

Factors associated with children's dietary patterns during COVID-19 pandemic lockdown: a multinational study across Middle Eastern Arab Nations

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ABSTRACT

This study investigated the impact of the COVID-19 pandemic on Middle Eastern Arab children's eating habits, body weight, lifestyle, physical activity, sleeping hours, use of smart electronic devices, and mental health. The exploratory study utilized a self-administered questionnaire distributed to parents of children aged 4–12 years. Multinomial logistic regression was used to model the relationship between the predictors and children's body weight changes during the pandemic. A total of 891 responses were collected from Bahrain, Jordan, Lebanon, Saudi Arabia, United Arab Emirates, Iraq, and Oman. The average weight gain among children during the pandemic was 4.19 ± 3.08 Kg. Sedentary lifestyle significantly increased from 4% (pre-pandemic) to 17.9% (during the pandemic, unadjusted odds ratio [UOR] = 5.2, $P < 0.001$). Sleeping hours exceeding 9 hours per day rose from 26.2% to 38.2% (UOR = 1.73, $P < 0.01$), and emotional eating increased from 72% to 91.5% (UOR = 4.18, $P < 0.001$). Moreover, 84% of parents reported increased use of smart electronic devices by their children (5.48 ± 2.87 hours). A significant proportion of children exhibited elevated levels of nagging (44.2%), stress (33.8%), loneliness (26.9%), and anxiety (22.5%). Factors associated with increased body weight included being female (adjusted odds ratio [AOR] = 1.32, $P < 0.005$), residing in Jordan and Bahrain (AOR = 3.39 and 3.34, respectively, $P < 0.001$), having a working mother (AOR = 1.38, $P = 0.03$), having overweight parents (AOR = 1.2 for mothers and 1.68 for fathers, $P < 0.05$) with high-income (AOR = 1.31, $P = 0.04$), and being overweight

prior to the pandemic (AOR = 13.76, $P < 0.001$). These findings highlight the negative impact of the COVID-19 lockdown on children's health. Effective mitigation of future lockdown-related health consequences necessitates comprehensive interventions involving collaboration among health authorities, parents, and schools. A multifaceted approach encompassing educational initiatives, promoting physical activity and healthy eating habits, establishing clear screen time guidelines, and offering robust mental health support is imperative.

Key words:

COVID-19; lockdown, children; children health; school closure; eating habits; lifestyle.

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INTRODUCTION

The COVID-19 pandemic has dramatically changed the world and altered key health determinants.¹⁻³ The most crucial risk of the pandemic to children's well-being is not the infection itself but its sequelae. This pandemic has exerted public health impacts on children's quality of life that would last for a lifetime. These include poor nutrition, screen addiction, social isolation, and mental health disorders.^{4,5}

COVID-19-related school closures have a negative impact on children's daily lives, including insufficient physical activity, excessive sedentary behavior, and unbalanced nutrition, as well as exposing children to an elevated risk of obesity.^{6,3} Childhood obesity can severely impact a child's health, as it can lead to experiencing medical conditions such as diabetes mellitus and cardiovascular diseases.^{7,8} Although reducing the pandemic's immediate effects is critical, highlighting the pandemic's long-term impact on children's quality of life is also crucial.³ Routines, socialization, and friendships are all key components of a child's optimal psychological development. Being confined or secluded disrupts a child's or adolescent's everyday habits. As such, it is required to investigate the impact of the

outbreak's containment measures and schools' closures on children's mental health and well-being.^{9,10} A previous study has revealed that self-isolation at home due to the pandemic lockdown was associated with lower levels of physical activity, longer sedentary time, changes in eating habits, and sleeping disturbances in adults.⁹

To our knowledge, no multinational study conducted in the Middle East has investigated children's dietary patterns during the COVID-19 pandemic. Therefore, this study aimed to investigate the impact of the COVID-19 pandemic and its associated quarantine and school closures on the children's eating habits, lifestyle, physical activity, sleeping hours, use of smart electronic devices, and mental health. Moreover, the predictors associated with the children's weight change during the pandemic were determined.

METHODS

Study Design

This exploratory cross-sectional study was conducted using a self-administered questionnaire between November 2021 and February 2022. This study focused on adult parents (≥ 18 years)

having at least one child aged between 4 to 12 years and residing in Middle Eastern Arab countries. The survey form link was disseminated through various social networking platforms, including WhatsApp, Twitter, Facebook, and Instagram. Additionally, multiple news and radio platforms aided in sharing and inviting participants to complete the survey. Moreover, researchers within each country collaborated with parenting groups to ensure access to a diverse pool of parents with children aged 4–12 years.

