

Assessing Changes in Lifestyle and Health-Related Behaviors During the COVID-19 Pandemic: A Cross-Sectional Web-Based Survey Among Lebanese Adults

Danielle Saadeh (✉ daniellesaadeh@hotmail.com)

INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban)

Aline Hajj

Faculty of Pharmacy, Saint-Joseph University of Beirut

Diana Malaeb

INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban)

Hala Sacre

INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban)

Chadia Haddad

INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban)

Pascale Salameh

INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban)

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Abstract

Background

The novel coronavirus disease 2019 (COVID-19) has quickly become a worldwide threat to human health and has significantly impacted peoples' lives and changed their lifestyle and health behaviors (LHB). This study aims to assess changes in lifestyle and health-related behaviors such as daily habits, dietary habits, physical activity, sleep patterns, psychological problems, and sexual behaviors among the general population in Lebanon during the COVID-19 pandemic.

Methods

A cross-sectional web-based survey conducted between January 9 and January 28, 2021, enrolled 403 Lebanese adults. The study questionnaire was developed on Google forms in English and Arabic. It included questions about sociodemographic characteristics, COVID-19, and behavior changes (smoking, alcohol consumption, sexual and hygiene behaviors, and intake of nutritional supplements and immunity-boosting foods), in addition to three scales, i.e., the Lifestyle and Health Behaviors Changes (LHBC-17), WHO-5 Well-being Index, and Fear of COVID-19 scale (FCV-19S). Data analysis was done on SPSS software version 21.

Results

The mean age of participants was 29.74 ± 10.81 years, with 51.2% of females. Most participants reported that COVID-19 has profoundly affected their LHBs, whether positively or negatively. Female gender (Beta=-2.336), living in Lebanon (Beta=-7.502), smoking nargileh (Beta=-3.433), having a high BMI (Beta=-0.263), and spending more hours per day using electronic devices during the COVID-19 lockdown (Beta=-0.853) were significantly associated with lower LHBC-17 scores (negative LHB changes). Whereas, living in an urban region (Beta = 2.464), having a job (Beta = 1.920), good overall health (Beta = 3.543), a higher quality of life (Beta = 0.204), and having physical (Beta = 2.101) and mental (Beta = 1.586) health unaffected by the COVID-19 lockdown were all significantly associated with higher LHBC-17 scores (positive LHB changes).

Conclusions

Lebanese adults reported several unfavorable lifestyle changes and psychological problems during the lockdown due to COVID-19. Health-promotion strategies are needed to assess negative changes both on physical or mental health and maintain as much as possible positive health-related behaviors among the Lebanese population.

Background

The novel coronavirus disease 2019 (COVID-19) has quickly become a worldwide threat to human health [1] and has drastically impacted peoples' lives, bringing about a sudden and radical change in their daily routine and lifestyle [2]. Considering the outbreak of COVID-19, social distancing and preventive measures are recommended to combat and reduce contamination risks [3], such as hand hygiene, essential to prevent the transmission of pathogens and reduce the risk of acquired infections [4].

Although it is the cornerstone in curbing the pandemic, several studies have demonstrated that confinement induces lifestyle behavior changes, promoting sedentary and poor dietary habits [2, 5–9]. Physical activity is reduced due to compulsory home isolation and the lockdown imposed on different public and social settings [8]. Indeed, community mobility data from 15 countries revealed that the time spent in places associated with physical activity, such as parks, beaches, and community gardens, was lower during the COVID-19 lockdown. Conversely, the time spent at home watching television (TV), playing video games, and using electronic devices has increased during confinement, where people tend to go to bed later and wake up later, which explains further the limited physical activity [7].

Furthermore, social distancing caused by home confinement increases the risk of psychosocial disorders due to the limited communication and interaction with society [10, 11]. Psychological and emotional disorders manifested by depression, anxiety, and frustration are common during COVID-19 as it is still an ongoing pandemic surrounded by controversies in terms of mode of transmission and treatment. Thus, individuals tend to experience greater psychosocial and emotional pressures during the lockdown, associated with unhealthy lifestyle behaviors, such as physical and social inactivity, unhealthy diet, and poor sleep quality [11, 12]. A multi-centered international study has shown that social isolation during the COVID-19 lockdown has deleterious effects on mental wellness, characterized by increased anxiety and stress [13].

People who experience psychological disorders and stressful events during the COVID-19 lockdown are more prone to consume unhealthy food rich in fat and sugar to relieve feelings of tension, anger, and confusion [10]. Furthermore, due to stringent lockdown restrictions, households would stockpile ultra-processed and high-calorie foods, leading to the ingestion of unhealthy foods [14]. The COVID-19 lockdown has affected weight gain due to the limited access to daily grocery shopping coupled with reduced consumption of fresh foods and increased intake of processed convenient foods [2], particularly those high in sugar to help cope with COVID-19 psychological distress and improve the mood [15, 16].

As for the association between COVID-19 and smoking behaviors, it is complex and bidirectional. It is suggested that COVID-19 might lead to reduced or even cessation of smoking due to the fear of contracting the virus and the increased risk of hospitalization among smokers [17–21]. Oppositely, for some tobacco users, mental stress and anxiety are eased through smoking, which results in increased consumption [22].

In Lebanon, the COVID-19 outbreak occurred together with an unprecedented economic crisis, with the first confirmed case reported on February 21, 2020. As of this date, the Lebanese government has implemented preventive measures to curb the spread of the disease. However, the steadily increasing numbers of COVID-19 cases have mandated several sterner interventions, including curfews and total lockdowns [23].

Several studies were conducted to assess the effects of the COVID-19 pandemic on Lebanese adults, covering mental health, domestic violence, weight change, stress, and anxiety [24–27]. Their findings revealed that the fear of COVID-19 was associated with a negative weight perception [25] and higher stress and anxiety, particularly in women [26]. Furthermore, extended confinement was associated with a higher weight change perception [25].

These studies have addressed some of the factors affected by the COVID-19 pandemic; however, none has evaluated lifestyle and health-related behavior changes among Lebanese adults. Understanding the associations between lifestyle risk factors and COVID-19 is essential to identify people at risk of exhibiting unhealthy behaviors during the lockdown since it is hypothesized that lifestyle measures and health-related behaviors are altered during the COVID-19 pandemic.

