Applied nutritional investigation

Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The CASPIAN-IV study

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ABSTRACT

Objectives: The consumption of high energy and low nutritional content foods, which are known as junk foods, has increased. The aim of this study was to evaluate the association between junk food intake and mental health in a national sample of Iranian children and adolescents.
Method: Data were obtained from a surveillance system entitled CASPIAN-IV (Childhood and Adolescence Surveillance and Prevention of Adult Non communicable Disease) study of school students, ages 6 to 18 y in Iran. The students and their parents completed two sets of reliable questionnaires obtained from Global School Health Survey translated to Persian. The student questionnaire comprised several questions such as psychiatric distress (worry, depression, confusion, insomnia, anxiety, aggression, and worthless) and violent behaviors (physical fighting, being a victim, and bullying). The junk foods consisted of sweets, sweetened beverages, fast foods, and salty snacks.
Results: In the sample of 13 486 children and adolescents, the frequency of junk food consumption was significantly associated with psychiatric distress ($P < 0.001$). There was a significant association between violent behaviors and intake of junk foods ($P < 0.001$) except for sweets, whereas the association between sweetened beverages consumption and being a victim was not significant ($P > 0.05$). Additionally, the results of logistic regression showed that daily consumption of sweetened beverages and snacks significantly increased the odds of self-

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reported psychiatric distress. Also, daily consumption of salty snacks was significantly associated with violent behavior, including physical fighting (odds ratio [OR], 1.39; 95% confidence interval [CI], 1.21–1.60), being a victim (OR, 1.19; 95% CI, 1.04–1.37), and bullying (OR, 1.55; 95% CI, 1.32–1.82).

Conclusion: Junk food consumption may increase the risk for psychiatric distress and violent behaviors in children and adolescents. Improvement of eating habits toward healthier diets may be an effective approach for improving mental health.

Introduction

In recent decades, consumption of high-energy foods and drinks has increased. The association between weight status and total energy intake indicates the key role of a healthy diet [1–3]. Foods such as chocolate, sweetened drinks, nut-based spreads, and snacks such as crisps, chocolate bars, or candies, which are high in fat, salt, and/or sugar but low in nutritional content are referred to as *junk foods*.

The findings of some studies show that the intake of total energy, total carbohydrates, confectionary, soft drinks and fast foods has significantly increased in children, leading to an alarming rise of obesity [4,5].

Current epidemiologic data show that at least 20% of children and adolescents suffer from a mental health problem and up to 50% of these problems onset in adolescence. In other words, adolescence is a substantial period for development of mental disorders [6]. The World Health Organization considers mental health problems to be a main health issue in adolescence. It is estimated that by 2020, it will be one of the most crucial health problems in the world [7]. Thus, identifying factors contributing to mental health problems as expressed in behavioral and mood is of high importance in children and adolescents.

Recent evidence suggests a link between common mood and dietary patterns. For example, in Western countries, whereas eating patterns containing high amounts of red meat and confectionary have been linked with poorer mental health in early adolescents, higher intake of fruits and green vegetables were associated with better behavioral outcomes [8]. Furthermore, it has been shown that a healthy diet is associated with better mood and cognition in older adults [9].

Considering the significant role of eating patterns on mental health, the aim of this survey was to investigate the association between junk food consumption and self-reported mental health in a national sample of Iranian children and adolescents.

Table 1
Questions used to screen psychiatric distress and violent behaviors according to Global School-based Student Health Survey questionnaires

Question	Response
Psychiatric distress	
During the past 6 mo, how often did you experience a feeling of worthlessness so that you could not perform your daily activities?	1. Almost Every day (considered as yes)
During the past 6 mo, how often did you experience aggression so that you could not perform your daily activities?	2. More Than once a week (considered as yes)
During the past 6 mo, how often did you experience anxiety so that you could not perform your daily activities?	3. Almost Every week (considered as yes)
During the past 6 mo, how often did you experience insomnia so that you could not perform your daily activities?	4. Almost Every month (considered as no)
During the past 6 mo, how often did you experience confusion so that you could not perform your daily activities?	5. Rarely Or never (considered as no)
During the past 12 mo, did you ever feel sad or hopeless?	1. Yes
	2. No
During the past 12 mo, how often have you been so worried about something that you could not sleep at night?	1. Never (considered as no)
	2. Rarely (considered as no)
	3. Sometimes (considered as no)
	4. Most of the time (considered as yes)
	5. Always (considered as yes)
Violent behaviors	
During the past 12 mo, how many times have you been in a physical fight?	1. None (considered as no)
	2. 1 times (considered as yes)
	3. 2 times (considered as yes)
	4. 3 times (considered as yes)
	5. 4 times (considered as yes)
During the past 3 mo, how many times were you bullied?	1. None (considered as no)
	2. 1–2 times (considered as yes)
	3. 2–3 times (considered as yes)
	4. 4 times or more (considered as yes)
During the past 3 mo, how many times did you bully someone?	1. None (considered as no)
	2. 2–3 times (considered as yes)
	3. 4 times or more (considered as yes)