Questionnaire development and structure

After reviewing relevant published articles,¹¹⁻¹⁴ the study investigators have established a questionnaire that includes 71 close-ended questions (with pre-defined responses). This questionnaire consisted of five main sections. The first section documented the parents' socio-demographic data, economic status, educational level, living conditions, and parents' body weight. The second section recorded the child's data related to sex, age, body weight, height, and the status of school enrollment. The third section assessed the child's body weight changes, lifestyle, physical activity, sleeping patterns, and mood changes prior to and during the pandemic. The fourth section documented the child's dietary pattern prior to and during the pandemic, including the frequency of consumption of different types of foods. The last section investigated the child's utilization of smart electronic devices.

Questionnaire revision and piloting

An expert panel in social and public health research revised the questionnaire for its face and content validity. Afterward, a pilot test was carried out on 30 individuals who have children aged between 4 to 12 years, which were chosen by a convenience approach. Participants were inquired to fill

out the questionnaire and comment on its clarity, comprehensibility, and cultural suitability. Then, the questionnaire was modified based on the participants' comments. Results obtained from the pilot test were not included in the study's final data analysis. A generated link to the questionnaire, using the Google Form, was posted through different social platforms (Facebook, Instagram, WhatsApp, and Twitter), and shared on daily basis for a period of four months to attain a representative sample from each country. Furthermore, several schools helped by sharing and inviting parents to participate in the survey.

Operational Definitions

Emotional Eating: refers to a tendency to eat more in response to negative emotions.¹²

Ethical considerations

The study design and conduction followed the World Medical Association's Declaration of Helsinki guidance. The study was approved by the Research and Ethics Committee at the corresponding author's affiliated institution. The questionnaire included an introductory paragraph to introduce the participants to the study's aim, followed by a statement to ensure the participants' anonymity and voluntary participation. Afterward, participants were asked to provide an electronic informed consent before starting to fill out the questionnaire.

Statistical analysis

The 22nd version of the Statistical Package for the Social Science (SPSS, IBM Corp., Armonk, NY, USA) was used for data analysis. The mean \pm standard deviation and percentages were used for continuous and categorical variables, respectively. Normality was checked using the Shapiro-Wilk test. Multinomial logistic

regression was performed to model the relationship between the predictors and children's body weight changes during the pandemic, and was divided into three groups (unchanged, increased body weight, decreased body weight). The likelihood ratio chi-square test was used to assess the model's goodness of fit. Statistical significance was considered at $p < 0.05$.

RESULTS

Participant's socio-demographics

Participants residing in countries other than the Arab Middle Eastern countries or those residing in countries that did not actively participate in achieving a representative sample were excluded from

the data analysis ($n = 106$). The participants included in the study were 891 individuals from seven different Arab Middle Eastern countries as follows: Bahrain (231, 25.9%), Jordan (185, 20.8%), Saudi Arabia (144, 16.2%), UAE (107, 12%), Iraq (102, 11.4%), Lebanon (80, 9%), and Oman (42, 4.7%). Almost two-thirds of the participants who completed the questionnaire were children's mothers (687, 77.1%), and one-third had a monthly household income between \$1,000 – \$4,000 (269, 30.2%). The mean age of the children's mothers was 35.63 ± 7.79 years, while the mean age of the children's fathers was 41.27 ± 8.42 years. Almost half of the children had both parents working (435, 48.8%). **Table 1.** summarizes the participants' sociodemographic data.

Table 1. Participants' sociodemographic information (N = 891).

Information	n (%)
Country of residence	
<i>Bahrain</i>	231 (25.9)
<i>Jordan</i>	185 (20.8)
<i>Saudi Arabia</i>	144 (16.2)
<i>United Arab Emirates</i>	107 (12)
<i>Iraq</i>	102 (11.4)
<i>Lebanon</i>	80 (9)
<i>Oman</i>	42 (4.7)
Number of children	
Mean \pm SD	2.36 ± 1.27
Citizenship	
<i>Citizen</i>	757 (85)
<i>Resident</i>	134 (15)
The participant's relationship to child	
<i>Mother</i>	687 (77.1)
<i>Father</i>	204 (22.9)
Marital status	
<i>Married</i>	798 (89.6)
<i>Single</i>	55 (6.2)
<i>Divorced/Separated</i>	32 (3.6)
Child mother's age	
Mean \pm SD	35.63 ± 7.79
Child father's age	
Mean \pm SD	41.27 ± 8.42