Therefore, this study aims to assess changes in lifestyle and health-related behaviors such as daily habits (hygiene, smoking, alcohol, and work), dietary habits (intake, meal pattern, and snack consumption), physical activity (duration and type), sleep patterns (length and quality), psychological problems (physical and emotional exhaustion, irritability, and tension), and sexual behaviors among the Lebanese adults during the COVID-19 pandemic.

Methods

Study design and sampling

A cross-sectional web-based survey conducted between January 9 and January 28, 2021, enrolled 403 Lebanese adults using the snowball sampling technique. All people above 18 with access to the internet were eligible to participate. The study questionnaire developed on Google Forms was self-administered, anonymous, and available in two languages English and Arabic. The survey link was distributed through various social media platforms (WhatsApp, Facebook, and Instagram) to reach participants from all Lebanese Governorates/Districts (Beirut, Mount Lebanon, North, Beqaa/Baalbeck/Hermel, and South/Nabatieh). Participants were encouraged to share it with friends and people they know.

The first page of the questionnaire included explanations of the study objectives and the following informed consent statement: Completing the questionnaire requires 10 to 15 minutes and indicates your consent to participate. Participation in this study was voluntary, and participants received no incentive in exchange for their participation.

Sample size calculation

The Epi info software (Centers for Disease Control and Prevention, Epi Info™) was used to calculate the required sample size [28]. The minimum sample calculated was 350 participants based on a population size of 3,413,308 Lebanese adults (according to the population estimates of 2019–2020 from the Central Administration of Statistics) [29], an alpha error of 5%, a power of 80%, a confidence level of 95%, and an expected frequency of behavior changes due to COVID-19 of 35% in our population (according to a recent study on eating habits and lifestyle behaviors during the COVID-19 pandemic in 18 countries from the Middle East and North Africa region, including Lebanon that represented 11.5% of the overall sample) [30]. The final sample size comprised 403 participants to allow for adequate power for multivariable statistical analyses.

Questionnaire

The questionnaire consisted of three sections, including closed- and open-ended questions.

The first part of the questionnaire clarified the sociodemographic features of participants: age, gender, marital status, education level, family monthly income, the number of people living in the same house, the number of rooms in the house, occupation status, the region of residence, and religion. The household crowding index was calculated by dividing the number of persons living in the house by the number of rooms, excluding bathrooms and kitchen. The family monthly income, in Lebanese pound (LBP), was divided into four levels: no income, low (< 1500000 LBP), intermediate (1500000–3000000 LBP), and high income (> 3000000 LBP). Two additional questions, rated on a 5-point Likert scale from 0 (not worried at all) to 5 (extremely worried), assessed financial distress by measuring how worried participants are about their current financial situation and being unable to meet regular monthly living expenses.

The second part consisted of COVID-19-related questions, such as direct or potential contact with someone with COVID-19, having been diagnosed or tested positive with COVID-19, family history of COVID-19, and the changes in hours spent working/studying/using electronic devices (screen time), salary/income, and weight during the COVID-19 pandemic.

The third part of the questionnaire consisted of three scales and questions about health-related behavior changes as follows.

Lifestyle and Health Behavior Changes questionnaire (LHBC-17)

This 17-item newly constructed questionnaire (LHBC-17) is a short, concise, and user-friendly tool based on a validated questionnaire [31] used to assess the lifestyle and health-related behavior changes during the COVID-19 pandemic. It covers all essential aspects of lifestyle and health-related behaviors, including dietary habits (intake, meal pattern, and snack consumption), physical activity (duration and type), sleep (length and quality), and psychological health (irritability, stress, and anxiety).

Diet-related items (1 to 9) assess the consumption of main meals, snacks, healthy and balanced diet (including whole grains, fruits, vegetables, eggs, nuts), and unhealthy foods (fried food, fast food, sugar-sweetened products). Physical activity-related items (10 to 12) assess the participation in aerobic exercise, household-related activities (cooking, laundry, cleaning), and leisure-related activities (indoor/outdoor activities, walking, and gardening). Two questions (13 and 14) assessed sleep length and levels of stress and anxiety. The last three questions (15 to 17) evaluated psychological health changes, i.e., irritability and physical and emotional exhaustion. All items were graded on a 5-point Likert scale: (a) Significantly increased (b) Slightly increased (c) Grossly similar (d) Slightly decreased (e) Significantly decreased.

The total score was calculated by adding responses to all items, depending on change outcomes; grades could be negative (tending for the worse) or positive (tending for better).

Items (1, 2, 6, 7, 8, 9, 14, 15, 16, and 17) considered as negative behavior were scored 2 (Significantly decreased), 1 (Slightly decreased), 0 (Grossly similar), -1 (Slightly increased), -2 (Significantly increased). Items (4, 5, 10, 11, and 12) considered as positive behaviors were scored 2 (Significantly increased), 1 (Slightly increased), 0 (Grossly similar), -1 (Slightly decreased), -2 (Significantly decreased). Items 3 and 13, considered as negative behavior changes whether increased or decreased, were scored 0 (Grossly similar), -1 (Slightly increased/decreased), -2 (Significantly increased/decreased).

Item 3 that assessed changes in meal and snack portions during COVID-19 is rated, assuming that the person had regular portions of meals and snacks before the pandemic. Also, item 13 that evaluated changes in hours of sleep during COVID-19 is rated, assuming that the individual was getting an adequate 6–8 hours' sleep before the pandemic.

Thus, higher LHBC-17 scores indicate a change to the better in lifestyle and health-related behaviors (LHB), while lower LHBC-17 scores indicate worsening of LHB among participants ($\alpha_{\text{Cronbach}} = 0.71$).

WHO-5 Well-Being Index

The WHO-5 Well-Being Index developed by the World Health Organization (WHO) is a 5-item tool that measures mental well-being during the past two weeks [32, 33]. In this study, the Arabic validated version (WHO-5-A) was used [34]. The raw score calculated by summing the five answers ranges from 0 to 25, with higher scores indicating increased well-being ($\alpha_{\text{Cronbach}} = 0.95$). The WHO-5-A is a helpful screening tool to detect depressive episodes among Lebanese adults at a cut-off point of less than 13. Therefore, a score below 13 reflects poor well-being and is an indication for testing for possible depression [34].

