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Is Meal Frequency Associated with Mental Distress and Violent Behaviors in Children and Adolescents? the CASPIAN IV Study

Hossein Ansari [1], Roya Kelishadi [2], *Mostafa Qorbani [3,4], Morteza Mansourian [5], Zeinab Ahadi [4], Mohammad Esmaeil Motlagh [6], Gelayol Ardalan [2], Saeid Safiri [7], Hamid Asayesh[8], Rasool Mohammadi[9], *Ramin Heshmat [3]

[1]Health Promotion Research Center, Department of Epidemiology and Biostatistics, Zahedan University of Medical Sciences, Zahedan, Iran. [2]Child Department of Pediatrics, Child Growth and Development Research Center, Research Institute for Primordial Prevention of Non-communicable Disease, Isfahan University of Medical Sciences, Isfahan, Iran. [3]Department of Community Medicine, Alborz University of Medical Science, Karaj, Iran.[4]Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. [5]Department of Health Education and Promotion, School of health, Iran University of Medical Sciences, Tehran, Iran. [6]Department of Pediatrics, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. [7]Managerial Epidemiology Research Center, Department of Public Health, School of Nursing and Midwifery, Maragheh University of Medical Sciences, Maragheh, Iran. [8]Department of Medical Emergencies, Qom University of Medical Sciences, Qom, Iran. [9]Department of Epidemiology and Biostatistics, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Abstract

***Background*:** This study aimed to assess the relationship between meal frequency with mental distress and violent behavior among a nationally representative sample of Iranian children and adolescents.

***Materials and Methods*:** The participants of this national study were 14,880 Iranian students with 6 to 18 years of age. They were selected from urban and rural regions of Iran by multi-stage cluster sampling method. The data were obtained about demographic information, mental distress, violent behaviors and meal frequency by the questionnaire of the World Health Organization-Global School-based Student Health Survey (WHO-GSHS).

***Results*:** The response rate was 90.6%. The participants who were categorized as the group eating 3 meals per week significantly experienced less mental distress than those who were categorized as consuming 2 meals and one/no meal per week (P-value < 0.05). The min rate of violent behaviors was observed among participants who were classified as consuming 3 meals group and the max rate in one/no meal group. Participants who were categorized as consuming one/ no meal and 2 meals per week had higher risk of mental distress and violent behaviors compared with those whom consumed 3 meals per week.

***Conclusions*:** Meal skipping was significantly associated with mental problems and violent behaviors among Iranian children and adolescents and this association was independent of known confounders.

Key Words: Behavior problems, Children, Mental disorders, Meal frequency, Meal skipping.

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Corresponding Authors:

Mostafa Qorbani & Ramin Heshmat, School of Medicine, Alborz University of Medical Sciences, Baghestan, Boulevard, 31485/56, Karaj, Iran; and EMRI, Dr Shariati Hospital, North Karegar St, Tehran 14114, Iran.

Email: mqorbani1379@yahoo.com; rheshmat@tums.ac.ir

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1-INTRODUCTION

Mental distress is one the most serious health problem in all around the world, especially during childhood and adolescence period. According to recent epidemiological survey, a fifth of children experienced some psychiatric problems, and data showed the half of mental distress among matures developed at the time of adolescence (1). The recent study presented the prevalence of psychiatric distress among Iranian children and adolescents were from 5.7 to 17.7 percent (2), and another important health problem among children and adolescents is violent behaviors. According to earlier study, the approximately 27%, 33%, and half of Iranian students aged 10 to 18 years have experienced bullying, being victim, and physical fight, respectively (2).

