x week	15 (71.4)	6 (28.6)	$\chi^2 = 7.582$, p = 0.108
	3–4x week	54 (52.9)	48 (47.1)	
	5–6x week	142 (60.7)	93 (39.3)	
	>7x week	1272 (53.6)	1099 (46.4)	
Fried Food Score	None	78 (62.9)	46 (37.1)	
	1–2x week	151 (63.2)	88 (36.8)	**$\chi^2 = 26.603$, p <0.0001**
	3–4x week	387 (55.9)	305 (44.1)	
	5–6x week	657 (54.5)	548 (45.5)	
	>7x week	226 (45.7)	268 (54.3)	

Estimates shown in bold are those that are statistically significant at $p < 0.05$.

A chi-square analysis was also conducted on Table 7 with the overall diet scores and associations were found between diet components and region for all food groupings except energy drink consumption. Breakfast consumption was fairly similar between the Levant and the Gulf except for the fact that 56.8% and 60.5% of Levantine persons consumed breakfast five to six times per week and every single day of the week respectively. Vegetable consumption was also notably different between the 2 regions with 72.9% of Gulf persons not consuming any vegetables at all and 60.9% eating vegetables only 1 to 2 times per week. Levantine participants also consumed more fruit than their Gulf counterparts with 60.8% and 57.2% eating fruit 5 to 6 times per week and every day respectively. Dairy consumption scores were fairly similar among the regions however Levantine persons were found to consume it more regularly. 63.9% ate dairy 5 to 6 times a week and 58.2% had it every day compared to the 54.4% of Gulf respondents who only had it once or twice per week and the 51.2% who did not consume dairy at all. Intake of nuts was similar between the regions with the majority of total participants consuming nuts once or twice a week (40.5%). 54.4% of Gulf respondents did not consume nuts at all and nut intake was higher among the Levant with 55.7% having it 3 to 4 times, 53.5% having it 5 to 6 times and 54.3% consuming nuts more than 7 times a week. Use of herbs was also higher in the Levant with 64.7% and 68.0% using herbs respectively 5 to 6 times and more than 7 times a week. 55.3% of Gulf participants did not consume herbs at all. Sweet drink intake also varied between the regions. Total consumption was 32.0% 5 to 6 times a week however, Levantine persons consumed sweet drinks less frequently with 61.2% having it once or twice a week and 69.7% not having it at all. With preserved foods, total consumption was highest at 44.3% 5 to 6 times per week. 60.7% and 54.3% of Levantine persons consumed preserved foods 3 to 4 times and 5 to 6 times per week respectively and 50.8% of Gulf persons consumed it more than 7 times a week. Intake of sweets was highest in the Gulf with 56.8% eating sweets more than 7 times per week contrasting with the 58.6% of Levantine respondents who only ate sweets once or twice a week and 60.0% who did not eat sweets at all. And finally, total fried food intake was highest 5 to 6 times per week. 54.3% of Gulf persons consumed fried food more than 7 times per week compared to the 63.2% and 62.9% of Levantine participants who ate it respectively once or twice a week or not at all.

Crosstabulation tests were also conducted on the International Physical Activity Questionnaire (IPAQ) to determine if there were any significant differences between PA and region, however none were found, which suggests that PA output was the same or very similar for both regions.

CHAPTER IV

DISCUSSION

The main objective of this cross-sectional study was to compare the differences in the data between the Levant and the Gulf and highlight which demographic and lifestyle variables played the most significant roles in impacting mental wellbeing during the COVID-19 lockdown period. There were notable sociodemographic differences between the Levant and the Gulf, specifically age, education levels, BMI, smoking status, marital status, type of housing and overall health status. However, when these demographics were tested against mental wellbeing, the variables of age, type of housing, smoking status, presence of chronic disease and subjective overall health status were the ones that were significantly associated in affecting mental wellbeing.