Fear of COVID-19 scale (FCV-19S)

The FCV-19S is a 7-item scale developed to assess the fear of COVID-19 among the general population [35]. In this study, the Arabic validated version of the FCV-19S was used [36]. Items are graded on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total score is calculated by adding up each item score, where higher scores indicate a greater fear of COVID-19 ($\alpha_{\text{Cronbach}} = 0.91$) [35].

Questions related to other behaviors changes

Questions related to risky behaviors, such as smoking, alcohol consumption, and sexual behaviors, were included to assess the changes that occurred during COVID-19 among the study population. The questions were: “Did your smoking behavior change during the COVID-19 pandemic?”; “Did your alcohol drinking behavior change during the COVID-19 pandemic?”; “During the COVID-19 pandemic, have your sexual and intimate behaviors (dating, kissing, cuddling, spending private time with your partner, having sexual intercourse with your partner...) changed?”; and “During the COVID-19 pandemic, have your sexual desire changed?”. These questions were assessed as follows: (a) Significantly increased (b) Slightly increased (c) Grossly similar (d) Slightly decreased (e) Significantly decreased. The option “I prefer not to answer” was added for sexuality-related questions. For smoking and alcohol consumption, two additional answers per behavior were possible, i.e., “I have recently started smoking/drinking alcohol”, and “I don’t smoke/drink alcohol”.

Moreover, four questions evaluated hygiene behavior changes during the COVID-19 pandemic, including handwashing, surfaces and materials disinfection, respiratory etiquette (the use of face mask and cough etiquette), social distancing, and avoiding crowded places. Two questions assessed changes in nutritional supplements and immunity-boosting foods intake (lemon, turmeric, garlic, citrus fruits, and green leafy vegetables) during the COVID-19 pandemic. All these questions were also graded on a 5-point Likert scale as follows: (a) Significantly increased (b) Slightly increased (c) Grossly similar (d) Slightly decreased (e) Significantly decreased.

Translation procedure

The LHBC-17 scale was translated from English into Arabic using the forward and backward translation method. One of the authors performed the translation from English into Arabic, and another author did the back-translation. Discrepancies were resolved by consensus between the original English version and the translated one.

Statistical analysis

Data analysis was done using the SPSS software version 21. A “weighting” variable was created to adjust for the composition of our sample (especially the over or under-representation of gender and Governorate distribution), aiming at reflecting that of the Lebanese adult population.

Cronbach’s alpha was calculated for the reliability analysis of all scales. Scales with a coefficient value of 0.7 or higher are considered internally consistent [37].

Descriptive statistics were performed to represent the participants’ characteristics and LHB changes during the COVID-19 pandemic and were expressed as frequencies and percentages for categorical variables and as means and standard deviations (SD) for continuous variables.

The associations between the LHB changes and the participants' characteristics and associated health factors were compared with the Pearson correlation for continuous variables and the Student t-test or ANOVA F test for categorical variables with two or more levels, respectively. The Bonferroni test was used for multiple comparisons to control the overall significance level for some set of inferences performed as a follow-up to ANOVA.

A multivariate analysis was conducted using a three-level nested model analysis taking the LHBC-17 scale as the dependent variable. The first level included sociodemographic- and work-related variables. In the second level, the LHBs were added to the significant variables found in the first level. The third level consisted of all the COVID-19-related variables added to the variables found significant in the first and second levels. In each level, the stepwise method was used simultaneously to remove the weakest correlated variables and come up with a model that best explains the distribution. All variables that showed a p-value < 0.2 in the bivariate analysis were included as covariates in the related levels. Standardized beta and their 95% CIs were used to quantify the associations between variables and LHB changes. A p-value less than 0.05 was considered significant.

Results

Descriptive analysis

Our sample consisted of 403 participants; the mean age was 29.74 ± 10.81 years, with 51.2% females and 48.8% males. Most participants were single (64.8%), had a university degree (85.2%), and lived in an urban area (68.6%). The mean household crowding index was 1.11 ± 0.88 . Of the total sample, 34.2% had low to no income, 25.5% had intermediate income, and 40.3% had a high income. Moreover, 44.4% reported a decrease in salary during the COVID-19 pandemic, and 34.6% declared being very or extremely worried about their current financial situation. About half of the participants had full-time jobs (48.8%) and were mainly working/studying from home (53.2%) during the lockdown period; 37.2% were health care professionals, and 44.5% had direct/potential contact with confirmed/suspected COVID-19 patients. More than half of the participants (51.6%) had a normal weight range ($BMI = 24.17 \pm 4.41 \text{ kg/m}^2$), and only 11.3% were obese ($BMI \geq 30 \text{ kg/m}^2$). Also, 32.4% reported weight gain during the COVID-19 pandemic, 31.7% lost weight, and 28.1% maintained weight. Most participants stated they had a significant (52%) and slight (23.7%) increase in sitting and screen time (TV and electronic devices). When queried about their overall health state, the majority reported a good health state (49.5%), and only 2.7% reported a poor state of health.

Regarding hygiene, most participants reported significantly or slightly increased changes in their behaviors during the COVID-19 pandemic in terms of handwashing (86%), surfaces and materials disinfection (87.2%), respiratory etiquette (90.9%), and social distancing (88.2%).

Only 26.2% of the participants were previously diagnosed with COVID-19 while 55.5% reported a history of COVID-19 in the family. Moreover, 9.2% were diagnosed/screened for depression/anxiety due to COVID-19 by a specialist/doctor and only 13.4% had chronic diseases.

In this study, 24.3% of the surveyed individuals smoked cigarettes, 20.4% smoked nargileh, 1.4% started smoking during the pandemic, and 61.8% of those who already smoked slightly and significantly increased smoking. Moreover, 43.2% of participants drank alcohol, 1.1% of the participants started drinking during the pandemic, and 37.6% of those who already drank slightly and significantly increased alcohol drinking behavior.

Finally, 29.6% of the surveyed individuals reported they had slightly and significantly decreased their sexual behaviors during the COVID-19 pandemic, such as dating, kissing, cuddling, spending intimate time, or having sexual intercourse with their partner and 15.5% had slightly and significantly decreased sexual desire.

Description of the scales used in the study

Table 1 describes all the scales used in this study in terms of mean, standard deviation (SD), median, minimum, maximum, and Cronbach Alpha values.