The association between mental health problem and dietary behaviors was assessed previously. The prior researches showed the positive association between breakfast intake (3, 4) and breakfast quality with mental distress (5). The obtained results indicated that the rate of mental distress and mood problems was notably less among children and adolescents who consumed breakfast daily. Also, the non-skipper breakfast had better grades, attention, and memory (6). In addition, some studies determined the association between junk food consumption and mental problems and it was found that children and teenagers who consumed junk food had poorer mental health(7, 8) and high rate of violent behaviors (8). The results of Wendy H et al's study showed that the rate of mental problem was higher among adolescents who consumed more red meat, confectionary and fast food than teenagers who had high intakes of fruits and leafy green vegetables (9). The various studies have been conducted about association of mental status with dietary behaviors, but little is recently known about the association between meal frequency with mental health and violent behaviors.

As best of our knowledge there has been no study that assessed the association between meal frequency with mental distress and violence behaviors, and no previous national study was conducted among Iranian children and adolescents in this field. This study aimed to investigate whether meal frequency is associated with mental distress and violent behaviors among children and adolescents.

2- MATERIALS AND METHODS

This study was conducted as the fourth survey of a school-based surveillance system entitled "Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable Disease" (CASPIAN-IV) study (2011-2012) in Iran. The methodology of this study, have been published before, therefore it is presented briefly (10) and here in brief we explain it.

The participants of this national study were 14,880 Iranian students from 6 to 18 years who were selected from urban and rural regions of Iran through a multi-stage cluster sampling methods. Completely, the aim of study and protocol were described to the students and their parents by the team and then parents and students gave written informed consent and oral assent, respectively. The data were obtained about demographic information, mental distress, violent behaviors and meal frequency based on the protocol of the World Health Organization- Global School-based Student Health Survey (WHO-GSHS) that was been translated in Persian. Previously, the validity and reliability of questionnaire was approved (11).

In this study, worthless, angriness, anxiety, insomnia, confusion, depression and worried problems were considered as a mental distress and bullying, being victim and physical fight as violent behaviors. The students were asked how often they

had these problems during specific time. Also, the meal frequency was assessed by breakfast, lunch and dinner frequency intake on weekdays and weekends. Mental distress, violent behaviors and meal frequency were assessed by questions of WHO-GSHS questionnaires, which are presented in (Appendix.1). Body mass index (BMI) was calculated as weight (kg) divided by height (m2). Physical activity was estimated by two questions:

- During the past week, on how many days were you physically active for overall 30 minutes per day? Responses options were from 0 to 7 days.
- How much time do you spend in exercise class regularly in school per week? Responses ranged from 0 to 3 or more hours.

Physical activity (PA) less than two times per week was considered as mild, two to four times a week was considered as moderate and more than 4 hours a week was considered vigorous PA.

Socioeconomic status (SES) was evaluated through principal component analysis (PCA) methods by some variables including parents' education, parents' job, possessing private car, school type (public/private), type of home (rented/ private) and having personal computer in home were summarized in one main component. This main component was classified into tertiles. The first tertile was defined as low, second tertile as moderate and third tertile as high SES.

Junk food group were defined according to foods with a high amount of salt (popcorn, chips, cheese curls, and pretzels), sugar (soda, soft drinks), trans fats and saturated fats (fast food like hot dogs, cheese burger, fried chicken, etc.). Consumption level of junk food was categorized into daily, weekly, and rarely group. Screen time was assessed by asking how long students spent their time on watching TV/video and on using computer. Smoking status included current and passive smoker. Pupils were categorized as current smoker who reported using tobacco products like cigarette, pipe, hookah etc. every day. If they reported that persons smoked tobacco products in their presence, who were defined as passive smoker.

2-1. Ethical considerations

The study was reviewed and approved by Ethical committees of Tehran University of Medical Sciences and Isfahan University of Medical Sciences- Iran. The process of sampling and examination began after explaining the project to the students and their parents. Participation in the study was voluntary. Written informed consent and verbal consent were obtained from parents and students, respectively.