Table 2
Baseline characteristics of the participants: The CASPIAN-IV study

Variable	6–10 y (%)	11–14 y (%)	15–19 y (%)	Overall (%)	P- value*
Family size					
<4	2489 (58)	2275 (49)	1727 (39)	6491 (49)	<0.001
>4	1728 (42)	2323 (51)	2669 (61)	6774 (51)	
Father's occupation					
Unemployed or deceased	185 (4)	236 (5)	236 (5)	657 (5)	0.39
Worker or government employee	1991 (47)	2137 (47)	1944 (46)	6072 (47)	
Farmer	375 (9)	434 (10)	426 (10)	1235 (9)	
Self- employed	1686 (40)	1734 (38)	1640 (39)	5060 (39)	
Mother's occupation					
Housekeeper or deceased	3854 (89)	4093 (88)	3933 (89)	11 880 (89)	0.45
Worker or government employee	322 (7)	394 (9)	343 (8)	1059 (8)	
Other	126 (3)	156 (3)	127 (3)	409 (3)	
Father's education					
Illiterate/elementary school	393 (9)	484 (11)	594 (14)	1471 (11)	<0.001
Secondary school/high school	3256 (76)	3430 (75)	3099 (72)	9785 (75)	
University	614 (15)	637 (14)	579 (14)	1830 (14)	
Mother's education					
Illiterate/elementary school	616 (14)	729 (16)	925 (21)	2270 (17)	<0.001
Secondary school/high school	3244 (75)	3515 (76)	3163 (72)	9922 (74)	
University	450 (11)	397 (8)	319 (7)	1166 (9)	
Sedentary lifestyle					
Watching TV					
≤2 h/d	2510 (58)	2220 (48)	1852 (42)	6582 (49)	<0.001
>2 h/d	1781 (42)	2418 (52)	2560 (58)	6759 (51)	
Working on computer					
≤2 h/d	4013 (96)	4147 (91)	3656 (84)	11 816 (90)	<0.001
>2 h/d	175 (4)	387 (9)	698 (16)	1260 (10)	
Screen time					
≤4 h/d	3901 (90)	3781 (81)	3214 (73)	10896 (81)	<0.001
>4 h/d	410 (10)	870 (19)	1213 (27)	2493 (19)	
Physical activity					
Mild	1180 (27)	1431 (31)	1941 (44)	4552 (34)	<0.001
Moderate	1623 (38%)	1794 (39%)	1491 (34%)	4908 (36%)	
Severe	1488 (35)	1415 (30)	982 (22)	3885 (39)	
Socioeconomic status					
Low	1428 (36)	1421 (33)	1297 (32)	4146 (34)	0.02
Medium	1379 (34)	1429 (33)	1291 (32)	4099 (33)	
High	1220 (30)	1443 (34)	1478 (36)	4141 (33)	
Family history					
Hypertension	2243 (52)	2506 (54)	2414 (55)	7163 (54)	0.20
Dyslipidemia	1783 (42)	2048 (44)	2057 (47)	5888 (44)	<0.001
Diabetes mellitus	1052 (36)	1676 (37)	1678 (39)	4856 (37)	0.02
Obesity	1844 (43)	2135 (46)	2099 (48)	6078 (45)	0.003
Body mass index					
Underweight	542 (13)	640 (14)	439 (10)	1621 (12)	<0.001
Normal	2940 (68)	2836 (62)	3054 (69)	8830 (66)	
Overweight	322 (7)	487 (10)	478 (11)	1287 (10)	
Obese	495 (12)	637 (14)	452 (10)	1584 (12)	
Body image					
Thin	1934 (45)	1423 (31)	1237 (28)	4594 (34)	<0.001
Normal	1859 (43)	2241 (48)	2457 (49)	6257 (47)	
Obese	538 (12)	995 (21)	1045 (23)	2578 (19)	
Passive smoking					
Yes	1413 (33)	1551 (34)	1593 (36)	4557 (34.5)	0.03
No	2835 (67)	3043 (66)	2772 (64)	8650 (65.5)	
Current smoking					
Yes	22 (0.5)	55 (1)	272 (6)	349 (2)	<0.001
No	4327 (99.5)	4623 (99)	4183 (94)	13133 (98)	

* Comparisons based on χ^2 test.

