International Journal of Medical Science and Health Research

Vol. 5, No. 02; 2021

ISSN: 2581-3366

Impact of Covid-19 Lockdown on Adults' Health in North Africa

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doi: 10.51505/ijmshr.2021.5205 URL: http://dx.doi.org/10.51505/ijmshr.2021.5205

Abstract

The lockdown caused major upheavals in everyone's life and a considerable public health burden. These changes are bound to lead weight gain and increase the rate of obesity around the world.

The aim of the present survey was to determine the impact of the COVID-19 lockdown on global health in a population of adults from Constantine, Algeria. More precisely, the survey aimed at determining factors associated with obesity, as well as a comparison of the lifestyle changes and habits of this population before and during the COVID-19 lockdown.

The questionnaire was deployed via an Algerian electronic platform named "Word Form" and shared its link on social networks.

A total of 1400 subjects completed the survey and after validation of the data, 1000 respondents have been included in the study. The age of our population was >19 years old. About 45% of the participants declared that their diet became imbalanced during the COVID-19 lockdown (P=0.016). In contrast, 63% admitted to snacking after dinner and 74% snaking between meals represented a high association which weight gain (P<0.01). The results suggests that poor sleeping patterns can lead to weight gain and an increase in body mass index (P <0.01).

The COVID-19 pandemic had a serious impact on the eating habits and lifestyle changes during the pandemic after the lockdown period in an adult Algerian population.

Keywords: Health, COVID-19, adults, lifestyle behaviours, sleeping patterns.

Introduction

Because of the worldwide spread of a novel coronavirus disease (COVID-19) on January 30, 2020, the World Health Organization (WHO) declared COVID-19 as a global pandemic[1]. Given the pandemic situation, public health recommendations and governmental measures have resulted in lockdowns and many restrictions on daily living, including isolation, social distancing, and home confinement. The Algerian Government implemented several restrictive measures on 12 th March, 2020 in order to contain the infection spread by postponing study in all schools and universities and suspended work, a part from that of the emergency services. In

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addition, all malls and local businesses such as salons, employment places, restaurants, and gyms were closed[2].

Long-term home confinement and lockdown have affected daytime routines which added various challenges and changes to human life worldwide, causing an unprecedented impact on human health, lifestyle physical activity, sleep routines, social life, and has affected the local and international economy[3]. All of those factors may-increased stress induced by the disruption of daily routine, along with fear and anxiety regarding the spread of the disease and its consequences for people's health, work, family and personal matters.

Previous studies among quarantined people have shown an association between increased emotional disturbances, anxiety, general stress levels, lower mood and the amount of food consumed [4]. López-Bueno et al. (2020) proposed that poorer psychological wellbeing and mental health during COVID-19 lockdown is associated with health behaviors such as alcohol consumption, diet, sleep, and physical activity[5]. Furthermore, sedentary behaviors, anxiety, and boredom caused by home confinement, could influence motivation to eat, change lifestyle patterns, reduce diet quality based on plant food (vegetables, legumes, fruits), healthy fats, rich protein-low fat food[6]. In addition, people increased consumption of unhealthy food, uncontrolled eating, snacking between meals, high fat food, and overall higher number of main meals, which are known to be independent risk factors for metabolic complications such as obesity, diabetes and cardiovascular disorders[7].

Nutritional status of individuals has been used as resilience towards destabilization during this COVID-19 pandemic. Optimal nutrition and dietary nutrient intake impact the immune system in different manners, including affecting susceptibility to infection, severity of disease, and recovery time, and is therefore a significant consideration in the management of COVID-19.[8]

The aim of the present study was to determine the impact of the COVID-19 lockdown on bodyweight gain by comparing the lifestyle changes, dietary habits and sleeping patterns before and during the lockdown among adults in Algeria.

Materials and Methods

Study design

An anonymous, structured and online survey based on a self-designed was conducted among adult Algerian in the region of Constantine, Algeria.

The survey was conducted in full agreement with the national and international regulations and to the Declaration of Helsinki (2000). All participants were fully informed about the survey and gave their consents to answer the questionnaire before the beginning of the study.

