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Considerable decreased fruits and snack consumption in Iran population during COVID-19 lockdown: a cross-sectional web-based survey National Food and Nutrition Surveillance

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Abstract

Background Inadequate fruits and vegetables intake is associated with several diseases. This study aimed to explore changes in fruits and snack consumption during the COVID-19-related lockdown in Iran.

Methods An online cross-sectional survey among Iranian households was conducted from the 4th to 25th April 2020, during the COVID-19 lockdown. Data were collected about any changes in frequency consumption of the fruits and snacks and the reasons for the changes. Ordinal logistic regression was performed to examine which factors contributed to changes in consumption. To account for the complex sampling design and allow inferences valid for the population, sampling weights were used in all analyses.

Results A total of 21,290 households took part in the survey. During the epidemic, consumption of fruits and snacks decreased by 35% and 44%, respectively. Among the households whose fruit intake was decreased, about 21% fully omitted it from their food baskets. Residing in rural areas, having more than six members in the household, income loss, and residing in deprived provinces were directly associated with decreased consumption of fruits and snacks. Being a female-headed household was positively associated, and having persons with COVID-19 in the households was inversely associated, with decreased consumption of fruits. The main reason for reducing fruit and snack consumption was income loss.

Conclusions A significant decline in fruit and snack consumption because of COVID-19 lockdown was seen among the Iranian households. It is likely that these changes in dietary habits will become longstanding with consequent adverse health outcomes.

Keywords COVID-19, Lockdown, Fruit, Snack, Survey

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Introduction

The newly emerged infectious disease, COVID-19, spread inexorably worldwide, leading to the World Health Organization (WHO) declaring it a pandemic [1]. Under such circumstances, all countries, including Iran, established lockdown measures to slow the expansion of the outbreak. In Iran, the first case of COVID-19 was documented on 19th of February and a lockdown was imposed on 7th of March, 2020 [2]. Thus, from the 7th of March, 2020, millions of Iranians were instructed to stay at home.

The lockdown, globally, has brought about some positive and negative impacts. For example, lessening the magnitude of the first epidemic wave and improving air quality have been mentioned as positive impacts [3, 4]. However, some negative consequences, such as an increase in unemployment and income loss, increase in loneliness and unhappiness, psycho-social consequences due to increasing marital discord, and domestic violence have been attributed to the lockdown [5–9].

Maintaining a healthy dietary habit, especially amid the pandemic, is crucial to boosting the immune system. From a nutritional point of view, remaining at home for a long time may lead to alterations in dietary habits, lifestyles, and food security among people [10–12]. Although the lockdown may result in having more time for cooking and a decrease in fast-food consumption, [13, 14] remaining at home and the disturbance to the daily routine may cause boredom [15]. In addition, a negative mood caused by the COVID-19 can lead to “food craving” [16], which in turn, can deleteriously impact healthy eating. Furthermore, limited shopping opportunities may reduce the intake of fresh foods, namely, fruits and vegetables, at the expense of junk foods and snacks, which are typically high in sugar, fat, and salt [17].

Fruits are very good sources of natural antioxidants and phytochemicals with immunomodulatory effects [18]. It has been estimated that about 3.0% (~1.7 million) of deaths globally, some 11% of ischemic heart disease deaths, nearly 14% of gastrointestinal deaths and 9% of stroke deaths are attributed to inadequate fruits and vegetables intake [19, 20]. Adequate consumption of fruits and vegetables has, therefore, been recommended as a protective strategy against several human pathologies including severe forms of COVID-19 in the subjects with underlying diseases [21]. Nevertheless, changes of consumption pattern during COVID-19 lockdown have been quite different in various communities. Though some reports indicate decreased intake of fruits, some others show unchanged or even increased consumption [22–25]. According to the Iran’s Statistical Center reports, purchase (as a proxy of consumption) of vegetables in the Iranian households has had little changes over the

last decade while that of fruits shows a decline especially since 2019 [26]. Understanding how the pandemic could alter food consumption patterns will help public health authorities in tailoring interventions to fulfill the population’s needs. To address the above issues, the present cross-sectional descriptive–analytical study was conducted using a web-based electronic self-administered questionnaire to explore changes in the intake of fruits and snacks during the nationwide COVID-19-related lockdown in Iran.