Gender was found to be a predictor of mental wellbeing in the initial study by Kilani et al [27] and this was confirmed by the first regression that involved all demographic and lifestyle variables. Its significance, however, was lost in the adjusted regression. A cross-sectional study in Egypt (n=510) had previously discovered that being of young age, being female, having a chronic illness, having low income and living in urban areas were positive predictors of psychological issues [64] and this was further supported by a similarly designed study in Bahrain (n=1150) [65]. Apart from gender and income, the findings from these previous studies confirmed the results obtained in this study. Younger age groups tend to be triggered by surrounding stressors, and previous studies in China and Italy [66, 67] found that women were more vulnerable to stress and felt more feelings of helplessness than their male counterparts. Additionally, persons suffering with chronic illnesses were more susceptible to mental distress as they may perceive themselves to be of poor health and more liable to contract further disease [68].

The Levant had a younger demographic, higher rates of unmarried participants and a higher percentage of those who were educated primarily at the undergraduate level. Interestingly, even though the vast majority of total participants were non-smokers, the Levant had the higher rates of smokers. This reinforces the findings of the 2012 BREATHE study [69] which uncovered that smoking rates were highest in Jordan, Lebanon and Syria and primarily in persons under the age of 40. On the other hand, the Gulf had more of an older demographic which elucidated the significant majority of there being more married, divorced and widowed persons from this region. While there were more undergraduate educated participants hailing from the Levant, the Gulf claimed a significantly higher percentage of graduate degree holders. This could very well be due to the GCC Academic Revolution where three countries of note are home to especially thriving academic activity. These are Qatar, the UAE, and the KSA, which each have varying degrees of state control over higher education and boasts of contributing to both the quality and quantity of higher education in the region [70]. The type of housing was also significantly different between the regions where it was discovered that more persons in the Gulf region resided in urban areas whereas those in the Levant lived rurally. Urban living is associated with status as it is considered prime real estate, being near to workplaces, infrastructure and other amenities. City living is often costly and it can be postulated that many persons in Levantine countries may not be able to afford it. Based on the results of this study, urban living is associated with an increased risk of developing poor mental wellbeing. This finding was supported by a 2009 review that writes that "urbanization affects mental health through the influence of increased stressors, high levels of crime and violence, an overcrowded, polluted environment and reduced social support" [71].

Fascinatingly, an association was initially found between region and mental health when tested independently. Adding to the uncertainty in the world due to the pandemic, one would have assumed that the economic and safety situations in parts of the Middle East would have shown to have a secondary effect on mental health scores between participants in the Levant and the Gulf. However, when region was tested in the regression against the other variables, we found that regional location played no role in affecting mental health and may have been a confounding variable. Given the sample size of the study and keeping in mind that the majority of subjects came from university settings, this may not have been a true representation of the population and a likely limitation. Additionally, given that the Gulf plays host to many different nationalities, it cannot be assumed that participants originated in the country where the questionnaire was completed. It would be interesting for future studies to request the country of origin rather than country of residence in order to paint a more accurate comparison.

This study found that PA levels, sleep quality and overall health status had a positive impact on mental wellbeing. Table 5 demonstrated that in both the Levant and the Gulf, high PA levels gave the best chance of combating poor mental health compared to low levels. Moderate PA was also protective in both regions. When PA levels increased, the odds of scoring high and achieving a better overall mental health (WHO-5) score also increased. The biochemical explanation for this phenomenon is that during periods of PA, certain neurotransmitters are released in the brain such as endorphins and the reward hormone dopamine. These hormones allow the exerciser to obtain temporary feelings of euphoria [72]. PA also plays a role in lowering cortisol and other neurotransmitters that cause stress and anxiety. Regular PA is associated with reduced anxiety, reduced overall stress, better coping mechanisms and a reduction in depressive feelings [72,73]. Physiologically, regular PA can reduce blood pressure and improve insulin sensitivity which delays the development of non-communicable diseases such as heart disease, hypertension, type 2 diabetes mellitus and metabolic syndrome [74]. Interestingly, the results of the tests performed on the data confirmed that poor overall health status is associated with an increased risk of developing poor mental health. It can be assumed in this conclusion that with the increase in PA comes the subsequent reduced risk of delaying and preventing the development of chronic disease. While PA has evidently proven effective for physical health, it is similarly important for mental health as it has also been shown to improve sleep quality [75]. Results of this study also found that participants who lived primarily in the Gulf had higher rates of urban living as well as lower PA scores and thus, this can justify the significance of housing differences on rates of PA.