Methods and material

Participants

The data of the present study was obtained from the fourth survey of the school-based surveillance system entitled CASPIAN (Childhood and Adolescence Surveillance and Prevention of Adult Non communicable Disease) study. The aim of this study was to investigate nationally representative high-risk behaviors in school students in Iran (2011–2012). The methods of CASPIAN IV were described previously [10].

The participants in this nationwide study were elementary, intermediate, and high school students selected from 30 provinces of Iran by a cluster sampling method. Participants (N = 13 486) were ages 6 to 18 y (12.47 ± 3.36 y) and included 6640 girls. These students were stratified according to grade in school and residential area (urban or rural).

Measurements

Two sets of valid and reliable questionnaires obtained from the Global School Health Survey (GSHS) in Persian were completed for students and their parents.

Table 3
Prevalence of psychiatric distress and violence behavior by gender: The CASPIAN-IV study

Variable	Boys (%)	Girls (%)	Total (%)	P-value*
Psychiatric distress				
Worthlessness	581 (9)	801 (12)	1382 (10)	<0.001
Aggression	2395 (35)	2641 (40)	5036 (38)	<0.001
Anxiety	1469 (22)	1901 (29)	3370 (25)	<0.001
Insomnia	1016 (15)	1124 (17)	2140 (16)	0.01
Confusion	531 (8)	621 (9)	1152 (9)	0.01
Depression	1296 (19)	1498 (23)	2794 (21)	<0.001
Worried	1600 (24)	2322 (35)	3922 (29)	<0.001
Violent behavior				
Bullying	1405 (21)	942 (14)	2347 (18)	<0.001
Victim	2006 (29)	1664 (25)	3670 (27)	<0.001
Physical fighting	3295 (48)	2057 (31)	5352 (40)	<0.001

* Comparisons based on χ2 test.

The student questionnaire comprised physical activity, body image, screen time, passive and current smoking, violent behaviors, psychiatric distress, and so on. Psychiatric distress included worry, depression, confusion, insomnia, anxiety, aggression, and feelings of being worthless; violent behaviors included physical fighting, being a victim, and bullying, which were assessed by the questions shown in Table 1.

Additionally, the parents' questionnaire included concerns such as family size, socioeconomic status, parents' occupation, and family history. Trained personnel were asked to complete the questionnaire in a suitable atmosphere in the schools. Moreover, an expert team conducted and controlled the procedure.

Junk foods were defined as four groups including sweets (biscuits, cookies, cakes, chocolates, candies), sweetened beverages (soda, soft drinks), fast foods (hot dogs, hamburgers, cheeseburgers, fried chicken, pizza), and salty snacks (chips, cheese curls, popcorn, pretzels). The students were asked how often they consume one of these junk foods (seldom, weekly, or daily).

To calculate the body mass index of participants, school health professionals measured students' height and weight. Weight and height were measured with an accuracy of 0.1 kg and 0.1 cm, respectively.

Ethical approval was obtained from ethical committees and other relevant national regulatory organizations, and participants signed informed consent after receiving explanation of the study protocols.

Statistical analyses

The statistical analyses were conducted using STATA package (Stata statistical software: Release 12, StataCorp 2011, College Station, TX, USA). The qualitative variables were presented as number and percentage and quantitative variables as mean and SD. The analysis of categorical variables was performed using the Pearson χ^2 test. To evaluate the association between mental health and junk foods, a logistic regression with four models was used adjusting for possible confounders. In these models, each of the junk foods and mental factors were considered as independent and dependent variables. $P < 0.05$ was considered statistically significant.

Results

The participants included 13 486 students (6640 girls) ages 6 to 18 y. Baseline characteristic data are shown in Table 2. The mean age of the students was 12.47 ± 3.36 y. Prevalence of psychiatric distress and violent behaviors by sex are presented in Table 3. As this table shows, the prevalence of psychiatric distress is significantly higher in girls, whereas violent behaviors are more prevalent among boys. Feelings of anger and physically fighting were the most reported psychiatric distress and violent behavior.

The association between psychiatric distress and junk food consumption is presented in Table 4. There was a significant association between psychiatric distress and all four groups of junk foods ($P < 0.001$). Also, the relationship between violent behavior and consumption of junk foods is shown in Table 5. As presented, there was a significant association between

Table 4
Association between frequency of junk food consumption and psychiatric distress: The CASPIAN-IV study