Methods

Setting and study design

The data were derived from a descriptive–analytical cross-sectional study conducted in 21,290 Iranian households that participated in an online survey [27]. The anonymous questionnaire was administered from 4 to 25th April 2020, during which Iran was in a coronavirus epidemic lockdown, via the following weblink (<https://panel.rabit.ir/s/c1NEPPXL483.html>). The questionnaire comprised close-ended questions to explore changes in usual dietary intake in a semi-quantitative manner. The survey link was circulated through social media (e.g., WhatsApp, Instagram) and the website of the Deputy Minister of Research and Technology of the Ir. Ministry of Health (corona.research.ac.ir). The vice-chancellors for health affairs and the community nutrition offices of the medical universities in all provinces received a formal letter from the Ministry of Health’s Community Nutrition Department. The objectives of the survey were explained in this letter, and they were asked to inform the community members covered by their services about the link via provincial health and nutrition professionals. We also adopted the snowball-sampling technique to ensure a large-scale distribution and recruitment. Participants were asked to roll out the online questionnaire to their acquaintances and relatives to reach as many respondents as possible.

Data collection

The anonymous online questionnaire consisted of questions about socio-demographic characteristics, any changes in frequency consumption of the selected food items, and the reasons for changing the frequency consumption during the COVID-19 lockdown.

Content validity and face validity of the questionnaire were evaluated by both experienced researchers in the field of nutrition and a non-expert group to ensure the simplicity and clarity of the questions, and modifications were introduced following the pilot study. Details on the development of the questionnaire have been presented elsewhere [27].

Assessment of other variables

This section included data regarding gender (male, female), education level (master/higher, bachelor, associate, diploma, elementary), and occupation of the households' heads (employee, self-employed, retired, health workers, teacher, driver, other), household size, provincial regions (urban/rural), presence of a high-risk person in the household (none, under-5 children, pregnant or lactating women, elderly), and any changes in household income (no changes, low decrease, half, cut), during the coronavirus epidemic. The presence of a person with a history of COVID-19 within the household (no, yes) and the security status of the province (secure, semi-secure, insecure) was also asked. The categorization of the provinces based on food security status was performed based on a national report [28].

Fruits and snack intake during the COVID-19 lockdown

The participants reported changes in the consumption frequency of fruits, salty, and sweet snacks during the COVID-19 lockdown compared with the pre-COVID-19 period. Options of the changes included "decreased," "unchanged," and "increased." In addition, the reasons for decreasing or increasing consumption were also included [27].

Statistical analyses

Descriptive analysis (i.e., mean, standard deviation, percentage) was conducted to assess the distribution of socio-demographic status among the respondents.

Ordinal logistic regression was conducted to examine which factors contributed to changes in the selected food items. A two-tailed $p < 0.05$ was considered significant. Two outcomes of fruit consumption changes per week (more vs. no changes vs. less) and decreases in fruit consumption (little decrease vs. half vs. omitted) were considered as dependent variables in the regression models, after confirmation that the overall parallel assumption had not been violated ($p = 0.515$ and $p = 0.133$, respectively).

The gender, education level, and occupation of the head of the household, household size, provincial regions, and the presence of a high-risk person in the household, any changes in household income during the coronavirus epidemic, the presence of a person with a history of COVID-19 within the household, and security status of the province were assessed as the independent variables.

To account for the complex sampling design and allow inferences valid for the population, sampling weights were used in all analyses. Stata version 16.0 (StataCorp LLC) was used for analyzing the data.

Ethics approval and consent to participate

At the beginning of the survey, all participants were informed about the study's objectives and context and gave their digital informed consent regarding privacy and information management policies. Furthermore, there was no compensation to participate. The study was conducted according to the guidelines laid down in the Declaration of Helsinki [29]. The Ethics Committee approved all procedures involving research study participants of the National Nutrition and Food Technology Research Institute (IR.SBMU.NNFTRI.REC.1399.066).