The LHBC-17 had a Cronbach Alpha of 0.71, suggesting an acceptable internal consistency. The overall mean for the LHBC-17 scale is -6.27 ± 7.61 , indicating a trend towards increased unhealthy lifestyles and health-related behaviors, particularly diet (-2.28 ± 5.87), sleep (-2.01 ± 1.34), and psychological (-2.80 ± 2.15) scores. However, the physical activity score showed a slight increase in healthy physical activities (0.82 ± 2.83) among participants during the COVID-19 pandemic.

Furthermore, 63.9% of the study participants had a WHO-5-A score below 13, therefore considered to have poor mental well-being.

Based on the FCV-19S results, 55.9% of the participants had a high fear from COVID-19 (scores between 21 and 35), while 44.7% had low fear (scores between 1 and 20).

Table 1
Description of the scales used

	Mean	SD	Median	Minimum	Maximum	Cronbach's Alpha
FCV-19S	20.46	7.12	21.00	7.00	35.00	0.91
WHO-5-A	11.13	6.88	10.00	0.00	25.00	0.95
LHBC-17 scale	-6.27	7.61	-6.00	-28.00	25.00	0.71
LHBC diet score (9 items)	-2.28	5.87	-2.00	-15.00	14.00	
LHBC physical activity score (3 items)	0.82	2.83	1.00	-6.00	6.00	
LHBC sleep score (2 items)	-2.01	1.34	-2.00	-4.00	2.00	
LHBC psychological score (3 items)	-2.80	2.15	-3.00	-6.00	6.00	
Abbreviations: SD : Standard deviation; FCV-19S : Fear of COVID-19 scale; WHO-5-A : WHO-5 Well-Being Index Arabic version; LHBC : Lifestyle and health behaviors changes.						

Bivariate analysis

The results of the bivariate analyses taking the LHBC-17 scale during the COVID-19 pandemic as the dependent variable are summarized in Tables 3 and 4.

Female participants had significantly healthier behaviors than males ($p = 0.004$).

Lower LHBC-17 scores were significantly associated with the following sociodemographic features: being a Lebanese permanent resident ($p < 0.001$), living in Beirut, Beqaa, and North ($p < 0.001$), living in a rural region ($p < 0.001$), school level of education (vs. university level) ($p < 0.001$), being Muslim or Christian (vs. atheist) ($p < 0.001$), no/low family income ($p = 0.003$), being very worried not to meet the monthly living expenses ($p < 0.001$), being unemployed ($p < 0.001$), working in the military sector (vs. private sector) ($p = 0.007$), smoking cigarettes ($p = 0.007$), and poor overall health ($p < 0.001$).

Furthermore, lower LHBC-17 scores were also significantly associated with the following changes due to the COVID-19 pandemic: a higher number of hours spent using electronic devices during the lockdown ($p = 0.002$), a higher BMI ($p = 0.027$), increased weight ($p < 0.001$), increased smoking ($p < 0.001$), increased alcohol consumption ($p < 0.001$), having a family member infected with coronavirus ($p < 0.001$), and greater fear of COVID-19 ($p = 0.014$).

However, higher well-being (WHO-5-A) scores were associated with higher LHBC-17 scores ($p < 0.001$).

The mean hours per day spent using electronic devices significantly increased (from 5.33 ± 4.13 before the lockdown to 7.88 ± 4.48 during the lockdown) ($p < 0.001$). Also, participants who reported negative

changes in physical health during the confinement were those who significantly increased the intake of nutrition supplements (72.3%) and immunity-boosting foods (77.9%) ($p < 0.001$).

Details of the associations between sociodemographic and COVID-19-related variables and the LHBC-17 scale are shown in Tables 2 and 3.

Table 2
Associations between sociodemographic variables and the LHBC-17 scale

	n (%)	LHBC-17 scale Mean (SD)	p- value*
Gender			0.004
Male	197 (48.8%)	-5.14 (7.96)	
Female	207 (51.2%)	-7.33 (7.11)	
Residency			< 0.001
Resident	381 (94.5%)	-6.66 (7.51)	
Visitor	22 (5.5%)	0.42 (6.29)	
Governorate			< 0.001
Beqaa/Baalbeck/Hermel	48 (11.9%)	-8.14 (5.55)	
Beirut	42 (10.4%)	-9.06 (7.37)	
Mount Lebanon	160 (39.7%)	-5.65 (8.17)	
South/Nabatieh	76 (18.9%)	-3.08 (6.07)	
North	77 (19.1%)	-8.00 (7.84)	
Living place			< 0.001
Rural	127 (31.4%)	-7.18 (7.97)	
Urban	277 (68.6%)	-4.25 (6.99)	
Educational level			< 0.001
School level	60 (14.8%)	-8.73 (5.13)	
University level	344 (85.2%)	-5.83 (7.89)	
Marital status			0.091

	n (%)	LHBC-17 scale	p- value*
		Mean (SD)	
Married	135 (33.4%)	-6.74 (7.51)	
Single	261 (64.8%)	-5.88 (7.66)	
Divorced	4 (1.1%)	-14.68 (3.00)	
Widowed	3 (0.7%)	-6.58 (6.09)	
Religion			< 0.001
Atheist	25 (6.1%)	0.98 (8.64)	
Christian	225 (55.8%)	-6.76 (7.99)	
Druze	9 (2.2%)	-7.00 (7.10)	
Muslim	120 (29.7%)	-7.09 (6.17)	
I prefer not to answer	25 (6.3%)	-4.79 (5.86)	
Family monthly income			0.003
No income	51 (12.7%)	-8.45 (5.41)	
Low income	87 (21.5%)	-5.08 (8.03)	
Intermediate income	103 (25.5%)	-7.81 (7.06)	
High income	163 (40.3%)	-5.20 (8.03)	
Occupation			< 0.001
I currently work	217 (53.8%)	-5.42 (7.88)	
Currently unemployed/I lost my job because of COVID-19	20 (4.9%)	-7.56 (6.85)	
I don't work	65 (16.0%)	-4.65 (7.27)	
Retired/housewife/student		-8.85 (6.77)	
Health care professional			0.221