The questionnaire, included 159 questions divided into 4 different sections: the first one inquired demographic information (age, gender, place of residence, home domicile, current employment), the second, anthropometric data (height, and weight changes), the third, dietary habits

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information (adherence to the Mediterranean diet, daily intake of certain foods, food frequency, and number of meals/day) and the forth, lifestyle habits information (grocery shopping, smoking habit, and sleep quality). From these data, we calculated body mass index (BMI= Weight in *Kilograms* / (Height in *Meters*) ^{2}). Moreover, we compared the body weight before and after the COVID-19 lockdown. The questionnaire was conducted from May 5th and August 29th, 2020 on 1000 subjects randomly selected.

People with metabolic syndrome, sleeping trouble and using drugs and those whom did not complete the questionnaire were excluded from the study.

Data collection

This kind of online research is a recommended approach to reach subjects swiftly, ensuring their safety under pandemic conditions. The questionnaire was deployed *via* an Algerian electronic platform called "WordForm" and shared its link on different social networks (*i.e.* Facebook, Instagram, Tweeter) in order to ensure a wide dissemination and to obtain a big number of answers.

Statistical Analyses

All the statistical analyses were performed using SPSS software version SPSS 20.0 (Statistical Package for the Social Sciences, IBM Corporation; Chicago, IL. August 2011) and data were expressed as means ± standard deviation (SD).

The quantitative parameters were presented as the mean ± SD and the qualitative parameters as percentage. To analyze the differences between BMI, two or more independent groups, the Mann–Whitney U test or Kruskal–Wallis analysis of variance (ANOVA) were used, respectively. The Chi-square was used to determine frequency differences within the participants for diet quality, sleeping patterns and eating behaviors. Pearson correlation was used to assess the relationships between the continuous predictor variables of sleep and screen time. A value of $P < 0.05$ was considered statistically significant.

Results

On the 29th of August 2020, the access to the online questionnaire was concluded, and the data collected were analyzed. After validation of the data, 1400 subjects completed the questionnaire, 1000 respondents have been included in the study. In addition, the demographic breakdown and anthropometric data of the studied population were presented in Table1, the females represented 66% of the respondents, and most of them were aged between 18 and 29 years.

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Table 1: Distribution of the population by weight status and anthropometric characteristics before and during the COVID-19 lockdown.

Variables		N (%)	P-value
Gender	female	660 (66%)	**0.001**
	male	340 (34%)	
Age (years) ↑	18 – 29	611 (61.1%)	**0.001**
	30 – 70	389 (38.9%)	
Living area	Favored	771 (77.1%)	**0.001**
	Disfavored	229 (22.9%)	
Socioeconomic situation	Student	395 (39.5%)	**0.001**
	Employee	429 (42.9%)	
	Unemployed	176 (17.6%)	
Housing	Apartment without balcony	167 (16.7%)	**0.001**
	Apartment with balcony	510 (51.0%)	
	House without exterior	207 (20.7%)	
	House with exterior	510 (51.0%)	
Variables		**Means ± SD**	**P-value**
Height (m) ↑		166. 22±6. 703	_
Weight (kg) ↑	Before lockdown	79.534±15.022	**0.001**
	During lockdown	82.490±15.190	

BMI (kg/m²) ↑	Before lockdown	31,98 ± 5,61	**0.001**
	During lockdown	35.01 ± 6.31	
N= number of samples; (↑) Continuous data are presented by: mean ± standard deviation; BMI: Body Mass Index; (-): empty cell. P values in bold express significant difference.			

During the COVID-19 lockdown period, both females and males gained weight parallel to BMI when compared to the previous period of time (31.98 ± 5.61 kg/m² vs. 35.01 ± 6.31 kg/m²), (P<0.001).

For the socio-economic parameter, we found that employees had a higher frequency (42.7%) than students 39.5% and unemployed 17.6%.

The other findings showed that people who lived in disfavored area were the minority with a frequency of 77.1 % compared to those who lived in a favored area (22.9 %).