Variable	Sweets			Sweetened beverages			Fast foods			Salty snacks		
	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)	Weekly (%)	Daily (%)
Feeling worthless												
Yes	369 (27)	503 (36)	508 (37)	438 (32)	599 (43)	344 (25)	940 (68)	366 (27)	69 (5)	642 (47)	490 (35)	246 (18)
No	2776 (23)	5101 (43)	4027 (34)	3804 (32)	5781 (49)	2325 (19)	8746 (73)	2843 (24)	309 (3)	6127 (52)	4305 (36)	1461 (12)
P-value*	<0.001			<0.001			<0.001			<0.001		
Aggression												
Yes	1236 (25)	1951 (39)	1838 (36)	1515 (30)	2360 (47)	1156 (23)	3459 (67)	1402 (28)	162 (32)	2342 (47)	1846 (37)	831 (16)
No	1925 (23)	3663 (44)	2709 (33)	2746 (33)	4026 (49)	1529 (18)	6256 (75)	1818 (22)	217 (26)	4453 (54)	2953 (35)	886 (11)
P-value	<0.001			<0.001			<0.001			<0.001		
Anxiety												
Yes	905 (27)	1296 (39)	1160 (34)	966 (29)	1575 (47)	823 (24)	2313 (69)	909 (27)	137 (4)	1610 (48)	1201 (36)	544 (16)
No	2267 (23)	4325 (43)	3398 (34)	3301 (33)	4827 (48)	1869 (19)	7424 (74)	2316 (23)	245 (3)	5201 (52)	3608 (36)	1176 (12)
P-value	<0.001			<0.001			<0.001			<0.001		
Insomnia												
Yes	573 (27)	771 (36)	791 (37)	614 (29)	954 (44)	570 (27)	1411 (66)	626 (29)	100 (5)	992 (47)	774 (36)	365 (17)
No	2582 (23)	4841 (43)	3755 (34)	3640 (32)	5437 (49)	2107 (19)	8300 (74)	2590 (23)	277 (3)	5798 (52)	4025 (36)	1347 (12)
P-value	<0.001			<0.001			<0.001			<0.001		
Confusion												
Yes	295 (26)	436 (38)	420 (36)	306 (26)	515 (45)	329 (29)	749 (65)	339 (30)	61 (5)	523 (45)	399 (35)	227 (20)
No	2856 (23)	5169 (43)	4125 (34)	3943 (33)	5871 (48)	2345 (19)	8953 (74)	2872 (24)	318 (2)	6262 (52)	4396 (36)	1482 (12)
P-value	0.01			<0.001			<0.001			<0.001		
Depression												
Yes	735 (26)	1095 (39)	595 (35)	845 (30)	1255 (45)	691 (25)	1942 (70)	724 (26)	123 (4)	1369 (49)	978 (35)	440 (16)
No	2415 (23)	4504 (43)	3578 (34)	3397 (32)	5123 (49)	1983 (19)	7749 (74)	2481 (24)	257 (2)	5403 (52)	3816 (36)	1267 (12)
P-value	<0.001			<0.001			<0.001			<0.001		
Worried												
Yes	1010 (26)	1536 (39)	1374 (35)	1244 (32)	1811 (46)	865 (22)	2723 (70)	2143 (27)	250 (3)	1898 (48)	1408 (36)	609 (16)
No	2143 (23)	4068 (43)	3163 (34)	3006 (32)	4574 (49)	1801 (19)	6974 (74)	2143 (23)	250 (3)	4889 (52)	3378 (36)	1099 (12)
P-value	<0.001			0.001			<0.001			<0.001		

* Comparisons based on χ2 test.

Table 5
Association between frequency of junk food consumption and violent behavior: The CASPIAN IV study

Variable	Sweets			Sweetened beverages			Fast foods			Salty snacks		
	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)	Seldom (%)	Weekly (%)	Daily (%)	Seldom (%)
Physical fighting												
Yes	1255 (24)	2311 (43)	1772 (33)	1540 (29)	2626 (49)	1178 (22)	3682 (69)	1472 (28)	186 (3)	2522 (47)	2017 (38)	794 (15)
No	1910 (24)	3323 (41)	2792 (35)	2733 (34)	3780 (47)	1515 (19)	6075 (76)	1755 (22)	195 (2)	4292 (53)	2798 (35)	929 (12)
P-value*	0.11			<0.001			<0.001			<0.001		
Victim												
Yes	864 (24)	1546 (42)	1254 (34)	1139 (31)	1766 (48)	760 (21)	2616 (71)	939 (26)	108 (3)	1792 (49)	1347 (37)	520 (15)
No	2306 (24)	4093 (42)	3311 (34)	3140 (32)	4645 (48)	1933 (20)	7149 (74)	2290 (23)	273 (3)	5028 (52)	3474 (36)	1202 (12)
P-value	0.98			0.35			<0.001			0.005		
Bullying												
Yes	576 (25)	939 (40)	827 (35)	657 (28)	1130 (48)	557 (24)	1580 (67)	657 (28)	107 (5)	1031 (44)	906 (39)	401 (17)
No	2588 (23)	4676 (43)	3719 (34)	3605 (33)	5258 (48)	2127 (19)	8254 (74)	2557 (23)	274 (3)	5763 (53)	3895 (35)	1318 (12)
P-value	0.11			<0.001			<0.001			<0.001		

* Comparisons based on χ2 test.