Information	n (%)
Parents' working Status	
<i>Father is employed</i>	408 (45.8)
<i>Mother is employed</i>	20 (2.2)
<i>Both parents are employed</i>	435 (48.8)
<i>Both parents are unemployed</i>	26 (2.9)
<i>Father is retired</i>	2 (0.2)
Monthly household income	
< \$600	195 (21.9)
\$601–\$1,000	154 (17.3)
\$1,001–\$4,000	269 (30.2)
\$4,001–\$7,000	119 (13.4)
\$7,001–\$10,000	80 (9)
> \$10,000	74 (8.3)
Child mother's weight	
<i>Underweight</i>	22 (2.5)
<i>Normal body weight</i>	601 (67.5)
<i>Overweight</i>	220 (24.7)
<i>Obese</i>	48 (5.4)
Child father's weight	
<i>Underweight</i>	16 (1.8)
<i>Normal body weight</i>	578 (64.9)
<i>Overweight</i>	247 (27.7)
<i>Obese</i>	50 (5.6)
Child's residency	
<i>Small apartment/house</i>	187 (21)
<i>Medium apartment/house</i>	473 (53.1)
<i>Big apartment/house</i>	231 (25.9)
Child mother's education	
<i>No education</i>	5 (0.6)
<i>School</i>	121 (13.6)
<i>Some college</i>	126 (14.1)
<i>University</i>	463 (52)
<i>Postgraduate</i>	176 (19.8)
Child father's education	
<i>School</i>	178 (20)
<i>Some college</i>	120 (13.5)
<i>University</i>	349 (39.2)
<i>Postgraduate</i>	244 (27.4)

SD, standard deviation.

Children's Data

The mean age of the children was 7.65 ± 2.63 years. Almost half of the children were males (487, 54.7%) and enrolled in schools (679, 76.2%). Notably,

12.6% of the children were overweight, while 1.6% were obese. When parents were inquired about the changes in their children's body weight during the pandemic, one-third of them reported that

their children had gained weight (287, 32.2%). The mean of body weight gained during the pandemic was 4.19 ± 3.08 Kg, while the mean of body weight lost was 2.21 ± 1.23 Kg (See **Table 2.**). When parents were asked about their children's

mood during the COVID-19 pandemic, almost half of them reported that their children became more nagging (251, 44.2%), stressed (192, 33.8%), lonely (153, 26.9%), and anxious (125, 22.5%).

Table 2. Children's data, body weight, and mood change during the COVID-19 pandemic (N = 891).

Information	n (%)
Child's age	
Mean \pm SD	7.65 \pm 2.63
Child's sex	
Male	487 (54.7)
Female	404 (45.3)
Child's enrollment status in school	
No	53 (5.9)
Still in pre-school (kindergarten)	159 (17.8)
Yes, in school	679 (76.2)
Child's weight	
Underweight	75 (8.4)
Normal body weight	690 (77.4)
Overweight	112 (12.6)
Obese	14 (1.6)
Mean \pm SD	27.9 \pm 12.3
Child's height	
Mean \pm SD	122 \pm 22
Child's body weight changes during the pandemic	
Did not change	556 (62.4)
Increased	287 (32.2)
Decreased	48 (5.4)
Weight gained during the pandemic	
Mean \pm SD	4.19 \pm 3.08
Weight lost during the pandemic	
Mean \pm SD	2.21 \pm 1.23

^a As multiple responses were given, numbers do not add up to 891.

Children's lifestyle and dietary habits before and during the COVID-19 pandemic**Table 3.** Children's lifestyle and dietary habits before and during the COVID-19 pandemic (N= 891).