2-2. Statistical analysis

Continuous variables were determined by t-test and ANOVA and reported as mean [95% confidence interval (CI)]. Categorical data was expressed as percent (95%CI) and analyzed by Pearson Chi-square test. Different logistic regression models were used to assess the association of meal frequency with mental distress and violent behaviors. **Model I,** was a crude model (without adjusted). In **Model II,** the association was adjusted for age, gender and living place and in **Model III**, screen time, physical activity, SES, passive and active smoking, sleep duration, junk food, and BMI were adjusted in the model. All statistical measures were estimated using survey data analysis methods. Data was analyzed by using STATA package version 11.0 (Stata Statistical Software: Release 11. College Station, TX: Stata Corp LP. Package). P-value < 0.05 was considered as statistically significant.

3-RESULTS

Overall, 13,486 Iranian students in the age range of 6-18 years old were participated out of 14,880 invited pupils (

response rate: 90.6%). They were 6,640(49.2%) girls and 6,846 (50.8%) boys; 75.6% of students were from urban and 24.4% from rural areas.

Characteristics of participants according to the age groups were shown in (Table.1). The mean of BMI was 18.8 (CI 95%: 18.7, 19.0). The most of students spent less than 2 hours for watching TV, computer, etc (81.3%, 95% CI: 80.4, 82.2).76.7% of students had sleep duration more than 8 hours per day (95% CI: 75.5, 77.7). The most of students (43.8 %, 95% CI: 42.7, 45.0) were passive smoker. Angriness was the most common mental distress had been observed among Iranian students (37.7%, CI 95%: 36.5, 38.9) and confusion had the least percentage (8.6%, 95% CI: 8.04, 9.2). The most prevalent violent behavior was seen among students was physical fight (39.9%, 95% CI: 38.6, 41.2). 60.1 percent of students ate 3 meals per week (61.1%, 95% CI: 59.8, 62.3), and also 9.6% had one/no meal per week (95% CI: 8.9, 10.3). Table 2, present the association of meal frequency with mental distress and violent behaviors. The participants who were defined as consuming 3 meals per week group significantly experienced less mental distress than students were categorized as consuming 2 meals and one/no meal per week (P = 0.001). Also, the frequency of mental distress was significantly less among students consumed 2 meals per week than students consumed one/ no meal per week (P= 0.001). Prevalence of angriness among students consumed 3 meals, 2 meals, and one/no meal was 32.4% (95% CI: 31.0, 33.8), 44.5% (95% CI: 42.7, 46.4), and 50.2% (95% CI: 47.0, 53.4) respectively.

The minimum rate of violent behaviors was observed among participants were classified as consuming 3 meals group and the maximum rate in one/no meal consuming group.

Table.3, illustrates the odds ratio (OR) and 95% CI of mental distress and violent behaviors according to meal frequency. Pupils who were categorized as consuming one/ no meal and 2 meals per week had more risk of mental distress and violent behaviors compared with those who consumed 3 meals per week. The last model (multivariate analysis) showed that-the mental distress and violence behaviors were significantly associated with meal frequency (P= 0.001).

Appendix 1: List of questions to assessment mental distress and violent behaviors

Question Mental distress	Response/definition
During the past 6 months, how often did you experience worthless so that you cannot do your daily activity?	1. Almost every day (considered as Yes). 2. More than once a week (considered as Yes). 3. Almost every week (considered as Yes). 4. Almost every month (considered as No). 5. Rarely or never (considered as No).
During the past 6 months, how often did you experience aggression so that you cannot do your daily activity?	
During the past 6 months, how often did you experience anxiety so that you cannot do your daily activity?	
During the past 6 months, how often did you experience insomnia so that you cannot do your daily activity?	
During the past 6 months, how often did you experience confusion so that you cannot do your daily activity?	
During the past 12 months, did you ever feel so sad or hopeless?	1.Yes 2. No
During the past 12 months, 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 months, how many times you had 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 months, how many times you were 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 months, how many times you got 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).
Meal frequency	
3 meals:	as having breakfast>4/week and lunch>4/week and dinner>4/week
2 meals	as having 2 meals > 4/week
One/ no meal:	as having maximum 1 meal> 4/week

Table 2: Association of meal frequency with mental distress and violent behaviors in Iranian children and adolescents: the CASPIAN-IV Study