The Table 2 depicted the diet quality before and during lockdown. The results demonstrated a significant increase in the consumption of fried, proteins, fat, and sweets in parallel with a significant decrease in the consumption of fruits, vegetables and dairy products.

Table 2: Impact of diet quality changes on bodyweight during the COVID-19 lockdown.

Variables		**Before lockdown**	**During lockdown**	**P-value weight status**	***PΔ***
Fruits and vegetables	**Yes**	663 (66.3%)	587 (58.7%)	**0.001**	**0.001**
	No	413(41.3%)	337 (33.7 %)		
Fried	**Yes**	561 (56.1%)	579 (57.9%)	**0.001**	**0.001**
	No	439 (43.9%)	421 (42.1%)		

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Starchy foods	**Yes**	678 (67.8%)	681 (68.1%)	0.070	0.069
	No	322 (32.2%)	319 (39.1%)		
Proteins	**Yes**	442 (44.2 %)	615 (65.1%)	**0.001**	**0.002**
	No	558 (55.8 %)	385 (38.5%)		
Sweet drinks	**Yes**	453 (45.3 %)	783 (78.3%)	0.449	0.390
	No	547 (54.7%)	217 (21.7%)		
Water		1.83±0.619	2.15±0.687	**0.012**	**0.016**
Fat	**Yes**	585 (58.5%)	756 (75.6%)	**0.001**	**0.018**
	No	415 (41.5%)	244 (24.4%)		
Sweets	**Yes**	589 (58.9%)	780 (78.0%)	**0.005**	0.260
	No	411 (41.1%)	220 (22.0%)		
Dairy products	**Yes**	736 (73.6%)	474 (47.4%)	**0.050**	**0.026**
	Non	264 (26.4%)	526 (52.6%)		
***PΔ* = difference between weight during lockdown and before the lockdown. P values in**					

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bold express significant difference.

Significant associations between BMI, fruits and vegetables consumption (Rs = −0.128), fired (Rs = −0.057), starchy foods (Rs = −0.133), fat (Rs = 0.075), water (Rs = −0.088) and dairy products (Rs = −0.019) have been observed.

The Table 2 also revealed that 58.9 % of the population consumed more sweets after the lockdown compared to the previous period (*i.e.* 41.1% did not consume sweets before). Although, during this period, people tended to increase their consumption of sugar products, with a frequency of 78.0%.

A constant consumption of carbohydrates represented by starches (P=0.0069), fried foods (P=0.001) and proteins (P=0.002) was also observed (- Mann–Whitney U, P< 0.05) during the lockdown. The bodyweight gain was highly due to the increased consumption of fat and sweets ($p < 0.001$ by the chi-square test). There was no relationship between sweet drinks consumption and bodyweight gain ($P > 0.05$).

The impact of lockdown on lifestyle quality and especially on the eating behavior and sleeping patterns is presented in Table 3.

Table 3: Impact of eating behavior on body weight change during the lockdown.

Variables		Before lockdown	During lockdown	P-value weight status	*PΔ*
Number of meals per day	**2**	326 (32.6%)	48 (4.8%)	**0.001**	**0.001**
	3	419 (41.9%)	189 (18.9%)		
	4	208 (20.8%)	472 (47.2%)		
	>4	47 (4.7%)	291 (29.1%)		
Fixed meal times	**Yes**	522 (55.2%)	381 (38.1%)	**0.001**	0.697
	No	478 (47.8%)	619 (61.9%)		
	Yes	542 (54.2%)	448 (44.8%)	**0.050**	0.645