Information	Before the pandemic n (%)^a	During the pandemic n (%)^a	UOR	P-value^b
Child's activity				
<i>Sedentary/inactive</i>	36 (4)	160 (17.9)	5.20	< 0.001*
<i>Slightly active</i>	94 (10.5)	337 (37.8)	5.16	
<i>Active</i>	673 (75.5)	320 (36)	0.18	
<i>Hyperactive</i>	88 (10)	74 (8.3)	0.83	
Child's physical activity				
<i>No activity</i>	303 (34)	463 (52)	2.10	0.002*
<i>Once-to-twice weekly</i>	235 (26.3)	207 (23.2)	0.84	
<i>Three-to-four times weekly</i>	177 (19.8)	104 (11.7)	0.53	
<i>Five-to-six times weekly</i>	54 (5.9)	28 (3.1)	0.50	
<i>On daily basis</i>	122 (13.8)	89 (10)	0.70	
Child's sleeping hours/day				
<i>< 6 hours</i>	25 (2.8)	35 (3.9)	1.42	< 0.001*
<i>6-7 hours</i>	82 (9.2)	75 (8.4)	0.91	
<i>7-8 hours</i>	248 (27.8)	158 (17.7)	0.56	
<i>8-9 hours</i>	303 (34)	284 (31.8)	0.91	
<i>> 9 hours</i>	233 (26.2)	339 (38.2)	1.73	
Number of meals the child eats during the day				
<i>One meal</i>	12 (1.3)	18 (2)	1.51	< 0.01*
<i>Two meals</i>	120 (13.3)	127 (14.2)	1.07	
<i>Three meals</i>	553 (61.4)	424 (47.5)	0.55	
<i>≥ Four meals</i>	206 (22.7)	322 (36.3)	1.88	
Does the child eat breakfast?				
<i>No</i>	63 (7)	75 (8.4)	0.96	0.03*
<i>Yes, always</i>	638 (71)	588 (66)	0.75	
<i>Yes, sometimes</i>	190 (22)	228 (25.6)	1.27	
Does the child eat a snack between main meals?				
<i>No</i>	78 (8.7)	68 (7.6)	0.86	0.12
<i>Yes, always</i>	503 (56.5)	544 (61)	1.21	
<i>Yes, sometimes</i>	310 (34.8)	279 (31.4)	0.85	
Does the child eat lunch?				
<i>No</i>	23 (2.5)	24 (2.7)	1.04	0.02*
<i>Yes, always</i>	788 (88.5)	757 (85)	0.74	
<i>Yes, sometimes</i>	80 (9)	110 (12.3)	1.43	

Information	Before the pandemic n (%) ^a	During the pandemic n (%) ^a	UOR	P-value ^b
Does the child eat dinner?				
<i>No</i>	40 (4.5)	38 (4.3)	0.95	0.43
<i>Yes, always</i>	689 (77.3)	678 (76)	0.93	
<i>Yes, sometimes</i>	162 (18.2)	175 (19.7)	1.10	

UOR, unadjusted odds ratio

^a Percentages for the column

^b Univariate analysis using Pearson's Chi-square test

*= statistically significant ($P < 0.05$)

Table 3. compares the children's lifestyle and dietary habits before and during the COVID-19 pandemic. Children were more likely to live a sedentary lifestyle during the pandemic, where the number of children not being physically active significantly increased from 4% (pre-pandemic) to 17.9% (during the pandemic, unadjusted odds ratio [UOR] = 5.2, $P < 0.001$). Moreover, children's

sleeping hours have increased significantly during the pandemic, where they were more likely to sleep more than 9 hours per day (UOR = 1.73, $P < 0.01$). In addition, the children were commonly eating more frequent meals throughout the day, where the number of children eating four or more meals significantly increased during the pandemic (from 22.7% to 36.3%, UOR = 1.88, $P < 0.001$) relative to pre-pandemic.

Table 4. Type of food consumed by the children before and during the COVID-19 Pandemic (N = 891).

Item	Before the pandemic n (%) ^a	During the pandemic n (%) ^a	UOR	P-value ^b
How many times a week does your child eat fast food?				
<i>Once to twice a week</i>	694 (77.8)	628 (70.6)	0.67	< 0.001*
<i>Three to four times weekly</i>	122 (13.6)	89 (9.9)	0.70	
<i>≥ Five times weekly</i>	75 (8.4)	174 (19.5)	2.64	
How many times a week does your child eat vegetables and fruits?				
<i>Once to twice a week</i>	238 (26.7)	235 (26.4)	0.98	0.77
<i>Three to four times a week</i>	261 (29.2)	270 (30.4)	1.05	
<i>≥ Five times weekly</i>	392 (44.1)	386 (43.2)	0.97	
How many times a week does your child drink milk?				
<i>None</i>	142 (16)	144 (16.1)	1.02	0.61
<i>Once to twice a week</i>	174 (19.5)	178 (20)	1.03	
<i>Three to four times a week</i>	152 (17)	157 (17.6)	1.04	
<i>≥ Five times weekly</i>	423 (47.5)	412 (46.2)	0.95	