	n (%)	LHBC-17 scale	p- value*
		Mean (SD)	
Yes	150 (37.2%)	-5.91 (8.49)	
No	224 (55.4%)	-6.20 (6.93)	
Not applicable	30 (7.4%)	-8.55 (7.66)	
Work sector			0.007
Military sector	30 (7.4%)	-10.57 (3.21)	
Private sector	202 (50.1%)	-5.51 (7.83)	
Public sector	38 (9.4%)	-7.15 (7.72)	
Not applicable	134 (33.2%)	-6.20 (7.66)	
Work status			0.764
Full-time	197 (48.8%)	-6.25 (7.86)	
Part-time	69 (17.1%)	-6.83 (6.93)	
Not applicable	138 (34.2%)	-6.00 (7.62)	
Worried about your current financial situation			0.047
Not at all worried	38 (9.5%)	-6.47 (10.38)	
A little worried	107 (26.5%)	-6.04 (6.66)	
Moderately worried	119 (29.4%)	-5.35 (6.26)	
Very worried	81 (20.2%)	-8.47 (8.37)	
Extremely worried	58 (14.4%)	-5.32 (8.16)	
Worried about not being able to meet ordinary monthly living expenses			< 0.001
Not at all worried	50 (12.3%)	-4.97 (7.98)	

	n (%)	LHBC-17 scale	p- value*
		Mean (SD)	
A little worried	135 (33.4%)	-6.33 (6.48)	
Moderately worried	112 (27.8%)	-6.45 (7.19)	
Very worried	68 (16.9%)	-9.29 (7.84)	
Extremely worried	39 (9.6%)	-1.81 (9.26)	
Health coverage			0.111
Yes	314 (77.7%)	-7.26 (6.24)	
No	90 (22.3%)	-5.98 (7.95)	
Cigarette smoking			0.007
Yes	98 (24.3%)	-6.84 (7.62)	
No	305 (75.7%)	-4.46 (7.34)	
Nargileh smoking			< 0.001
Yes	82 (20.4%)	-8.69 (5.65)	
No	321 (75.7%)	-5.64 (7.92)	
Alcohol			0.158
Yes	174 (43.2%)	-6.75 (6.79)	
No	229 (56.8%)	-5.63 (8.55)	
Chronic diseases			0.361
Yes	54 (13.4%)	-4.99 (11.44)	
No	249 (86.6%)	-6.46 (6.83)	
Overall health			< 0.001

	n (%)	LHBC-17 scale	p-value*
		Mean (SD)	
Not good	11 (2.7%)	-16.21 (4.19)	
Fair	106 (26.2%)	-9.14 (7.17)	
Good	200 (49.5%)	-5.97 (7.14)	
Very good	87 (21.6%)	-2.18 (6.99)	
	mean ± SD	r	p-value*
Age (in years)	29.74 ± 10.81	0.06	0.227
BMI (in Kg/m ²)	24.17 ± 4.41	-0.11	0.027
Household crowding index	1.11 ± 0.88	-0.13	0.009
WHO-5-A	11.13 ± 6.88	0.16	0.001
Abbreviations: LHBC : Lifestyle and health behaviors changes; n : number; % : percentage; SD : Standard deviation; r : correlation coefficient; BMI : Body Mass Index; WHO-5-A : WHO-5 Well-Being Index Arabic version; Kg : Kilogram; m : meter.			
* Bold numbers represent significant results (p < 0.05).			

Table 3
Associations between COVID-19 related variables and the LHBC-17 scale

	n (%)	LHBC-17 scale Mean (SD)	p-value*
Have any direct/potential contact with confirmed/suspected COVID-19 patients in your work			0.082
Yes	179 (44.5%)	-7.08 (7.53)	
No	133 (33.1%)	-6.08 (6.66)	
Not applicable	91 (22.4%)	-4.91 (8.87)	
During lockdown periods due to COVID-19, did you continue to go to work as usual?			0.952
Yes	121 (30.0%)	-6.22 (7.68)	
No	168 (41.6%)	-6.17 (7.16)	
Not applicable	114 (28.3%)	-6.45 (8.23)	
Outside lockdown periods due to COVID-19, did you continue to go to work as usual?			0.678
Yes	188 (46.7%)	-6.04 (7.83)	
No	89 (22.0%)	-6.89 (6.79)	
Not applicable	126 (31.3%)	-6.16 (7.85)	
During the COVID-19 pandemic, did you start working/studying from home?			0.039
Yes	215 (53.2%)	-6.33 (7.51)	
No	125 (31.0%)	-7.19 (7.59)	
Not applicable	64 (15.7%)	-4.21 (7.74)	

	n (%)	LHBC-17 scale	p-value*
		Mean (SD)	
Salary/income decreased because of the COVID-19 pandemic			0.628
Yes	179 (44.4%)	-6.67 (7.24)	
No	123 (30.4%)	-5.87 (8.69)	
Not applicable	102 (25.2%)	-6.03 (6.86)	
Weight change during COVID-19			< 0.001
My weight is stable	113 (28.1%)	-3.41 (6.48)	
I lost some weight	128 (31.7%)	-5.11 (7.43)	
I gained some weight	131 (32.4%)	-10.34 (7.54)	
I don't know	32 (7.8%)	-4.33 (5.28)	
Did your smoking behavior change during the COVID-19 pandemic?			< 0.001
Significantly increased	41 (10.1%)	-3.34 (8.44)	
Slightly increased	66 (16.3%)	-9.95 (5.92)	
Grossly similar/unchanged	35 (8.7%)	-5.62 (5.32)	
Slightly decreased	9 (2.2%)	-3.09 (5.55)	
Significantly decreased	17 (4.3%)	-5.01 (8.30)	
I have recently started smoking	6 (1.4%)	-4.00 (5.13)	
I don't smoke	230 (57.0%)	-6.12 (7.92)	