Table 6
Odds ratios (95% CI) of The frequency of junk food consumption and psychiatric distress: The CASPIAN-IV study

Variable	Worthlessness Or (95% CI)	Aggression Or (95% CI)	Anxiety Or (95% CI)	Insomnia OR (95% CI)	Confusion Or (95% CI)	Depression OR (95% CI)	Worried Or (95% CI)
Sweets							
Model I*							
Seldom	1	1	1	1	1	1	1
Weekly	0.74 (0.63–0.86)	0.82 (0.75–0.91)	0.75 (0.67–0.83)	0.71 (0.63–0.81)	0.81 (0.69–0.96)	0.79 (0.71–0.89)	0.80 (0.72–0.88)
Daily	0.94 (0.82–1.09)	1.05 (0.95–1.17)	0.85 (0.76–0.95	0.94 (0.83–1.07)	0.98 (0.83–1.15)	0.88 (0.78–0.98)	0.92 (0.83–1.02)
Model II†							
Seldom	1	1	1	1	1	1	1
Weekly	0.81 (0.69–0.95)	0.90 (0.81–0.99)	0.83 (0.75–0.93)	0.78 (0.69–0.89)	0.89 (0.76–1.05)	0.88 (0.79–0.99)	0.90 (0.81–0.99)
Daily	1.01 (0.88–1.17)	1.14 (1.03–1.26)	0.93 (0.83–1.04)	1.03 (0.90–1.17)	1.06 (0.90–1.25)	0.96 (0.85–1.08)	1.01 (0.91–1.12)
Model III‡							
Seldom	1	1	1	1	1	1	1
Weekly	0.82 (0.69–0.97)	0.93 (0.83–1.03)	0.82 (0.73–0.92)	0.75 (0.65–0.87)	0.88 (0.73–1.05)	0.90 (0.80–1.01)	0.90 (0.81–1.01)
Daily	0.99 (0.84–1.15)	1.16 (1.03–1.29)	0.88 (0.78–0.99)	0.93 (0.81–1.07)	1.03 (0.86–1.23)	0.96 (0.85–1.10)	0.99 (0.88–1.11)
Model IV§							
Seldom	1	1	1	1	1	1	1
Weekly	0.81 (0.69–0.96)	0.93 (0.83–1.04)	0.82 (0.73–0.92)	0.74 (0.64–0.86)	0.88 (0.73–1.05)	0.90 (0.80–1.01)	0.90 (0.81–1.01)
Daily	0.97 (0.83–1.14)	1.06 (1.03–1.30)	0.88 (0.78–1.00)	0.92 (0.80–1.06)	1.01 (0.84–1.21)	0.96 (0.85–1.09)	0.98 (0.87–1.10)
Sweetened beverages							
Model I*							
Seldom	1	1	1	1	1	1	1
Weekly	0.89 (0.78–1.03)	1.06 (0.97–1.16)	1.11 (1.01–1.22)	1.04 (0.92–1.16)	1.13 (0.96–1.32)	0.98 (0.88–1.09)	0.95 (0.87–1.04)
Daily	1.28 (1.09–1.50)	1.37 (1.22–1.52)	1.50 (1.33–1.69)	1.60 (1.40–1.83)	1.80 (1.51–2.15)	1.40 (1.23–1.59)	1.16 (1.03–1.29)
Model II†							
Seldom	1	1	1	1	1	1	1
Weekly	0.92 (0.80–1.05)	1.07 (0.98–1.17)	1.14 (1.03–1.26)	1.04 (0.92–1.17)	1.14 (0.97–1.34)	0.98 (0.89–1.09)	0.98 (0.89–1.08)
Daily	1.29 (1.10–1.51)	1.36 (1.21–1.51)	1.52 (1.35–1.73)	1.57 (1.37–1.80)	1.78 (1.50–2.13)	1.37 (1.21–1.56)	1.18 (1.05–1.32)
Model III‡							
Seldom	1	1	1	1	1	1	1
Weekly	0.93 (0.80–1.08)	1.06 (0.96–1.16)	1.12 (1.00–1.24)	1.03 (0.91–1.16)	1.11 (0.93–1.32)	0.96 (0.86–1.08)	0.99 (0.89–1.10)
Daily	1.26 (1.06–1.49)	1.30 (1.15–1.47)	1.47 (1.29–1.69)	1.46 (1.27–1.69)	1.69 (1.40–2.04)	1.40 (1.22–1.61)	1.15 (1.01–1.31)
Model IV§							
Seldom	1	1	1	1	1	1	1
Weekly	0.93 (0.80–1.07)	1.05 (0.95–1.16)	1.12 (1.01–1.25)	1.02 (0.90–1.15)	1.10 (0.92–1.32)	0.96 (0.86–1.08)	0.99 (0.89–1.10)
Daily	1.25 (1.05–1.48)	1.30 (1.15–1.47)	1.48 (1.29–1.69)	1.46 (1.27–1.69)	1.66 (1.37–2.00)	1.41 (1.23–1.61)	1.14 (1.00–1.30)
Fast foods							
Model I*							
Seldom	1	1	1	1	1	1	1
Weekly	1.19 (1.04–1.37)	1.39 (1.27–1.52)	1.25 (1.14–1.38)	1.42 (1.27–1.58)	1.41 (1.21–1.63)	1.61 (1.05–1.29)	1.27 (1.16–1.39)
Daily	2.07 (1.58–2.73)	1.35 (1.09–1.66)	1.79 (1.45–2.21)	2.12 (1.66–2.70)	2.29 (1.70–3.08)	1.90 (1.52–2.38)	1.31 (1.04–1.64)
Model II†							
Seldom	1	1	1	1	1	1	1
Weekly	1.11 (0.97–1.28)	1.31 (1.19–1.43)	1.15 (1.04–1.27)	1.31 (1.17–1.47)	1.31 (1.13–1.51)	1.05 (0.95–1.17)	1.17 (1.07–1.29)
Daily	1.83 (1.38–2.43)	1.17 (0.95–1.45)	1.53 (1.22–1.91)	1.81 (1.41–2.32)	1.97 (1.45–2.67)	1.60 (1.26–2.01)	1.10 (0.87–1.41)
Model III‡							
Seldom	1	1	1	1	1	1	1
Weekly	1.11 (0.96–1.30)	1.23 (1.11–1.36)	1.10 (0.99–1.23)	1.28 (1.13–1.44)	1.26 (1.07–1.47)	1.07 (0.96–1.20)	1.14 (1.03–1.27)
Daily	1.62 (1.19–2.21)	1.01 (0.80–1.29)	1.40 (1.10–1.79)	1.69 (1.30–2.21)	1.68 (1.19–2.36)	1.49 (1.16–1.92)	1.04 (0.80–1.36)