Our study also found an association between poor sleep scores and lower mental wellbeing scores, however there was no significant difference found between the regions. The brain requires a minimum amount of 7 hours of sleep each night in order to function optimally [76] and poor sleep quality is associated with an increased risk of developing and even worsening mental health ailments such as anxiety and depression [77]. In addition, the relationship between sound sleep and optimal physical health has been well documented. Sleep deficiency will not only result in feelings of general fatigue, but can increase the risk for a wide range of diseases and other health problems [78]. These include obesity, heart disease, high blood pressure, diabetes, and stroke. A lack of sleep can also pose a threat to physical safety, from falling asleep behind the wheel of a moving vehicle, to being at a higher risk of being in a workplace accident [79]. In other words, adequate and restful sleep protects both mental and physical health.

While there was no direct association between sleep and region, Table 4 illustrates that good sleep quality significantly raises the odds of obtaining good mental wellbeing. This revelation led to further testing on the individual questions of the PSQI where it was revealed that the majority of the Gulf relied on the use of sleep medication to fall asleep, had more problems being able to fall asleep within 30 minutes and had difficulty falling asleep because it was too hot. This could potentially explain the delayed ability to fall asleep and the increased use of sleep aids as melatonin production is interrupted when the surrounding environment is too hot and the body's core temperature is therefore unable to drop [80]. The poor sleep latency can also be explained by the increased use of blue light technology from computers, televisions and smart phones as these blue light emissions also interfere with melatonin production and can cause difficulty to fall asleep [81]. This is a prominent phenomenon especially in the UAE where it has been found that 65% of residents lack sleep due to too much smart phone use [50]. A disturbed sleep-wake circadian rhythm where the body does not obtain the right signalling from the body's internal clock can lead to struggles in falling asleep, difficulty waking up and overall low-quality sleep [82].

There was an initial association found between region and dietary scores though this was refuted by the regression involving all the variables and as such, a relationship between a balanced diet and overall mental wellbeing was not established. Diet did not affect mental wellbeing in the Gulf and it can be presumed that their current climate of economic stability affords this. Diet did however influence mental wellbeing in the

Levant, and when this was scrutinized more in depth by the chi-square analysis on dietary scores, there were significant differences between the Levant and the Gulf with all intakes of all food categories except energy drinks. In fact, Levantine participants consumed breakfast much more frequently and had higher intakes of vegetables, fruit, dairy, nuts and herbs as well as the highest percentage of high dietary scores. This is a stark contrast compared to the findings of Gulf participants who had the highest percentage of low scores and consumed sweets, sweet drinks, preserves and fried foods much more frequently than their Levantine peers and this can partially justify the higher rates of overweight and obesity that was observed in these participants. The higher BMI scores in the Gulf can also be due to the low PA scores that were obtained and this is supported by the results of the Saudi Arabian study where a change in dietary patterns including choosing high carbohydrate 'comfort foods' and low levels of PA led to weight gain during quarantine periods [83]. It should be noted that overconsumption of high caloric foods such as sugar-sweetened beverages and fried foods can lead to increases in fat mass, the development of non-communicable and other chronic diseases as well as poor overall health [84,85]. Our results also demonstrate that the presence of chronic disease as well as overall health status was found to affect mental wellbeing. As high diet scores in the Levant increased the odds of good mental wellbeing, it may support the theory that healthy diets such as the Mediterranean diet which is rich in vegetables, fruits, nuts and other healthy fats, is protective [86].

What would be interesting to see in future studies involving FFQs that compare the Levant and the Gulf is the inclusion of questions that ask about the frequency of foods such as meat, chicken, fish and egg consumption. This would paint a very different picture regarding the inference that current food choices in the MENA region are influenced by more economic means, as these animal-derived foods have astronomically increased in price in certain parts of the Levant such as in Lebanon, where many persons have adopted a vegetarian lifestyle not out of choice [87]. In fact, according to the World Bank's periodic assessment of the COVID-19 repercussions on food prince inflation, it was revealed that food prices in Lebanon were the most expensive in the entire MENA region [88].