Results

A total of 21,290 households participated in the survey. Accordingly, about 90% of the household heads were men and the majority (74%) of the respondents resided in rural areas. The mean age of household heads was 44.7y (44.2–44.9, 95% CI). The data indicated that almost 43% of the respondents had an academic degree, 33% were under diploma, and 24% had a diploma. Households with 3–5 members were dominant (78%); however, households with 1–2 and >6 members comprised 16% and 6% of the households, respectively. The majority (54%) of the households had no high-risk members, while the weighted percentages of high-risk members, including those under 5 years, pregnant/nursing women, and elderly, were 23%, 3%, and 10%, respectively. Ten percent of the households had more than one high-risk member.

The majority (34.3%) of the household heads were self-employed, whereas employees, retirees, drivers, teachers, and health workers comprised 20.5%, 11.7%, 3.9%, 3.1%, and 2.7% of the occupations, respectively, and 23.8% of the household heads had other jobs (Fig. 1).

As demonstrated in Table 1, the consumption of fruits and snacks during COVID-19 lockdown changed among most of the participants. Consumption frequency of fruits and snacks decreased among 35% and 44% of the households, respectively. On the other hand, fruit and

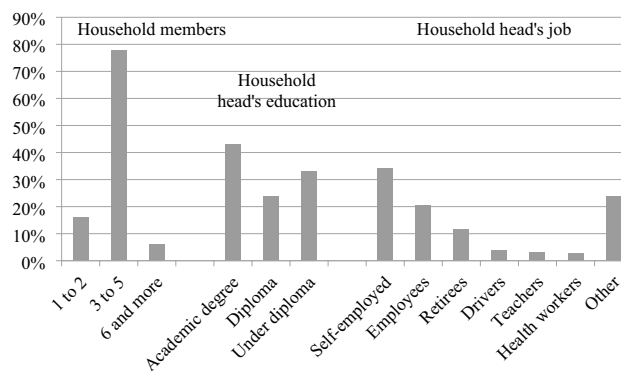


Fig. 1 Certain characteristics of the studied population

Table 1 Changes in consumption of fruit and snacks in household per week after COVID-19 epidemic

Variables	Changes status	N(%)
Fruit	No changes	9631 (44.8)
	Decrease	7809 (35.0)
	Increase	3850 (20.2)
Total		21,290 (100)
Snack	No changes	9673 (43.1)
	Decrease	9563 (44.4)
	Increase	2054 (12.5)
Total		21,290 (100)

snack consumption among 45% and 43% of the households stayed the same as before, respectively. Of the households who reported decreased fruit intake, approximately 21% entirely omitted it.

Table 2 shows that residing in rural areas (OR=1.23, 95%CI 1.13, 1.34, $p<0.001$), having more than six household members (OR=1.18, 95%CI 1.01, 1.37, $p=0.032$), decreasing income (Low decrease: OR=2.08, 95%CI 1.88, 2.28, $p<0.001$; Half: OR=2.52, 95%CI 2.26, 2.82, $p<0.001$; Cut: OR=5.38, 95%CI 4.74, 6.11, $p<0.001$), and residing in food insecure provinces (Semi secure: OR=1.12, 95%CI 1.01, 1.23, $p=0.019$; Insecure: OR=1.98, 95%CI 1.77, 2.20, $p<0.001$) were positively associated with decreased consumption of fruits and snacks. Lower education and having high-risk family members were inversely associated with consumption frequency of fruits and snacks. However, the association between having children under 5 years and decreased consumption of snacks was not significant. Being a female household head was inversely and having persons with COVID-19 in the households was directly associated with the consumption frequency of fruits (OR=1.16, 95%CI 1.02, 1.32, $p=0.023$, and OR=0.78, 95%CI 0.63, 0.96, $p=0.021$, respectively).

The consumption frequency of fruits and snacks was also directly associated with the occupation of health workers.

Among those households who reduced their fruit intake, 21% had eliminated it entirely (Fig. 2). In comparison, about half of the participants had cut it in half, and 30% had reduced it slightly.