	n (%)	LHBC-17 scale Mean (SD)	p-value*
Did your alcohol drinking behavior change during the COVID-19 pandemic?			< 0.001
Significantly increased	10 (2.5%)	-14.73 (7.70)	
Slightly increased	66 (16.4%)	-7.16 (8.01)	
Grossly similar/unchanged	83 (20.6%)	-6.49 (6.73)	
Slightly decreased	13 (3.1%)	-3.70 (7.24)	
Significantly decreased	27 (6.6%)	-1.91 (10.44)	
I have recently started drinking alcohol	4 (1.1%)	-2.49 (13.29)	
I don't drink alcohol	201 (49.7%)	-6.27 (6.89)	
During the COVID-19 pandemic, have your sexual and intimate behaviors (dating, kissing, cuddling, spending private time with your partner, having sexual intercourse with your partner...) changed?			0.023
Significantly increased	18 (4.4%)	-7.83 (7.78)	
Slightly increased	15 (3.7%)	-6.29 (7.72)	
Grossly similar/unchanged	74 (18.4%)	-4.18 (7.33)	
Slightly decreased	51 (12.5%)	-7.35 (8.64)	
Significantly decreased	69 (17.1%)	-4.67 (7.55)	
Does not apply	133 (33.1%)	-7.60 (6.62)	
I prefer not to answer	43 (10.8%)	-6.36 (8.86)	
During the COVID-19 pandemic, have your sexual desire changed?			< 0.001

	n (%)	LHBC-17 scale	p-value*
		Mean (SD)	
Significantly increased	30 (7.4%)	-8.51 (12.49)	
Slightly increased	23 (5.6%)	-9.43 (8.01)	
Grossly similar/unchanged	112 (27.7%)	-3.44 (5.61)	
Slightly decreased	35 (8.7%)	-7.48 (8.97)	
Significantly decreased	28 (6.8%)	-5.82 (8.84)	
Does not apply	93 (23.0%)	-6.39 (7.05)	
I prefer not to answer	71 (17.6%)	-8.42 (5.31)	
Diagnosed with COVID-19 by PCR testing			0.862
Yes	106 (26.2%)	-6.09 (6.76)	
No	220 (54.6%)	-6.21 (8.51)	
Not tested ever for COVID-19	78 (19.2%)	-6.68 (5.88)	
Lockdown affect physical health			< 0.001
No	182 (45.1%)	-5.02 (5.79)	
Yes negatively	134 (33.1%)	-10.02 (7.47)	
Yes positively	88 (21.8%)	-3.15 (8.86)	
Lockdown affect mental health			< 0.001
No	150 (37.1%)	-3.41 (6.21)	

	n (%)	LHBC-17 scale	p-value*
		Mean (SD)	
Yes negatively	198 (49.1%)	-8.26 (7.48)	
Yes positively	56 (13.9%)	-6.84 (9.11)	
Diagnosed with depression/anxiety due to COVID-19 by a specialist/doctor			0.351
Yes	37 (9.2%)	-7.86 (11.14)	
No	366 (90.8%)	-6.10 (7.16)	
Isolated/Quarantined for COVID-19			0.363
Yes	153 (37.9%)	-6.71 (7.64)	
No	250 (62.1%)	-5.99 (7.60)	
Lost someone due to COVID-19			0.119
Yes	84 (20.8%)	-7.42 (8.89)	
No	320 (79.2%)	-5.96 (7.23)	
History of COVID-19 in the family			< 0.001
Yes	224 (55.5%)	-7.27 (7.46)	
No	154 (38.1%)	-6.04 (7.29)	
I do not know	26 (6.4%)	1.09 (6.87)	
	mean ± SD	r	p-value*
Daily number of hours you spend working/studying if you started working/studying from home during the COVID-19 lockdown	4.07 ± 3.96	-0.03	0.590

	n (%)	LHBC-17 scale	p-value*
		Mean (SD)	
Hours spent using electronic devices (computers, cell phones, tablets...) before the COVID-19 lockdown	5.33 ± 4.13	-0.12	0.012
Hours spent using electronic devices (computers, cell phones, tablets...) during the COVID-19 lockdown	7.88 ± 4.48	-0.15	0.002
Daily number of working hours before the COVID-19 lockdown	5.64 ± 3.96	0.06	0.215
Daily number of working hours during the COVID-19 lockdown	4.31 ± 4.53	0.01	0.873
FCV-19S	20.46 ± 7.12	-0.123	0.014
Abbreviations: LHBC : Lifestyle and health behaviors changes; n : number; % : percentage; SD : Standard deviation; PCR : Polymerase Chain Reaction; r : correlation coefficient; FCV-19S : Fear of COVID-19 scale.			
* Bold numbers represent significant results ($p < 0.05$).			

Multivariable analysis

The nested model analysis taking the LHBC-17 scale as the dependent variable has shown several significant associations in each of the three models (Table 4).

The first model included the socio-demographic variables and showed that living in an urban region (Beta = 3.653) and currently working (Beta = 2.060) were significantly associated with higher LHBC-17 scores. Whereas being a female (Beta=-2.336), living in Beirut, Beqaa, and North Lebanon (Beta=-0.853), being a Lebanese permanent resident (Beta=-7.676), and currently worrying about the financial situation (Beta=-0.775) were significantly associated with lower LHBC-17 scores among our participants.

The second model, including the socio-demographic and general health-related behaviors variables, showed that living in an urban region (Beta = 3.025), currently working (Beta = 1.920), having good overall health (Beta = 3.510), and having a higher quality of life (Beta = 0.288) were significantly associated with higher LHBC-17 scores. Whereas being a female (Beta=-2.019), living in Beirut, Beqaa, and North Lebanon (Beta=-0.919), being a Lebanese permanent resident (Beta=-7.094), smoking nargileh (Beta=-3.137), and having a higher BMI (Beta=-0.263) were significantly associated with lower LHBC-17 scores.

The third model, consisting of the socio-demographic, the general health-related behaviors, and COVID-19-related variables, showed that living in an urban region (Beta = 2.464), having good overall health (Beta = 3.543), a higher quality of life (Beta = 0.204), and having physical (Beta = 2.101) and mental (Beta = 1.586) health affected by the COVID-19 lockdown were significantly associated with higher LHBC-17

scores. Whereas living in Beirut, Beqaa, and North Lebanon (Beta=-1.213), being a Lebanese permanent resident (Beta=-7.502), smoking nargileh (Beta=-3.433), gaining weight (Beta=-0.853), and spending more hours per day using electronic devices (Beta=-0.164) during the COVID-19 lockdown were significantly associated with lower LHBC-17 scores.