Item	Before the pandemic n (%) ^a	During the pandemic n (%) ^a	UOR	P-value ^b
How many times a week does your child eat dairy products?				
None	111 (12.5)	118 (13.2)	10.7	0.54
Once to twice a week	190 (21.3)	178 (20)	1.21	
Three to four times a week	173 (19.5)	165 (18.5)	0.94	
≥ Five times weekly	417 (46.7)	430 (48.3)	1.06	
How many times a week does your child eat starchy food?				
None	12 (1.3)	14 (1.5)	1.17	0.04*
Once to twice a week	141 (15.8)	106 (11.9)	0.72	
Three to four times a week	297 (33.3)	287 (32.2)	0.95	
≥ Five times weekly	441 (49.5)	484 (54.2)	1.21	
How many times a week does your child eat protein-rich food?				
None	37 (4)	38 (4.2)	1.03	0.96
Once to twice a week	135 (15.1)	144 (16.1)	1.08	
Three to four times a week	270 (30.3)	261 (29.2)	0.95	
≥ Five times weekly	449 (50.6)	448 (50.5)	1.0	
How many times a week does your child eat food that do not require cooking or reheating before serving (like soft/creamy cheeses, hot dog, canned food)?				
None	381 (42.8)	364 (40.9)	0.92	0.80
Once to twice a week	359 (40.3)	330 (37)	0.87	
Three to four times a week	94 (10.5)	123 (13.8)	2.55	
Five to six times a week	24 (2.7)	39 (4.3)	1.65	
Every day	33 (3.7)	35 (4)	1.06	
How much water does your child drink per day?				
< 0.5 L	133 (15)	143 (16)	1.09	0.90
0.5–1 L	405 (45.5)	404 (45.3)	1.00	
1.1–1.5 L	241 (27)	233 (26.3)	0.96	
1.6–2 L	77 (8.5)	75 (8.4)	0.97	
> 2 L	35 (4)	36 (4)	1.03	

UOR, unadjusted odds ratio

^a Percentages for the column

^b Univariate analysis using Pearson's Chi-square test

*= statistically significant ($P < 0.05$)

Table 4. documents different types and quantities of food being consumed by the children before and during the pandemic. The amount of fast food being consumed five or more times weekly has significantly increased during the pandemic compared with pre-pandemic (8.4% vs. 19.5%, UOR = 2.64, $P < 0.001$). Emotional eating has significantly increased among children from 72% (n = 641) prior to the pandemic to 91.5% (n = 815) during it (UOR = 4.18, $P < 0.001$).

The use of smart electronic devices among children

When parents were asked about their children's utilization of smart electronic devices, many participants reported that their children started to use smart devices more frequently during the pandemic (611, 83.8%, $P = 0.02$), with a mean of 5.48 ± 2.87 hours spent on these devices daily.

Predictors of the children's body weight changes during the COVID-19 pandemic

Table 5. Multinomial logistic regression for the predictors of the children's body weight change during the COVID-19 pandemic (N = 891).

Parameter	Body weight changes during the pandemic [unchanged body weight is the reference group]			
	Increased body weight		Decreased body weight	
	AOR	P-value	AOR	P-value
Child's age (years)	1.30	< 0.001*	1.07	0.43
Child' sex				
<i>Male</i>	Reference		Reference	
<i>Female</i>	1.32	<0.02*	0.85	0.66
Child mother's age	0.98	0.24	0.95	0.61
Child father's age	0.96	0.29	0.41	1.06
Country of residence				
<i>United Arab Emirates</i>	Reference		Reference	
<i>Bahrain</i>	3.34	0.001*	1.00	0.99
<i>Iraq</i>	1.92	0.15	0.16	0.09
<i>Jordan</i>	3.39	0.001*	0.25	0.11
<i>Lebanon</i>	1.30	0.59	0.19	0.10
<i>Oman</i>	1.48	0.45	0.23	0.27
<i>Saudi Arabia</i>	1.17	0.66	0.22	0.06
Citizenship				
<i>Resident</i>	Reference		Reference	
<i>Citizen</i>	0.74	0.30	2.65	0.69
Parents' working status:				
<i>Fathers works</i>	Reference		Reference	
<i>Mother works</i>	1.38	0.03*	0.22	0.63
<i>Both parents work</i>	1.49	0.01*	1.38	0.28
<i>Both parents do not work</i>	0.95	0.93	0.73	0.10
Monthly household income				
≤ \$1,000/month	Reference		Reference	
> \$1,000/month	1.31	0.04*	0.81	0.94
Mother's educational level				
<i>Low (diploma or lower)</i>	Reference		Reference	
<i>High (university of higher)</i>	0.89	0.61	0.54	0.13
Father's educational level				
<i>Low (diploma or lower)</i>	Reference		Reference	
<i>High (university of higher)</i>	0.86	0.49	1.09	0.81