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Skipping meals	**No**	458 (45.8%)	552 (55.2%)		
Do you eat a big portion of food?	**Yes**	447 (44.7%)	653 (65.3%)	0.453	0.074
	No	553 (55.3%)	347 (34.7%)		
Varied diet	**Yes**	608 (60.8 %)	524 (52.4%)	0.841	0.747
	No	392 (39.2%)	476 (47.6%)		
Balanced diet	**Yes**	614 (61.4%)	552 (55.2%)	**0.006**	**0.016**
	No	386 (38.6%)	448 (44.8%)		
Bakery products	**Yes**	746 (74.6%)	802(80.2%)	**0.001**	**0.001**
	No	254 (25.4%)	198 (19.8%)		
Snacks after dinner	**Yes**	554 (55.4%)	704 (70.4%)	**0.001**	**0.001**
	No	446 (44.6%)	296 (29.6%)		
Snacks between meals	**Yes**	529 (52.9%)	737 (73.7%)	**0.001**	**0.010**
	No	471 (47.1%)	263 (26.3%)		
Consumption of stimulants (Coffee, tea)	**Yes**	551 (55.1%)	629 (62.9%)	**0.010**	**0.001**

PΔ = difference between values during lockdown and before the lockdown. P values in bold express significant difference.

Globally, 47.2% of the questioned individuals reported increased eating habits during the lockdown period. They ate 4 times per day before and 29.1% of them ate more than 4 times after the lockdown period. The results showed a significant relationship between this change of eating habit and the bodyweight gain ($P < 0.01$). Furthermore, 55.5% of the participants had a fixed mealtime before and only 38.1% maintained this habit after the lockdown period. No significant association was found between the fixed meal times and the bodyweight gain. However, the percentage in our population of those skipping meals decreased from 54.8 % to 44.8% during the pandemic period ($P < 0.005$).

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Among the investigated participants, there was a decrease in the balanced daily diet number. Indeed 44.8% of adults declared that their diet became imbalanced during the COVID-19 lockdown (P =0.016). This was illustrated by a significant increase of bakery products and stimulant drink consumption (P < 0.05). This shift in these eating habits had a significant impact on bodyweight change (P <0.005)

The Table 4 described the impact of the COVID-19 lockdown on the sleeping habit and sleep quality in our adult population. About 16.7% of adults changed their bedtime (*i.e.* before lockdown there were 71.2% to sleep at the fixed time and after they were 54.5%). However, no significant association was found between a fixed bedtime and a higher BMI or bodyweight gain.

Table 4: Impact of sleeping patterns on body weight change during the lockdown.

Variables		Before lockdown	During lockdown	P-value weight status	*PΔ*
Stable sleeps schedules (bedtime)	**Yes**	712 (71.2%)	545 (54.5%)	**0.025**	0.511
	No	288 (28.8%)	455 (45.5%)		
Hours of sleep (per night)	**-6h**	352 (35.2%)	452 (45.2%)	**0.001**	**0.001**
	6-8h	576 (57.6%)	347 (34.7%)		
	>8h	72 (7.2%)	201 (20.1%)		
Nap	**Yes**	258 (25.8%)	574 (57.4%)	**0.001**	**0.001**
	No	742 (74.2%)	426 (42.6%)		
Time spent in front of a screen (computer, TV, tablet, phone)	**Yes**	403 (40.3%)	715 (71.5%)	**0.001**	**0.001**
	No	597 (59.7%)	285 (28.5%)		
Using the phone before sleeping	**Yes**	563 (56.3%)	755 (75.5%)	**0.001**	**0.003**
	No	437 (43.7%)	245(24.5%)		
PΔ = difference between values during lockdown and before the lockdown. P values in bold express significant difference.					

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In addition, there was a significant relationship between predicted variable hours of sleep per night and bodyweight gain (Rs=0.132); (P <0.01). The present result reported that adults with a sleeping time under 6 or fewer hours per night were at greater risk for bodyweight gain compared with subjects who slept between 6–8 or more than 8 hours (P= 0.000).

Finally, the increase in the screen time exposure (+31.2%) and in time with mobile phones or tablets (+19.2%) before sleeping had a significant impact on the bodyweight among our population (Rs = 0.63; P <0.01) during the lockdown period.

Discussion

The COVID-19 pandemic has transformed and continue to transform people's daily life because of the associated lockdown restrictions.

According to our knowledge, this study was among one of the first to investigate the immediate impact of the COVID-19 lockdown on eating habits, lifestyle changes and sleeping patterns among adult Algerian *via* an online survey.