Variables	Meal frequency			
	One / no meal	2 meals	3 meals	P-value [a]
Mental distress				
Worthless	20.7(18.4,23.1)[1]	12.2(11.1,13.4)	7.7(7.0,8.4)	0.001
Angriness	50.2(47.0,53.4)	44.5(42.7,46.4)	32.4(31.0,33.8)	0.001
worried	42.9(39.8,46.0)	35.5(33.8,37.4)	24.4(23.1,25.7)	0.001
Insomnia	27.0(24.4,29.7)	19.5(18.2,20.9)	12.4(11.5,13.3)	0.001
Confusion	17.3(15.1,19.8)	9.8(8.9,10.9)	6.6(6.0,7.2)	0.001
Depression	29.8(27.1,32.6)	25.1(23.6,26.8)	17.5(16.5,18.6)	0.001
Anxiety	39.8(36.8,42.8)	31.4(29.7,33.2)	19.7(18.6,20.8)	0.001
Violent behaviors				
Victim	30.4(27.7,33.1)	28.4(26.8,30.1)	26.2(25.0,27.4)	0.002
Bully	20.7(18.4,23.2)	19.8(18.3,21.3)	15.9(14.9,16.8)	0.001
Physical fight	43.1(40.1,46.2)	41.8(40.7,43.7)	38.4(36.9,39.9)	0.0004
1: 95% CI, **a**: P-values are resulted from analysis of variance (ANOVA), P<0.05 is significant.				

Table 3: Odds ratios (95% CI) for mental distress and violence behaviors across meal frequency

Variables	Meal frequency			
	3- meals	2- meals	One/ no meal	P-value*
Worthless				
Model I[1]	Ref	1.6(1.4,1.8)	3.1(2.6,3.6)	0.001
Model II[2]	Ref	1.4(1.2,1.6)	2.4(2.1,2.9)	0.001
Model III[3]	Ref	1.4(1.2,1.6)	2.3(1.9,2.8)	0.001
Angriness				
Model I	Ref	1.6(1.5,1.8)	2.1(1.8,2.4)	0.001
Model II	Ref	1.5(1.3,1.6)	1.7(1.5,2.0)	0.001
Model III	Ref	1.4(1.2,1.5)	1.6(1.3,1.8)	0.001
Worried				
Model I	Ref	1.7(1.5,1.8)	2.3(2.0,2.6)	0.001
Model II	Ref	1.4(1.3,1.5)	1.7(1.5,1.9)	0.001
Model III	Ref	1.4(1.2,1.5)	1.6(1.4,1.9)	0.001
Insomnia				
Model I	Ref	1.7(1.5,1.9)	2.6(2.2,3.0)	0.001
Model II	Ref	1.5(1.3,1.6)	2.1(1.8,2.4)	0.001
Model III	Ref	1.4(1.3,1.6)	2.0(1.7,2.3)	0.001
Confusion				
Model I	Ref	1.5(1.3,1.7)	2.9(2.4,3.5)	0.001
Model II	Ref	1.3(1.1,1.5)	2.4(2.0,2.9)	0.001
Model III	Ref	1.2(1.1,1.5)	2.0(1.6,2.5)	0.001
Depression				
Model I	Ref	1.5(1.4,1.7)	1.9(1.7,2.2)	0.001
Model II	Ref	1.3(1.2,1.5)	1.5(1.3,1.8)	0.001
Model III	Ref	1.3(1.2,1.5)	1.4(1.2,1.7)	0.001
Anxiety				
Model I	Ref	1.8(1.7,2.0)	2.6(2.3,3.0)	0.001
Model II	Ref	1.6(1.4,1.7)	2.1(1.8,2.4)	0.001
Model III	Ref	1.6(1.4,1.7)	2.0(1.7,2.3)	0.001
Victim				
Model I	Ref	1.1(1.0,1.2)	1.2(1.0,1.4)	0.001
Model II	Ref	1.1(1.0,1.2)	1.3(1.1,1.5)	0.001
Model III	Ref	1.1(0.9,1.2)	1.2(1.0,1.4)	0.002
Bully				
Model I	Ref	1.3(1.1,1.4)	1.3(1.1,1.6)	0.001
Model II	Ref	1.3(1.1,1.4)	1.3(1.1,1.6)	0.001
Model III	Ref	1.1(1.0,1.3)	1.2(1.0,1.4)	0.002
Physical fight				
Model I	Ref	1.1(1.0,1.2)	1.2(1.0,1.3)	0.001
Model II	Ref	1.2(1.1,1.3)	1.3(1.1,1.5)	0.001
Model III	Ref	1.1(1.0,1.2)	1.2(1.0,1.4)	0.001