Parameter	Body weight changes during the pandemic [unchanged body weight is the reference group]			
	Increased body weight		Decreased body weight	
	AOR	P-value	AOR	P-value
Mother's bodyweight				
<i>Normal/underweight</i>	Reference	0.03*	Reference	0.61
<i>Overweight/obese</i>	1.20		0.81	
Father's bodyweight				
<i>Normal/underweight</i>	Reference	< 0.001*	Reference	0.03*
<i>Overweight/obese</i>	1.68		0.37	
Child parents' lifestyle				
<i>Sedentary to lightly active</i>	Reference	0.48	Reference	0.34
<i>Moderately to highly active</i>	0.87		0.69	
Child's residency				
<i>Big apartment/house</i>	Reference		Reference	
<i>Medium apartment/house</i>	0.96	0.88	0.44	0.06
<i>Small apartment/house</i>	1.46	0.20	0.57	0.37
The house/apartment have a good space, courtyard, or backyard for children to play				
<i>No</i>	Reference	1.15	Reference	0.24
<i>Yes</i>	1.1		0.48	
Is the child enrolled in school?				
<i>Yes, in school</i>	Reference		Reference	
<i>Still in pre-school</i>	0.86	0.63	0.98	0.97
<i>No</i>	0.74	0.55	5.04	0.01*
Child suffers from chronic medical condition				
<i>No</i>	Reference	0.93	Reference	0.01*
<i>Yes</i>	1.03		3.68	
Child's body weight				
<i>Normal or underweight</i>	Reference	< 0.001*	Reference	0.52
<i>Overweight or obese</i>	13.76		0.50	

AOR, adjusted odds ratio.

* Significant at 0.05 significance level.

Table 5 revealed that girls were more likely to gain weight during the COVID-19 pandemic than boys ($P < 0.05$). Moreover, children residing in Jordan (odds ratio [OR] = 3.39, $P < 0.001$) and Bahrain (OR = 3.34, $P < 0.001$) were more likely to gain weight during the COVID-19 pandemic compared with those residing in the UAE. Remarkably, children with

working mothers (OR = 1.38, $P = 0.03$) and those who have both parents employed (OR = 1.49, $P < 0.01$) were more likely to gain weight during the pandemic compared with those who only had their fathers working. Children of parents with higher monthly household income ($> \$1,000$) were more likely to gain weight (OR = 1.31, $P = 0.04$) than those with lower income ($\leq \$1000$).

Interestingly, children raised by parents who are considered overweight or obese were more prone to gain weight during the pandemic ($P < 0.05$). Remarkably, overweight and obese children were 13 times more likely to gain weight during the pandemic than those who were underweight or had normal body weight ($P < 0.001$).

DISCUSSION

Our results reveal that females were more likely to gain weight during the COVID-19 pandemic's lockdown period. This could be due to the Arab culture restricting female outdoor physical activities such as sports in some countries.¹⁵ In addition, children who live in Jordan and Bahrain were more prone to weight gain. The economy of Bahrain may explain this outcome since there is a positive correlation between the monthly income and gaining weight in children.¹⁶ In Jordan, however, the high percentage of children who gained weight may be linked to various reasons, including the more extended quarantine period and school closure secondary to the higher infection rates and the higher consumption rates of unhealthy food and high-carbohydrate meals prepared by mothers.¹⁷

Our results also revealed that children of parents with higher income (e.g., working mothers) were more likely to gain weight. It was reported that higher-income families were found to consume more expensive and unhealthy food than lower-income families in a recent study.¹⁸ Moreover, we found an association between children's weight gain and the absence of mothers from home, particularly when both parents were working. This absence can impact children's dietary patterns through changes in meal planning, food choices, eating behaviors, and the influence of alternative caregivers.^{1,3} We have also observed a significant increase in children's use of smart electronic devices

during the pandemic with a positive correlation with food intake. This observation was found to be comparable with the findings of a recent study.¹⁹

Remarkably, we have found that overweight children were more likely to gain weight during the pandemic. Studies, however, have also reported a remarkable misbalance in homeostasis due to the lockdown stress, which may increase the ghrelin hormone level that may trigger hunger and increase appetite.²⁰ On the other hand, increased boredom in children was strongly correlated with increased food intake, emotional overeating, and frequency of eating snacks.²¹ However, the current study revealed a significantly higher intake of foods from all dietary groups during the lockdown compared with the pre-pandemic time. This was also observed in a recent study.¹³ It was also reported that late-night eating may lead to the development of metabolic syndrome.²²

The current study also found habitual modifications in food consumption and eating habits, which arose during the pandemic. The daily intake of unhealthy and starchy food has increased while consumption of vegetables, fruits, milk, dairy products, and protein-rich food has decreased. This confirms the findings of other similar study.²³ Our observation of children's mood changes during the COVID-19 pandemic was comparable with other research findings. The lockdown has affected the children's mood and caused psychological problems such as anxiety, stress, depression, and avoidance behavior.^{21,24,25}