Based on the 1000 responders, the present study demonstrated that the lockdown induced a significant increase of BMI (+9% in average) associated with an increase in fried and processed food consumption and a decrease in sleeping time. The present findings are in line with other research that has observed changes in BMI because of dietary habits and lifestyle behavior changes during the pandemic [9] and pointed out the detrimental impact of the lockdown on the global health of adults. This is reinforced by the fact that individuals' diet and lifestyle have an important impact on public health. The adoption of a healthy diet and eating behavior have an important role in diabetes, obesity, cardiovascular disease and cancer prevention [10].

The family income was another determinant that should be taken in consideration. Our findings showed that 39.5% of the population were students, 42.9% were employed and 17.6% were unemployed. The people with a higher income may have more financial means to afford a healthy and less energy-dense diet and so decrease the detrimental impact of the lockdown on eating habits. In contrast, individuals from disadvantaged socio-economic backgrounds may be at a greater risk of becoming obese. In addition, the majority of this last category of adults lived 51% live in apartment without balcony. According to other authors, housing conditions, units with a poor housing quality and non-functioning or inadequate outdoor were related to the current depressive lifetime and anxiety symptoms. These may also induce a change in eating habits, lifestyle and sleeping patterns of our population [11].

To explore the impact of the COVID-19 lockdown on eating habits of the selected population before and during the lockdown we analyzed different factors like the number of meals per day and snaking. More than one in two adults skipped meals during the lockdown. These results were in line with those of a previous study who stated that skipping meal was associated with a higher risk of body weight gain and incidence of obesity [12]. Moreover, our results showed that obese and overweighed subjects nibbled between meals in their current life. However, after the lockdown this habit was adopted by 73.7% of subjects in different weight status categories.

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These results corroborated with other results indicating that there was a positive association between snacking behaviors and weight status [13]. Furthermore, we found a high significant difference between bed snack and weight status. This point implies that nighttime eaters may consume more calories throughout a day than those who do not take a bed snack, and eating at night appears to have a lower energy expenditure than eating in the morning. As a result, these subjects will have circadian misalignment, which decreased plasma leptin concentrations and increased glucose levels Results in a reduction of the satiety hormone (leptin), accompanied by increased hunger and increased serum concentrations of the orexigenic factor ghrelin, which might add to the risk of developing obesity [14].

Although, a direct causal relationship between portion size and obesity has not been demonstrated, current research indicates that portion size is a key environmental driver of energy intake, and larger-than-appropriate portion sizes could increase the risk of weight gain. In addition, larger served portions resulting in a significant increase in energy intake influenced adults. Here, our study did not show a causal relationship between increased portion sizes and bodyweight gain or BMI increase before the lockdown, people tended to take two (32.6%) to three (41.9%) meals per day. After this period, it was respectively 47.2% and 29.1% of the studied population who took four or more meals per day. The increase in quantity of meals was suggested to be associated with the likelihood reduction of central obesity, and it is often recommended as a strategy for weight loss. Hence, it is presumed to reduce hunger, energy intake and bodyweight [15]. In addition, the people surveyed answered that they reduced their intakes of varied and balanced diets on their meals during the lockdown. This may represent one of the possible reasons explaining the gain in bodyweight or increase in BM1. The present result is consistent with those of a previous study indicating that the central problem causing obesity was a qualitative and quantitative dietary imbalance.