As shown in Table 3, residing in rural areas (OR=1.16, 95%CI 0.82, 1.26, $P=0.033$), having more than six members in the household (OR=1.30, 95%CI 1.02, 1.64, $P=0.030$), decrease in income (Half: OR=1.63, 95%CI 1.34, 1.97, $p<0.001$; Cut: OR=2.95, 95%CI 2.40, 3.63, $p<0.001$), and residing in food insecure provinces (Semi secure: OR=1.28, 95%CI 1.08, 1.52, $p=0.004$; Insecure:

OR=1.72, 95%CI 1.43, 2.07, $p<0.001$) were inversely associated with consumption frequency of fruits among those who had a decline in fruit consumption. Furthermore, lower education level was also inversely associated with consumption of fruits.

The main reason for reducing fruit and snack consumption during COVID-19 lockdown was income decrease, while fear of contamination was ranked as the second reason for reducing fruit and snack consumption (Fig. 3).

The prominent reason for increasing fruit consumption during the COVID-19 lockdown was boosting the immune system. On the other hand, a greater tendency and increasing free time were the most frequent reasons for snack consumption.

Discussion

Our study has detailed the first overview of Iranian households' fruit and snack intake during the COVID-19 lockdown, which is critical for developing strategies to improve diet quality and food security during times of crisis.

According to the current study, the lockdown had a significant impact on reducing fruit and snack consumption. Among the households whose fruit intake was decreased, about 21% entirely omitted it, while about half of the participants had cut it in half. The current results align with the studies conducted in UK and the state of Michigan that reported people had reduced fruit intake levels during the COVID-19 lockdown [30, 31].

Under the pandemic scenario, management of overweight or obesity is even more challenging; indeed, it is pivotal for individuals to adhere to risk management strategies that should also include a well-balanced diet including sufficient intake of fruits and vegetables [32].

On the other hand, decreased fruit intake may lead to a weakened immune system due to accumulating evidence of the antioxidant and anti-inflammatory effects of their components including vitamin C, carotenoids, B vitamins, and polyphenols, such as flavonoids, phenolic acids, stilbenes, and lignans [33–35]. Though the consumption of dietary supplements may have increased as an attempt to compensate for the resulting decreased micronutrient intake [36], recent evidence suggests that needy households commonly have less access to dietary supplements [37].

Residing in rural areas, having over six household members, decreasing income, and residing in deprived provinces were positively associated with reduced consumption of fruits and snacks. The main reason for reducing fruit and snack consumption during the COVID-19 lockdown was a reduction in family income. In line with our findings, some studies have demonstrated that fruits and vegetables are among the first items to be sacrificed

Table 2 Ordered logistic regression models of changes in intake of fruits and snacks during the COVID-19 lockdown

Variables	Fruit		Snack	
	OR (95%CI)	p value	OR (95%CI)	p value
Sex of household head				
Male	–	–	–	–
female	1.16 (1.02, 1.32)	0.023	1.12 (0.98, 1.29)	0.077
Urban/Rural				
Urban	–	–	–	–
Rural	1.23 (1.13, 1.34)	<0.001	1.12 (1.03, 1.21)	0.004
Household members				
01–Feb	–	–	–	–
03–May	1.0 (0.9, 1.12)	0.883	1.10 (0.98, 1.23)	0.091
> 6	1.18 (1.01, 1.37)	0.032	1.22 (1.04, 1.42)	0.01
High risk members				
No	–	–	–	–
< 5 years	1.12 (1.02, 1.21)	0.009	1.0 (0.91, 1.09)	0.93
Pregnant/lactating mothers	1.21 (0.99, 1.48)	0.053	1.32 (1.08, 1.61)	0.005
Elderly	1.21 (1.06, 1.39)	0.004	1.14 (0.99, 1.31)	0.056
More than one	1.46 (1.29, 1.65)	<0.001	1.18 (1.05, 1.33)	0.005
Occupation				
Employee	–	–	–	–
Self employed	0.88 (0.77, 1.0)	0.062	0.79 (0.68, 0.91)	0.001
Retired	1.18 (1.01, 1.38)	0.028	1.0 (0.85, 1.19)	0.921
Health workers	0.72 (0.57, 0.91)	0.006	0.79 (0.62, 1.0)	0.054
Teacher	1.18 (0.95, 1.47)	0.127	1.3 (1.05, 1.61)	0.014
Driver	1.14 (0.92, 1.41)	0.22	0.98 (0.79, 1.21)	0.876
other	1.13 (0.99, 1.29)	0.055	0.85 (0.74, 0.98)	0.032
Change in income				
No changes	–	–	–	–
Low decrease	2.08 (1.88, 2.28)	<0.001	1.96 (1.77, 2.18)	<0.001
Half	2.52 (2.26, 2.82)	<0.001	2.23 (1.99, 2.49)	<0.001
Cut	5.38 (4.74, 6.11)	<0.001	3.32 (2.93, 3.75)	<0.001
Persons confirmed with COVID-19 in the households				
No	–	–	–	–
Yes	0.78 (0.63, 0.96)	0.021	0.87 (0.71, 1.07)	0.207
Education				
Master/higher	–	–	–	–
Bachelor	1.08 (0.95, 1.24)	0.221	1.21 (1.04, 1.41)	0.011
Associate	1.14 (0.95, 1.36)	0.146	1.25 (1.03, 1.51)	0.023
Diploma	1.23 (1.06, 1.43)	0.005	1.33 (1.13, 1.56)	<0.001
High school	1.68(1.44,1.97)	<0.001	1.48 (1.25, 1.74)	<0.001
Security status of province				
Secure	–	–	–	–
Semi secure	1.12 (1.01, 1.23)	0.019	1.24 (1.12, 1.38)	<0.001
Insecure	1.98 (1.77, 2.20)	<0.001	1.44 (1.28, 1.60)	<0.001