(Continued)

Table 6 (*Continued*)

Variable	Worthlessness Or (95% CI)	Aggression Or (95% CI)	Anxiety Or (95% CI)	Insomnia OR (95% CI)	Confusion Or (95% CI)	Depression OR (95% CI)	Worried Or (95% CI)
Model IV[§]							
Seldom	1	1	1	1	1	1	1
Weekly	1.11 (0.95–1.29)	1.24 (1.12–1.37)	1.10 (0.99–1.23)	1.29 (1.14–1.46)	1.24 (1.06–1.46)	1.07 (0.95–1.20)	1.14 (1.02–1.26)
Daily	1.60 (1.17–2.18)	1.01 (0.80–1.29)	1.42 (1.11–1.81)	1.69 (1.29–2.21)	1.69 (1.20–2.39)	1.50 (1.16–1.94)	1.05 (0.81–1.37)
Salty snacks							
Model I[*]							
Seldom	1	1	1	1	1	1	1
Weekly	1.08 (0.95–1.23)	1.18 (1.08–1.29)	1.07 (0.98–1.17)	1.12 (1.00–1.25)	1.08 (0.94–1.25)	1.01 (0.91–1.11)	1.07 (0.98–1.17)
Daily	1.60 (1.36–1.89)	1.78 (1.57–2.02)	1.49 (1.31–1.70)	1.58 (1.37–1.82)	1.83 (1.54–2.18)	1.37 (1.19–1.56)	1.42 (1.25–1.61)
Model II[†]							
Seldom	1	1	1	1	1	1	1
Weekly	1.03 (0.91–1.18)	1.15 (1.05–1.26)	1.02 (0.93–1.12)	1.08 (0.97–1.21)	1.04 (0.90–1.20)	0.96 (0.87–1.06)	1.01 (0.92–1.11)
Daily	1.48 (1.25–1.74)	1.69 (1.50–1.92)	1.37 (1.20–1.56)	1.48 (1.29–1.71)	1.71 (1.44–2.04)	1.27 (1.11–1.45)	1.29 (1.14–1.47)
Model III[‡]							
Seldom	1	1	1	1	1	1	1
Weekly	1.01 (0.88–1.16)	1.11 (1.01–1.22)	0.99 (0.89–1.09)	1.03 (0.92–1.16)	0.94 (0.81–1.10)	0.96 (0.86–1.07)	0.99 (0.89–1.09)
Daily	1.29 (1.08–1.55)	1.52 (1.33–1.74)	1.24 (1.07–1.43)	1.33 (1.14–1.56)	1.51 (1.24–1.84)	1.24 (1.07–1.43)	1.20 (1.04–1.39)
Model IV[§]							
Seldom	1	1	1	1	1	1	1
Weekly	1.00 (0.87–1.15)	1.10 (1.00–1.22)	0.98 (0.89–1.09)	1.02 (0.90–1.15)	0.93 (0.79–1.08)	0.95 (0.85–1.06)	0.98 (0.88–1.08)
Daily	1.30 (1.08–1.56)	1.52 (1.33–1.73)	1.25 (1.08–1.44)	1.34 (1.14–1.56)	1.52 (1.25–1.85)	1.24 (1.07–1.43)	1.20 (1.04–1.38)