Nutritional deficiencies of energy, protein, and specific micronutrients are associated with depressed immune function and increased susceptibility to infection. An adequate intake of iron, zinc, and vitamins A, E, B6, and B12 is predominantly vital for the maintenance of immune function. Therefore, the key to maintaining an effective immune system is to avoid deficiencies of the nutrients that play an essential role in immune cell triggering, interaction, differentiation, or functional expression.[16]

To sum up, eating habits of our population have undergone marked changes in the lockdown, mainly because of the reduced consumption of natural foods such as fruits and vegetable and the increased consumption of processed foods, especially sauces, fried foods, soft drinks, refined grains. Moreover, we noticed that the sugar consumption increased from 58.9% to 78%. This behavior appeared may be because of the capacity of carbohydrates to reduce stress [17] or to compensate the decreased consumption of dairy products (*i.e.* main sources of the sleep-inducing amino acid tryptophan, which is a precursor of serotonin and melatonin) observed after the lockdown (73.6 % to 47.4 %). These products represent the main sources of the sleep-inducing amino acid tryptophan, which is a precursor of serotonin and melatonin. Moreover, tryptophan is involved in the regulation of satiety and caloric intake via serotonin that mainly lowers

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carbohydrate and fat intake, and inhibits neuropeptide Y, the most powerful hypothalamic orexigen peptides.[18]

Finally, to further explore the impact of the COVID-19 lockdown on the global health of adult, we investigated the quality of sleep. Sleep is a physiological and behavioral state, which plays an essential role in the homeostasis, energy metabolism, and cognitive function. Circadian rhythms coordinate most biological processes, requiring endogenous and peripheral clocks, which regulate the rhythm of physiological functions such as heart rate, gastrointestinal motility, hormonal secretion, macronutrient metabolism, energy metabolism, and gastrointestinal functions [18]. Quarantine-related stress results also to sleeping disturbances that in turn further worsen the stress and increase food intake, thus gave rise to a dangerous vicious cycle [16].

In the present study, we found a decrease in sleep duration during the lockdown compared to previous period. Almost half of the respondents (45.2%) slept less than 6 hours per night while 54.8% slept more than 6 hours. The current study also found that those who got fewer hours of sleep were the most exposed to bodyweight gain and BMI increase. This is consistent with prior research supporting the idea that the decrease in sleeping duration promotes obesity because of increased opportunities of eating [19].

Moreover, the sleeping disruption for half of our questionnaire population could be explained the observed increase of stimulant consumption and of digital media time use before going to bed. Indeed, caffeine stimulates the nervous system, which is able to inhibit adenosine receptors, and to be highly involved in sleep delays or even sleep disturbances [20]. In addition, the increase in digital media used before going to sleep may also influence the duration and quality of sleep because of narrowband light exposure affected cortisol levels, which activate photoreceptors located in the retina and finally increase the sympathetic nervous system response [21].

Thus, the reduction of sleeping time may lead to bodyweight gain in several ways, including eating to cope with negative emotions. As with melatonin, cortisol and salivary alpha amylase production exhibits a regular circadian pattern, affect human physiology and behavior acutely [13]. Our results are also in line with previous ones showing that sleeping restriction influenced two important hormones, leptin and ghrelin, which regulate metabolism and energy expenditure. Both the decrease in leptin and the increase in ghrelin seen with sleeping deprivation could potentially increase food intake and contribute to bodyweight gain [22]explaining the increase in BMI reported in our population.

Limitations of the study

Although, this study provided an insight into how the epidemic-related lockdown can affect dietary patterns and BMI, some limitations needed to be underlined. The research was based on an anonymous and online questionnaire excludes the possibility of verifying the data on objective grounds. The BMI was not measured directly before and after the lockdown, but declared by the individual's questionnaire.

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Conclusion

The present study provided, for the first time, information on the impact of the COVID-19 lockdown on health, eating habits and lifestyle changes in an adult Algerian population. Our results showed that the lockdown period may had negative impact on eating habits leading to bodyweight gain and BMI increase associated with an increase in time sedentary behavior at home. In self-selected sleep conditions, the timing of sleep and sleep habits significantly differed from those of socially fixed daily routine conditions. Our data suggested that poor *sleeping patterns* might lead to body*weight gain and an increase in BMI*. Based on the present results, it can be hypothesized that the lockdown period alter the global health in adult women and men. This led us to alert on the usefulness and safety of this kind of management of the present COVID-19 pandemic.

Acknowledgments

The authors would like to acknowledge all participants for their realization of this work.

The authors declare no potential conflicts of interest with respect to the authorship and publication of this article.

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