[38–41]. Harris et al., in a study in India, found that 62% of households changed their diets (especially to the detriment of healthy foods) since the outbreak of COVID-19, and approximately 50% reported falls in consumption of

fruits [42]. In a systematic review of 35 primary studies, it was found that the impact of the pandemic has been particularly adverse on households with low socio-economic status and those living in rural and deprived areas [43].

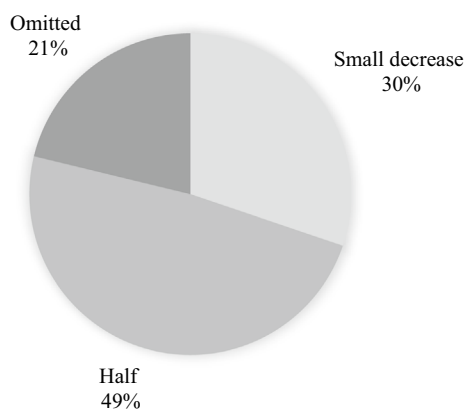


Fig. 2 The amount of decrease in fruits consumption in the studied households (%) during lockdown period among those households who reported decreased fruits consumption

It is worth noting that there were extensive job losses and income decrements in the world, including Iran, due to COVID-19, [11] and food-insecure households are much more likely to be sensitive to these changes in household income and employment status [44]. Indeed, some studies showed that the COVID-19 pandemic had changed the eating behaviors of food-insecure households, where such changes may be attributed to higher stress levels, fewer resources, and less access to food, leading to restrictions on food quantity and quality, including fruits and vegetables [45]. On the other hand, fluctuations in prices and availability that are usually seen during natural disasters have occurred as a result of the pandemic [46]. Therefore, fruit and vegetable demand are very inconsistent, and COVID-19 is likely to increase fruit and vegetable prices [47], both as a cause and consequence of food shortages.

Fear of contamination was ranked as the second reason for the reduction in fruit and snack consumption. This finding is consistent with those reported by Pakravan-Charvadeh et al. [11] and Kaya et al., [48] in Iran and Turkey who found that fruits and vegetables consumption had reduced among people due to the fear of virus contamination from the surfaces.

The prominent reason for increasing fruit consumption during the COVID-19 lockdown was boosting the immune system; which may be attributed to the observation that COVID-19 has made people more conscious of the amount of immune-boosting foods in their diet [49].

A greater tendency and increasing free time were the most frequent reasons reported for snack consumption.