[1]Without adjusted (crude models),[2]Adjusted for age, sex and region,[3]Additionally adjusted for screen time, physical activity, socioeconomic status, passive and active smoking, sleep duration, junk food, and BMI.
, * $P<0.05$ is significant.

Categories: the CASPIAN-IV study.

4-DISCUSSION

The present national study was conducted among Iranian students from 6-18 years and results of our study indicated that children and adolescents who consumed meals regularly and did not skip meals had fewer rate of mental distress and violent behaviors than students skipped some meals during week. The association between meal frequency with mental distress and violent behaviors remained significant after adjusting for known confounders.

Accumulating data suggest that skipping meals is associated with snaking eating among children and adolescents. The study by Gayle Savige et al. showed that students who eat snack food mostly are more likely to skip meals (6). Students reported many reasons that contributed to skip meals such as watching television, playing computer games or reading books (12). Previous study indicated that having a little time in the morning and not feeling hungry were two major reasons for skipping breakfast among Australian pupils (13). Unhealthy snacking behavior is particularly prevalent among children and adolescents that have a high level of fat, sugar, and low level of essential micronutrients. The results of Lien et al's study indicated that there is a significant relationship between soft drink consumption and mental health and conduct problems (14). Also, data showed that mental problems like anxiety, dizziness, and worthless is common among adolescents who consumed mostly soft drinks, sweets, chocolate and other unhealthy foods (8, 15). This association was observed between high intakes of salty snacks, sweets, and cakes with violent behaviors among adolescents (16).

Previous studies showed the association between food intake with serotonin signaling and diseases risk. Serotonin is a neurotransmitter that has important roles in appetite regulation and emotional behaviors (17). It is observed that the serotonin signaling decrease in depression, anxiety problem as well as Alzheimer's disease (18). The synthesis of serotonin in brain depends on the plasma concentration of tryptophan that can be converted to serotonin after food intake.

The current study had several strengths and limitations. To the best of our knowledge, it is the first study that assessed the association of meal frequency and mental distress and violent behaviors among children and adolescents in Middle East and North Africa region. Large and nationally representative sample size was strength of this study. The major limitation of our study was cross-sectional design, which makes causal inference of this association (meal frequency with mental distress and violent behaviors) incredible.

5-CONCLUSION

Totally, meal skipping was significantly associated with mental problems and violent behaviors among Iranian children and adolescents and this association was independent of known confounders. More studies to find out causality between meal frequency and mental problems and violent behaviors is recommended.

6-ABBREVIATIONS

- WHO-GSHS: World Health Organization-Global School-based Student Health Survey.
- CASPIAN Study: Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable Disease.
- PA: Physical activity.
- SES: Socioeconomic status.
- PCA: Principal component analysis.
- CI: Confidence interval.

7- AUTHORS' CONTRIBUTIONS

RK, RH, MEM, GA, and MQ conceived the study design and wrote the study protocol. HA, RK, RH, SS, ZA, MM, HA,

RM, and MQ Analyzed and interpreted the data. HA, RK, RH, MM, RM and MQ have been involved in drafting the manuscript or revising it critically for important intellectual content. All authors have given final approval of the version to be published.

8- CONFLICT OF INTEREST: None.

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