[*] Without adjusted (crude model).
[†] Adjusted for age and sex.
[‡] Additionally adjusted for family history of chronic diseases, mother's education, screen time, physical activity, socioeconomic status.
[§] Additionally adjusted for body mass index.

violent behaviors and junk food consumption ($P < 0.01$) except for the intake of sweets. Additionally, consumption of sweetened beverages was not associated with being a victim ($P > 0.05$).

Table 6 presents the association parameters (odds ratio [OR] and 95% confidence interval [C]) of junk food consumption with psychiatric distress from logistic regression models. In the multivariate model (model IV), those who consumed sweetened beverages and salty snacks daily (compared with seldom eaters) had a significantly higher risk for self-reported psychiatric distress. The OR for junk food consumption and violent behaviors are shown in Table 7. The multivariate model (model IV) showed a significant association between daily consumption (compared with seldom eaters) of salty snacks and all violent behaviors, including physically fighting (OR, 1.39; 95% CI, 1.21–1.60), being the victim (OR, 1.19; 95% CI, 1.04–1.37), and bullying (OR, 1.55; 95% CI, 1.32–1.82).

Discussion

The aim of the present study was to explore the association between junk food consumption and mental health of Iranian childhood and adolescents. In this study, we found a significant association between junk food consumption and mental health problems in this age group, independent of body mass index, screen time, socioeconomic status, physical activity, family history, and the other baseline characteristics. Students who consumed junk food on a daily basis were more likely to have mental health problems.

Our results are consistent with previous studies in which high intakes of junk food and unhealthy eating patterns were associated with mental health problems in adolescents [8,11–14]. The Western Australian Pregnancy Cohort (Raine) Study reported that Western dietary patterns with increased intakes of takeaway foods, confectionaries, and red meats were significantly associated with poorer behavioral outcomes in adolescents [8]. Also, two cohort studies in adolescents implicated that high consumption of unhealthy foods like sugar-sweetened soft drinks, sweets, chocolate, savory snacks, and fast foods was associated with high risk for behavioral problems and mental distress such as anxiety, dizziness, and feelings of worthlessness [15,16]. Additionally, a significant association between eating patterns and mental health such as psychiatric disorders has been reported [12]. It also has been found that there is an association between unhealthy diet (high consumption of salty snacks, sweets, and cakes) and violent behaviors in both boys and girls [17], whereas a healthy diet is considered a protective factor against depression and stress in girls [18].

Previous studies have explained the underlying causes of the relationship between mental health and eating patterns [19,20]. Unlike poor nutrient content of junk foods, adequate nutrient intake can improve mental health via several mechanisms. One possible mechanism is that normal functioning of the brain depends on a steady supply of nutrients. For example, folic acid, vitamin B_{12}, and polyunsaturated fatty acids are needed for proper functioning of central nervous system and may have an effect on mood via the synthesis of neurotransmitters, particularly serotonin [20–22].

The present study had several strengths and limitations. The main strength was its large national sample size and representative sample reflecting Iranian child and adolescent populations. Another strength was the assessment of lifestyle and socioeconomic factors that led to reducing the effects of possible confounders. Additionally, data collection was highly controlled. According to our knowledge, this is the first study to investigate the association between junk food consumption and mental health in Iran. The study's cross-sectional design was the main limitation and hence, follow-up surveys are

Table 7
Odds ratios (95% CI) of Frequency of Junk Food Consumption and Violent Behaviors: The CASPIAN-IV Study