The current study was associated with several limitations. First, the sample size of the present study is relatively small considering the population size of the Middle Eastern Arab countries. Second, this study utilized a self-administered questionnaire, where several reported variables may be subjective and misestimated (e.g., children's body weight, height, sleeping hours, physical activity,

and mood). Third, the inclusion of several questions pertaining to the children's dietary and lifestyle habits prior to and during the pandemic in the questionnaire introduced a potential for recall bias. Consequently, the validity and accuracy of the reported information may be questionable. However, to alleviate this bias, several strategies were implemented. Clear instructions were incorporated into the questionnaire, aiding participants in providing accurate responses. Furthermore, the design of the questions focused on capturing the changes that occurred during the pandemic period, thereby enhancing the likelihood that the information collected aligns with recent memory. Additionally, a self-administered questionnaire was employed to gather data from parents, who are considered reliable sources regarding their children's habits and behaviors. Fourth, the utilization of an online questionnaire may have introduced selection bias into the study sample. The participants consisted of parents who were more technologically inclined and willing to engage, potentially excluding a significant proportion of children from the survey. Consequently, this could have yielded a non-representative sample, thereby limiting the generalizability of the findings. Fifth, the level of restrictions and the length of the lockdown period may differ within the studied countries, which may indirectly impact our results. Finally, the emotional and psychological status of the parents due to the pandemic may have also affected their responses. While these acknowledged limitations exist, it is crucial to recognize that this research is exploratory in nature, aiming to provide a broad overview of children's dietary patterns during the pandemic.

RECOMMENDATIONS

The COVID-19 pandemic's lockdown has significantly affected children's physical and mental health. Their physical activities have decreased, their use of smart electronic devices, and their food consumption has increased. This, in addition to consuming unhealthy food, has led to weight gain, which may further lead to unfavorable consequences on their health. Moreover, children's psychological health has also been negatively affected. Therefore, to effectively mitigate the negative impact on children's health during future lockdowns, it is crucial to implement comprehensive interventions involving collaboration between health authorities, parents, and schools. These recommendations advocate for a multifaceted approach, including educational initiatives to raise awareness, promoting physical activity and healthy eating habits, establishing clear guidelines for screen time usage, offering robust mental health support, and implementing sustainable long-term monitoring strategies. By implementing these measures collectively, we can better safeguard children's well-being and minimize the detrimental effects of future lockdowns on their health.

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REFERENCES

1. Androustos O, Perperidi M, Georgiou C, Chouliaras G. Lifestyle Changes and Determinants of Children's and Adolescents' Body Weight Increase during the First COVID-19 Lockdown in Greece: The COV-EAT Study. *Nutrients*. 2021;13(3):1–11. doi: 10.3390/nu13030930.
2. Bennett G, Young E, Butler I, Coe S. The Impact of Lockdown During the COVID-19 Outbreak on Dietary Habits in Various Population Groups: A Scoping Review. *Front Nutr*. 2021;8:626432. doi: 10.3389/fnut.2021.626432.
3. Rundle AG, Park Y, Herbstman JB, Kinsey EW, Wang YC. COVID-19-Related School Closings and Risk of Weight Gain Among Children. *Obesity (Silver Spring)*. 2020;28(6):1008-9. doi: 10.1002/oby.22813.
4. Kim ES, Kwon Y, Choe YH, Kim MJ. COVID-19-related school closing aggravate obesity and glucose intolerance in pediatric patients with obesity. *Sci Rep*. 2021;11(1):5494. doi: 10.1038/s41598-021-84766-w.
5. Zemrani B, Gehri M, Masserey E, Knob C, Pellaton R. A hidden side of the COVID-19 pandemic in children: the double burden of undernutrition and overnutrition. *Int J Equity Health*. 2021;20(1):44. doi: 10.1186/s12939-021-01390-w.
6. Chaabane S, Doraiswamy S, Chaabna K, Mamtani R, Cheema S. The Impact of COVID-19 School Closure on Child and Adolescent Health: A Rapid Systematic Review. *Children (Basel)*. 2021;8(5). doi: 10.3390/children8050415.
7. Wen J, Zhu L, Ji C. Changes in weight and height among Chinese preschool children during COVID-19 school closures. *Int J Obes (Lond)*. 2021;45(10):2269-73. doi: 10.1038/s41366-021-00912-4.
8. Gondek E, Nowak D, Stachnik M, Sterczyńska M. Evaluation of the knowledge of mothers about the principles of children nutrition at an early school age. *Carpathian Journal of Food Science and Technology*. 2018;10(5):117–24.
9. Imran N, Aamer I, Sharif MI, Bodla ZH, Naveed S. Psychological burden of quarantine in children and adolescents: A rapid systematic review and proposed solutions. *Pak J Med Sci*. 2020;36(5):1106–16.
10. Galali Y. The impact of COVID-19 confinement on the eating habits and lifestyle changes: A cross sectional study. *Food Sci Nutr*. 2021;9(4):2105-13. doi: 10.1002/fsn3.2179.
11. Bahatheg RO. Young Children's Nutrition During the COVID-19 Pandemic Lockdown: A Comparative Study. *Early Child Educ J*. 2021;49(5):915-23. doi: 10.1007/s10643-021-01192-3.
12. Censi L, Ruggeri S, Galfo M, Buonocore P, Roccaldo R. Eating behaviour, physical activity and lifestyle of Italian children during lockdown for COVID-19. *Int J Food Sci Nutr*. 2022;73(1):93-105. doi: 10.1080/09637486.2021.1921127.
13. Al Hourani H, Alkhatib B, Abdullah M. Impact of COVID-19 Lockdown on Body Weight, Eating Habits, and Physical Activity of Jordanian Children and Adolescents. *Disaster Med Public Health Prep*. 2022;16(5):1855-63. doi: 10.1017/dmp.2021.48.
14. Cheikh Ismail L, Osaili TM, Mohamad MN, Al Marzouqi A, Jarrar AH, Zampelas A, et al. Assessment of eating habits and lifestyle during the coronavirus 2019 pandemic in the Middle East and North Africa region: a cross-sectional study. *Br J Nutr*. 2021;126(5):757-66. doi: 10.1017/S0007114520004547.
15. Ahmad Bahathig A, Abu Saad H, Md