To conclude, mental wellbeing scores were found overall to differ between the Levant and the Gulf with the Gulf having the highest percentage of better mental wellbeing scores and the Levant, the greater majority of low mental wellbeing scores. Given that the Levant had the healthiest lifestyle choices with higher PA and higher diet scores as compared to the Gulf, this can only be explained by the possible differences in socioenvironmental factors such as increased access to public infrastructure, medical care, job security, among others. A Swedish study had previously found a positive correlation between mental health in relation to socioeconomic conditions and lifestyle factors [89]. Future studies should consider including questions on income ranges to determine if socioeconomic status in addition to lifestyle factors have any influence on mental wellbeing in the MENA region.

CHAPTER V

CONCLUSION

We have isolated from this study that mental wellbeing has been negatively impacted during the COVID-19 pandemic and there is an urgent need to improve mental-health management in the entirety of the MENA region. The web of mental issues in the region are complex and varied and range from high-stress environments and fast-paced lifestyles in the oil-rich Gulf countries to severe depression, anxiety and PTSD in high-conflict, war torn countries. While the circumstances may be different between the regions, the overall effects of poor mental wellbeing need to be addressed in order for the general population to have a decent quality of life.

As evidenced from the results, mental wellbeing during this pandemic was heavily impacted by the variables of age, PA, quality of sleep, overall health status, presence of chronic disease and area of housing. Participants who were in good overall health, who regularly engaged in PA and who obtained satisfactory sleep quality received the higher mental wellbeing scores. Additionally, it has also been identified that region can play a role in influencing mental wellbeing even though the regression pointed to no significant difference in mental health status amongst those living in the Levant compared to those living in the Gulf states. However, even though comparisons have been made and are critical to create inferences, no conclusive remarks can be drawn at this time apart from the fact that PA was shown to be the most impactful and malleable variable when it comes to influencing mental wellbeing and this should be at the forefront of any lifestyle intervention. As poor sleep quality is associated with poor mental wellbeing, introducing PA into a lifestyle regime can act as a preventative measure in staving off mental illness.

Care should be taken to provide education and training regarding psychosocial issues to the general public, as current levels of understanding and awareness may not be enough. Mental health management committees should work to identify, create and disseminate evidence-based resources for managing mental health outcomes, including referrals for counselling as well as liaising with public health officials to encourage the importance of daily PA, raising awareness of good sleep etiquette, and encouraging overall health to combat the development of poor mental wellbeing. The provision of effective, evidence-based PA interventions as well as dietary guidance especially with regards to nutrition in countries with low socioeconomic status should be made readily available for all individuals.

Further studies should be undertaken to understand the impact of combining such lifestyle interventions with traditional mental health treatments including but not limited to psychopharmacology and psychotherapy. Recommendations for future studies involving the Levant and the Gulf should include comparing income brackets and other measures of job security to determine if these play a role in mental wellbeing.

CHAPTER VI

STRENGTHS AND LIMITATIONS OF THIS STUDY

This is one of the few studies comparing the Levant and the Gulf, and identifying if the variables PA, diet, sleep, and mental wellbeing in Arab educational institutions were associated during the COVID-19 pandemic. As this is one of the first studies of its kind in this period, the data collected will help to paint a better picture of the associations that were uncovered. A pilot study was also conducted which was important to test for the reliability and reproducibility of the questionnaires used, and the large sample size assisted in unveiling correlations.

However, some other limitations arose in this study. As the study sample was quite large in nature, the questionnaires only allowed for basic data collection and details of the variables are not explained which limited the comparison of the pre and during confinement effects of each variable. For example, BMI measurements were taken at the time of data collection but it would have been useful to observe and compare the differences between the readings at the start of the pandemic confinement in order to compare weight changes between Levant and Gulf states. Added to the point of the questionnaires, there may have been recall bias and possibly social desirability bias as the answers given by these Middle Eastern participants may reflect the social culture of the region. Furthermore, causality cannot be determined from the results of this study due to the sampling technique that was employed; since the data was collected via snowball sampling, it is not possible to say which are causes and which are effects of mental wellbeing symptoms. The observed relationships can potentially be bi-directional, for example, poor mental wellbeing can lead to difficulties with social interactions. Also, financial difficulties brought about by poor socioeconomic status can cause stress, anxiety and depression but these mental health challenges can also influence financial status through illness or absence from the workplace.

And finally, there was no distinctive inclusion and exclusion criteria however, this has been explained in the Methods section.

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