Variable	Physical fighting OR (95% CI)	Victim OR (95% CI)	Bullying OR (95% CI)
Sweets			
Model I*			
Seldom	1	1	1
Weekly	1.05 (0.96–1.16)	1.00 (0.90–1.11)	0.90 (0.80–1.01)
Daily	0.96 (0.87–1.06)	1.01 (0.90–1.13)	0.99 (0.88–1.13)
Model II†			
Seldom	1	1	1
Weekly	1.07 (0.97–1.17)	0.98 (0.88–1.09)	0.93 (0.82–1.05)
Daily	0.98 (0.89–1.09)	0.99 (0.88–1.11)	10.4 (0.91–1.18)
Model III‡			
Seldom	1	1	1
Weekly	1.09 (0.98–1.20)	0.99 (0.88–1.10)	0.94 (0.83–1.08)
Daily	0.98 (0.88–1.010)	0.98 (0.87–1.11)	1.05 (0.91–1.21)
Model IV§			
Seldom	1	1	1
Weekly	1.08 (0.97–1.20)	0.98 (0.87–1.09)	0.94 (0.83–1.08)
Daily	0.98 (0.88–1.10)	0.97 (0.86–1.09)	1.05 (0.91–1.21)
Sweetened beverages			
Model I			
seldom	1	1	1
Weekly	1.23 (1.13–1.34)	1.04 (0.95–1.14)	1.17 (1.05–1.31)
Daily	1.37 (1.23–1.53)	1.08 (0.96–1.22)	1.43 (1.25–1.64)
Model II			
seldom	1	1	1
Weekly	1.16 (1.06–1.27)	1.03 (0.93–1.13)	1.13 (1.01–1.26)
Daily	1.26 (1.13–1.40)	1.06 (0.95–1.19)	1.33 (1.16–1.52)
Model III			
seldom	1	1	1
Weekly	1.16 (1.05–1.27)	1.03 (0.93–1.14)	1.14 (1.01–1.30)
Daily	1.25 (1.11–1.40)	1.04 (0.91–1.18)	1.29 (1.11–1.49)
Model IV			
seldom	1	1	1
Weekly	1.16 (1.06–1.28)	1.04 (0.94–1.15)	1.15 (1.02–1.31)
Daily	1.25 (1.11–1.40)	1.04 (0.91–1.18)	1.30 (1.12–1.51)
Fast foods			
Model I			
seldom	1	1	1
Weekly	1.38 (1.26–1.50)	1.12 (1.01–1.23)	1.32 (1.19–1.47)
Daily	1.57 (1.27–1.93)	1.08 (0.85–1.37)	2.01 (1.58–2.55)
Model II			
seldom	1	1	1
Weekly	1.32 (1.21–1.45)	1.12 (1.02–1.24)	1.25 (1.12–1.39)
Daily	1.41 (1.14–1.75)	1.09 (0.86–1.38)	1.78 (1.40–2.26)
Model III			
seldom	1	1	1
Weekly	1.27 (1.15–1.40)	1.08 (0.98–1.20)	1.14 (1.01–1.28)
Daily	1.39 (1.10–1.77)	1.06 (0.81–1.37)	1.50 (1.16–1.94)
Model IV			
seldom	1	1	1
Weekly	1.28 (1.16–1.41)	1.08 (0.97–1.20)	1.14 (1.01–1.28)
Daily	1.40 (1.10–1.78)	1.07 (0.82–1.39)	1.51 (1.17–1.96)
Salty snacks			
Model I			
seldom	1	1	1
Weekly	1.22 (1.12–1.33)	1.08 (0.99–1.18)	1.30 (1.17–1.44)
Daily	1.45 (1.29–1.63)	1.21 (1.07–1.37)	1.70 (1.47–1.96)
Model II			
seldom	1	1	1
Weekly	1.24 (1.14–1.35)	1.09 (1.00–1.20)	1.30 (1.17–1.44)
Daily	1.51 (1.33–1.71)	1.24 (1.09–1.40)	1.71 (1.48–1.97)
Model III			
seldom	1	1	1
Weekly	1.20 (1.10–1.32)	1.08 (0.99–1.19)	1.25 (1.12–1.40)
Daily	1.39 (1.21–1.60)	1.20 (1.04–1.37)	1.55 (1.32–1.81)
Model IV			
seldom	1	1	1
Weekly	1.20 (1.09–1.31)	1.08 (0.98–1.19)	1.25 (1.12–1.40)
Daily	1.39 (1.21–1.60)	1.19 (1.04–1.37)	1.55 (1.32–1.82)

* Without adjusted (crude model).
† Adjusted for age and sex.
‡ Additionally adjusted for family history of chronic diseases, mother's education, screen time, physical activity, socioeconomic status.
§ Additionally adjusted for body mass index.

needed. Also, future interventional studies are needed to clarify effects of healthy diets on mental health of children and adolescents.

Conclusion

Junk food may increase the risk for psychiatric distress and violent behaviors in children and adolescents. Improvement of eating habits toward healthier diets may be an effective approach to prevent mental disorders.

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