- Yusop NB, Mohd Shukri NH, El-Din MME. Relationship between Physical Activity, Sedentary Behavior, and Anthropometric Measurements among Saudi Female Adolescents: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2021;18(16). doi: 10.3390/ijerph18168461.
16. Musaiger AO, Al-Roomi K, Bader Z. Social, dietary and lifestyle factors associated with obesity among Bahraini adolescents. *Appetite*. 2014;73:197-204. doi: 10.1016/j.appet.2013.11.002.
17. Al-Sabbagh MQ, Al-Ani A, Mafrachi B, Siyam A, Isleem U, Massad FI, et al. Predictors of adherence with home quarantine during COVID-19 crisis: the case of health belief model. *Psychol Health Med*. 2022;27(1):215-27. doi: 10.1080/13548506.2021.1871770.
18. Bulucu Büyüksoy GD, Çatıker A, Özdil K. Food Insecurity and Affecting Factors in Households With Children During the COVID-19 Pandemic: A Cross-Sectional Study. *Disaster Med Public Health Prep*. 2021:1-6. doi: 10.1017/dmp.2021.172.
19. Łuszczki E, Bartosiewicz A, Pezdan-Śliz I, Kuchciak M, Jagielski P, Oleksy Ł, et al. Children's Eating Habits, Physical Activity, Sleep, and Media Usage before and during COVID-19 Pandemic in Poland. *Nutrients*. 2021;13(7). doi: 10.3390/nu13072447.
20. Roy S, Tiwari S, Kanchan S, Bajpai P. Impact of COVID-19 pandemic led lockdown on the lifestyle of Adolescents and young adults. *medRxiv*. 2020 Jan 1;2020.08.22.20180000.
21. Philippe K, Chabanet C, Issanchou S, Monnery-Patris S. Child eating behaviors, parental feeding practices and food shopping motivations during the COVID-19 lockdown in France: (How) did they change? *Appetite*. 2021;161:105132. doi: 10.1016/j.appet.2021.105132.
22. Yoshida J, Eguchi E, Nagaoka K, Ito T, Ogino K. Association of night eating habits with metabolic syndrome and its components: a longitudinal study. *BMC Public Health*. 2018;18(1):1366. doi: 10.1186/s12889-018-6262-3.
23. Dondi A, Candela E, Morigi F, Lenzi J, Pierantoni L, Lanari M. Parents' Perception of Food Insecurity and of Its Effects on Their Children in Italy Six Months after the COVID-19 Pandemic Outbreak. *Nutrients*. 2020;13(1). doi: 10.3390/nu13010121.
24. Thakur K, Kumar N, Sharma N. Effect of the Pandemic and Lockdown on Mental Health of Children. *Indian J Pediatr*. 2020;87(7):552. doi: 10.1007/s12098-020-03308-w
25. Lopez-Serrano J, Díaz-Bóveda R, González-Vallespí L, Santamarina-Pérez P, Bretones-Rodríguez A, Calvo R, et al. Psychological impact during COVID-19 lockdown in children and adolescents with previous mental health disorders. *Rev Psiquiatr Salud Ment (Engl Ed)*. 2021. doi: 10.1016/j.rpsm.2021.04.002.