Table 3 Ordered logistic regression models of decrease in fruit consumption among households whose fruit intake was decreased during COVID-19 lockdown

Variables	Fruit		
	Odds Ratio	95%CI	p value
Gender of household head			
Men	–	–	–
Women	1.02	0.82, 1.26	0.836
Urban/Rural			
Urban	–	–	–
Rural	1.16	1.01, 1.33	0.033
Family members			
01-Feb	–	–	–
03-May	1.05	0.87, 1.27	0.589
> 6	1.3	1.02, 1.64	0.03
High risk members			
No	–	–	–
< 5 years	1.06	0.93, 1.22	0.345
Pregnant/lactating mothers	0.91	0.67, 1.23	0.554
Elder	1.02	0.83, 1.25	0.803
More than one	1.15	0.95, 1.39	0.127
Occupation			
Employee	–	–	–
Freelance	0.94	0.73, 1.20	0.646
Retired	1.15	0.87, 1.52	0.32
Health workers	0.99	0.61, 1.59	0.976
Teacher	1.27	0.89, 1.80	0.179
Driver	0.99	0.71, 1.37	0.956
other	1.21	0.94, 1.57	0.13
Change in income			
No changes	–	–	–
Low decrease	0.9	0.75, 1.08	0.281
Half	1.63	1.34, 1.97	<0.001
Cut	2.95	2.40, 3.63	<0.001
Persons confirmed with COVID-19 in the households			
No	–	–	–
Yes	1.4	0.96, 2.04	0.074
Education			
Master/higher	–	–	–
Bachelor	1.36	1.03, 1.80	0.03
Associate	1.49	1.24, 2.20	0.001
Diploma	1.65	1.07, 2.07	0.017
High school	2.21	1.65, 2.98	<0.001
Security status of province			
Secure	–	–	–
Semi secure	1.28	1.08, 1.52	0.004
Insecure	1.72	1.43, 2.07	<0.001

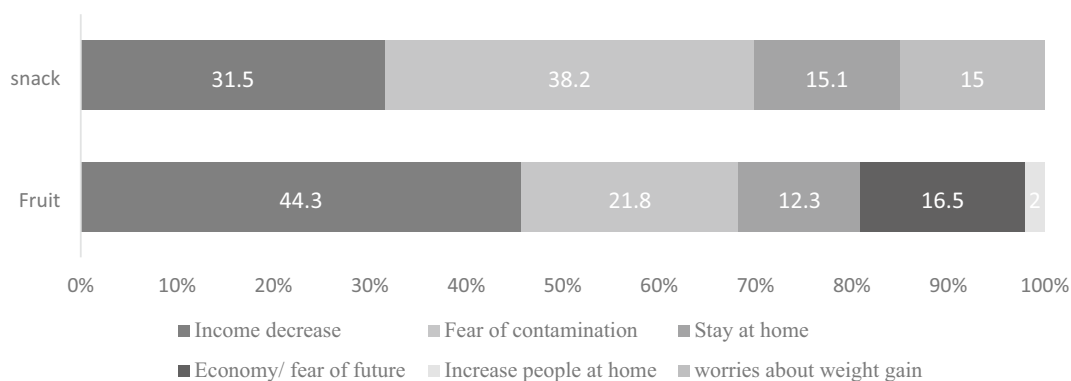


Fig. 3 Reasons for decrease in fruit and snack consumption during COVID-19 lockdown

Empirical evidence suggests that increasing free time is an incentive for increased snacking [50].

Moreover, we revealed that during the COVID-19 pandemic, female-headed households were likely to reduce their intake of fruits more than male-headed households. In accord to our results, studies conducted in Ethiopia and India have also shown that poorer and female-headed households have some of the lowest levels of dietary diversity and food security indices. [51] Nevertheless, in our investigation, the causes of these alterations were mostly related to cultural and financial poverty resulting in skipping healthy foods [43, 52].

Based on the present study, having high-risk household members was positively associated with decreased consumption of fruits and snacks. Thus, the pandemic may affect people's nutrition quality and quantity, particularly among the at-risk population [53]. Though epidemic lockdown-induced changes in dietary habits may be temporary in other communities, the concomitance of the epidemic with accelerated inflation in Iran may make these changes longstanding [14]. The importance of this issue lies in the fact that the pre-epidemic per capita consumption of fruits and vegetables were 160 and 248 g/d, respectively [26] which were already less than the recommended daily intake for health promotion [54]. While the amount of vegetable consumption showed a little change 2 years after the epidemic (~237 g/d), that of fruits decreased further (~139 g/d) [26]. Therefore, these dietary changes can adversely affect general health and potentially increase the susceptibility of the population to several diseases [55, 56].