Table 4
Nested model analysis taking the LHBC-17 scale as the dependent variable

First level: Socio-demographic variables				
Factor	Standardized beta	Unstandardized beta	95% [CI]	p-value
Governorate (Beirut/Beqaa/North vs. South)	-0.853	-0.146	[-1.435 ; -0.271]	0.004
Residency (resident vs. visitor)	-7.676	-0.231	[-10.976 ; -4.376]	< 0.001
Living place (urban vs. Rural)	3.653	0.223	[2.051 ; 5.255]	< 0.001
Occupation (work vs. don't work)	2.060	0.135	[0.627 ; 3.492]	0.005
Worried about financial situation (no vs. yes)	-0.775	-0.122	[-1.390 ; -0.159]	0.014
Gender (Female vs. male)	-2.336	-0.154	[-3.772 ; -0.900]	0.001
Variables entered in the first level: Gender, Age, Residency, Governorate, Living place (Urban/Rural), Education (school/university), Religion, Occupation, Work sector, Family monthly income, Worried about financial situation, Worried about not being able to meet the ordinary living expenses, Health coverage.				
Second level: Socio-demographic and general health and behaviors related variables				
Factor	Standardized beta	Unstandardized beta	95% [CI]	p-value
Governorate (Beirut/Beqaa/North vs. South)	-0.919	-0.157	[-1.478 ; -0.361]	0.001
Residency (resident vs. visitor)	-7.094	-0.213	[-10.178 ; -4.011]	< 0.001
Living place (urban vs. Rural)	3.025	0.185	[1.538 ; 4.512]	< 0.001
Occupation (work vs. don't work)	1.920	0.126	[0.540 ; 3.300]	0.007
Gender (Female vs. male)	-2.019	-0.133	[-3.429 ; -0.610]	0.005
Overall health (good vs. not good)	3.510	0.209	[2.004 ; 5.016]	< 0.001
WHO-5 well-being index	0.288	0.260	[0.183 ; 0.399]	< 0.001

First level: Socio-demographic variables				
Nargileh smoking (yes vs. no)	-3.137	-0.166	[-4.862 ; -1.413]	< 0.001
BMI (in kg/m²)	-0.263	-0.153	[-0.426 ; -0.100]	0.002
Variables entered in the second level: Gender, Residency, Governorate, Living place (Urban/Rural), Occupation, Worried about financial situation, Cigarette smoking, Nargileh smoking, Alcohol consumption, Overall health (Good/Not Good), BMI, WHO-5 well-being index				
Third level: Socio-demographic, general health and behaviors and COVID-19 related variables				
Factor	Standardized beta	Unstandardized beta	95% [CI]	p-value
Governorate (Beirut/Beqaa/North vs. South)	-1.213	-0.207	[-1.744 ; -0.682]	< 0.001
Residency (resident vs. visitor)	-7.502	-0.226	[-10.532 ; -4.472]	< 0.001
Living place (urban vs. rural)	2.464	0.150	[1.064 ; 3.864]	0.001
Overall health (good vs. not good)	3.543	0.211	[2.084 ; 5.003]	< 0.001
WHO-5-A	0.204	0.184	[0.091 ; 0.317]	< 0.001
Nargileh smoking (yes vs. no)	-3.433	-0.182	[-5.078 ; -1.788]	< 0.001
Weight change during COVID-19 lockdown (gained weight vs. stable weight)	-0.853	-0.105	[-1.576 ; -0.129]	0.021
COVID-19 lockdown affecting physical health (no vs. yes)	2.101	0.202	[1.069 ; 3.132]	< 0.001
COVID-19 lockdown affecting mental health (no vs. yes)	1.586	0.148	[0.403 ; 2.769]	0.009
Hours per day spent using electronic devices during COVID-19 lockdown	-0.853	-0.105	[-1.576 ; -0.129]	0.021
Variables entered in the third level: Gender, Residency, Governorate, Living place (Urban/Rural), Occupation, Nargileh smoking, Overall health (Good/Not Good), BMI, WHO-5 well-being index, Weight change during COVID-19 pandemic, Smoking behavior changes during COVID-19 pandemic, Alcohol dinking behavior changes during COVID-19 pandemic, COVID-19 lockdown affecting physical health, COVID-19 lockdown affecting mental health, Family history of COVID-19, Sexual desire changing during COVID-19 pandemic, Fear of COVID-19 scale, WHO-5 well-being index, Hours per day spent using electronic devices during COVID-19 lockdown.				
Abbreviations: LHBC : Lifestyle and health behaviors changes; WHO-5-A : WHO-5 Well-Being Index Arabic version; CI : confidence interval; vs. : versus; BMI : Body Mass Index; Kg : Kilogram; m : meter.				

Discussion

The COVID-19 pandemic had significant public health implications with severe economic and social consequences globally. Thus, this study aimed at evaluating the changes in various lifestyle habits during the COVID-19 pandemic among a sample of Lebanese adults.

Our results have shown that the COVID-19 pandemic, particularly the lockdown period, has profoundly affected LHBs, highlighting unfavorable lifestyle changes in dietary habits, physical activity (length and type), sleep (duration and quality), and psychological health (irritability, stress, and anxiety).

Several sociodemographic factors were associated with changes in lifestyle and behaviors, including gender. Expectedly, women exhibited significantly lower LHBC-17 scores than men; women and men might not equally experience the negative repercussions of long lockdown periods, fear of infection, frustration, boredom, financial loss, and stigma related to the COVID-19 pandemic. Previous work has demonstrated that Lebanese women had higher stress, anxiety, and post-traumatic stress symptoms than men [38]. As families were confined at home, the domestic chores workload on women has considerably increased, which could have consumed them physically. They had to assume their children homeschooling and secure a “state of tranquility” for learning children or partners, working remotely from home, at least during the total lockdown [39] [40–42]. Thus, lack of energy and time would reduce their ability to improve their habits and behaviors.

Other sociodemographic factors such as being a Lebanese permanent resident and worrying about the economic situation were associated with unfavorable lifestyle changes, whereas having a job and living in an urban region were significantly associated with positive changes. Such results can be explained by the economic hardship that adds to the sanitary crisis in Lebanon. Indeed, Lebanon is witnessing an unprecedented economic crisis and was recently downgraded from a high-income to upper-middle-income country by the World Bank [43]. This critical financial situation was amplified with the inability to control the exchange rates of USD versus Lebanese Pounds that dramatically skyrocketed in less than a year and has led to massive demonstrations, strikes, and temporary bank closures [44] [45]. Hence, Lebanese residents, particularly the unemployed or those worrying about their financial situation, cannot introduce good practices and afford healthy products; they would exhibit a limited and weakened motivation to change habits positively and enhance a healthy lifestyle.