This was the first nationwide study on changes in dietary habits of Iranian households during the COVID-19 epidemic. Nevertheless, some limitations regarding the present survey should be noted. First, the

study participants were chosen randomly and recruited voluntarily via snowball sampling, which may have introduced some bias into the recruited sample. Second, since the questionnaire was self-administrated, only people motivated by an interest in the topic might have participated in the survey. In addition, online surveys tend to exclude those people who are not web-illiterate, as well as older people. The above-listed limitations are common in online surveys, which are currently very common [30, 57, 58]. Nevertheless, these types of surveys are preferred over face-to-face interviews due to offering the possibility of gathering data from a distance during the COVID-19 pandemic [59, 60]. Notwithstanding, correspondence of the mean household size and the ratio of urban to rural households with the latest report of population census in Iran [61] indicates that the study population was representative of the whole country households. Another important limitation of this study is that it failed to define the type of snacks as healthy or unhealthy foods.

Conclusion

A significant decline in fruit and snack consumption because of COVID-19 lockdown was seen among Iranian households. Several factors including lower education, female-headed households, having high-risk family members, decrease in income, crowded households, residing in rural areas, and food insecure provinces, were associated with unhealthy changes of uneating behavior. Nevertheless, the main reasons were income decrease and fear of contamination showing the importance of food assistance and public health messaging about healthy eating more than ever. The present findings will help officials and policymakers to develop and implement regulations for similar situations.

Implications for policy making and interventions

- We found a remarkable decrease in fruits and snacks consumption among Iranian households during epidemic lockdown. Those households who were female-headed, resided in rural areas, low-income and more crowded tended to have more decrement in consumption frequency of fruits.
- Inadequate fruits consumption can bring about serious health consequences.
- Considering the economic conditions of Iran, it is plausible that these changes in dietary habits become long-lasting.
- Policy-making and strategies must be toward supportive interventions, including supplementation, home fortification and food baskets for needy households.

Abbreviations

COVID-19 Coronavirus disease of 2019
 NNFTRI National Nutrition and Food Technology Research Institute
 WHO World Health Organization

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Author contributions

All authors made substantial contributions to the conception and design of the work; the acquisition, analysis and interpretation of data for the work. MA and AD drafted the manuscript, TRN and CCTC revised the manuscript critically for important intellectual content. All authors gave final approval of the version to be published and agree to be accountable for all aspects of the work. MA: conceptualization (equal), investigation (equal), methodology (equal), validation (equal), writing, review and editing (equal); AD: conceptualization (equal), investigation (equal), methodology (equal); validation (equal), writing, review and editing (equal); BN: conceptualization (equal), statistical analyses, investigation (equal), methodology (equal); validation (equal); CCTC: conceptualization (equal), writing, review and editing (equal); SR: conceptualization (equal), investigation (equal); methodology (equal); validation (equal); DG: conceptualization (equal); investigation (equal); methodology (equal); validation (equal); HR: conceptualization (equal), investigation (equal); methodology (equal); validation (equal); software (equal); ZA: conceptualization (equal), supervision (equal); validation (equal), arrangement with health deputies of the provincial medical universities; MM: conceptualization (equal); supervision (equal); validation (equal), arrangement with health deputies of the provincial medical universities; FSG: conceptualization (equal), supervision (equal), validation (equal), arrangement with health deputies of the provincial medical universities; TRN: conceptualization (equal); investigation (equal); methodology (equal); project administration (leader); supervision (main supervisor); validation (equal); writing, review and editing (equal).

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Availability of data and materials

The data sets generated and/or analyzed during this study are not publicly available because of the use of data for further publications but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures were approved by Ethics Committee of the National Nutrition and Food Technology Research Institute (IR.SBMU. NNFTRI.REC.1399.066). All participants were properly instructed and gave online their informed consent to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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