As for the general health-related factors, an increased BMI and gaining weight during COVID-19 were significantly associated with lower LHBC-17 scores. Almost one-third of our sample reported weight gain, in agreement with previous findings showing that 31% of 1012 subjects reported weight gain since lockdown due to COVID-19 began in the United Arab Emirates [30]. Several other studies, including Lebanese ones, had demonstrated weight gain during the COVID-19 home confinement [2, 25, 46–48], likely due to boredom, anxiety, and stress reactions to COVID-19 leading to changes in eating habits, such as increased consumption of highly energetic foods (rich in sugar and fat) [49].

Our results revealed increased smoking among participants. Studies on changes in tobacco use during the pandemic have yielded controversial results [22, 50, 51]; some studies have reported increased tobacco use [52], while others have recorded decreased smoking [50]. Smokers usually intensify their consumption as a coping mechanism during the pandemic, given its detrimental consequences on mental health [53].

When exploring COVID-19-related factors, our results revealed that most participants reported a longer screen time, in line with previous findings [54–57], showing a 65–70% increase in screen time during the COVID-19 pandemic [54, 56]. This increase is explained by the imposed lockdown, where most people had to work or study from home and thus were more likely to spend long screen periods reading, homeschooling, playing, meeting, or watching movies [57]. In our study, participants who reported spending more time per day using electronic devices during the COVID-19 lockdown had significantly lower LHBC-17 scores. A report published by the WHO pointed out that young people, as in our study, might be particularly vulnerable to the harms of excessive screen time, including misinformation about COVID-19, cyberbullying, gaming disorder, and unhealthy sedentary lifestyles [58]. Previous studies have also reported these changes in dietary habits and lifestyle behaviors during the pandemic [9, 30, 48, 59, 60].

Surprisingly, in addition to the longer screen time reported during the COVID-19 pandemic, our results also revealed a slight increase in leisure time healthy physical activities. Moreover, participants who already had better well-being and overall health and those who did not report changes in their physical and mental health during COVID-19 had higher LHBC-17 scores, thus positive lifestyle changes. Similarly, increased physical activity was also described in a study among 1807 participants from the Middle East and North Africa (MENA) region, showing higher physical activity, better health status, and higher mental well-being scores [61]. However, a recent meta-analysis of 66 studies found opposite results, reflected by decreased physical activity and increased sedentary behaviors during the COVID-19 pandemic [62]. One explanation could be that during the period of data collection, the Lebanese government had not imposed strict mobility restrictions, and most of the young participants were able to dodge the vigilance of authorities to go out and continue their daily outdoor sports activities.

Our results revealed that participants who reported having physical and mental health affected by the lockdown had lower LHBC-17 scores, consistent with the findings of a study among Lebanese adults showing that the fear of COVID-19 coupled with economic hardship was associated with higher stress and anxiety [26]. This psychological distress could considerably affect health behaviors, as previously described [63, 64]. Most studies have demonstrated that higher depression, anxiety, and stress were significantly associated with negative changes in physical activity, sleep, smoking, and alcohol consumption [63]. Health-promotion strategies should be implemented to assess negative changes in physical or mental health and maintain as much as possible positive health-related behaviors, particularly in young populations [58].

Limitations and strength

Our study has several limitations related to its cross-sectional design and data collection process. Even though our sample was weighted to adjust for the over or under-representation of gender and Governorate distribution, our population consisted mainly of young people with a university level of education, thus expected to have high computer literacy and internet access. Therefore, our results might not be generalized to the whole population. Moreover, a possible information bias could be likely since the questionnaire was self-administered, with no possibility for clarifying confusing questions.

However, despite these limitations, to the best of our knowledge, this study is the first to evaluate the effect of sociodemographic features, general health-related behaviors, and COVID-19-related factors on lifestyle changes among the general Lebanese population, almost a year after the COVID-19 outbreak. Furthermore, the use of a standardized questionnaire with validated scales with very good to excellent reliability is likely to reduce possible information bias.

Conclusions

Lebanese adults reported several unfavorable lifestyle changes and psychological problems during the lockdown due to COVID-19. Health-promotion strategies are needed to assess negative changes both on physical or mental health and maintain as much as possible positive health-related behaviors among the Lebanese population.

List Of Abbreviations

COVID-19

Novel coronavirus 2019; LHB:Lifestyle and health behaviors; TV:Television; MENA:Middle East and North Africa; LBP:Lebanese pound; WHO-5:WHO-5 Well-being index; WHO-5-A:WHO-5 Well-Being Index Arabic version; FCV-19S:Fear of COVID-19 scale; LHBC:Lifestyle and health behaviors changes; SD:Standard deviation; ANOVA:Analysis of Variance; r:Correlation coefficient; BMI:Body Mass Index; Kg:Kilogram; m:Meter; CI:Confidence interval; SPSS:Statistical Package for Social Sciences; PCR:Polymerase Chain Reaction.

Declarations

Ethics approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and the study protocol was approved by the Lebanese International University (LIU) ethics committee (2020RC-034-LIUSOP). Electronic informed consent was obtained from all participants on the first page of the questionnaire.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analyzed during the current study are available in the INSPECT-LB repository, <https://inspect-lb.org/lifestyle-changes-and-health-related-behaviors-among-lebanese-adults-during-the-covid-19-pandemic>.

Competing interests

The authors declare they have no competing interests.

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Author's contributions

DS conceived and organized the study. PS participated in the design and coordination. DS prepared the study protocol for Institutional Review Board (IRB) approval, and DM followed and got the IRB approval for the study protocol. DS elaborated the first draft of the questionnaire. All authors helped in finalizing and testing the questionnaire. HS and DS performed the forward and back-translation. HS was responsible for the scientific editing of the study questionnaire and manuscript. DS, AH, DM, and CH drafted the manuscript. All authors shared the online questionnaire on social media. DS performed the statistical analysis. AH, DM, and CH helped in writing the paper. HS was responsible for all informatics tasks during this study, including data repository and management. PS helped with the statistical analysis, drafting, and critical review of the paper. All authors have read and approved the final manuscript and share responsibility for its final content.

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