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Factors Associated with Overweight/Obesity among Rural Secondary School Children in Bangladesh

Shakiratur Rahman[1], Md. Nurul Amin[1], Md. Jawadul Haque[2], Md. Entekhab-Ul-Alam[2], Shathi Kumar Rawson Kamal[3] Md. Abu Syem Shah Amanath Ullah[3], Nelofar Yasmin[3], Farhana Yasmin[3], Asadur Rahman[3], Shubhra Prakash Paul[3], Shitil Ibna Islam[3]

ABSTRACT

Background & Objective: Unhealthy dietary patterns in combination with a sedentary lifestyle could be contributing to some major health issues worldwide. Obesity in children and adolescents can have short- and long-term adverse health consequences including early mortality. Although previously limited to urban areas, with the rapid adoption of urban lifestyle by the rural people the problem is now ubiquitous. It is difficult to develop a policy for promoting health and reducing obesity among adolescents living in rural regions since there is a lack of information on the factors that contribute to this problem. The present study was, therefore undertaken to evaluate the factors influencing overweight and obesity among rural adolescents.

Methods: This cross-sectional study was done based on data collected by students of Rajshahi Medical College as part of their RFST (Rural Field-site Training) in 2019 from a rural area of Rajshahi, Bangladesh. A total of 535 students from two rural secondary schools participated in the study. Every alternate student of those schools from class VI-X was then included in the study as a respondent. The weight and height of the selected students were first taken followed by data collection on variables of interest. Using weight and height data, the body mass index (BMI) of the respondents was first determined and was plotted on a growth chart (recommended by CDC, Atlanta) to find the percentile. Then the nutritional status of the individual respondents was determined based on their percentile status and was classified as underweight, normal, overweight, or obese.

Results: Almost one-fifth (18.2%) of the respondents was found overweight or obese. Upon comparing respondents' demographic characteristics, food and exercise behaviour between overweight & obese and normal & underweight groups, the former group was found younger than the latter group. Respondents' socioeconomic status (SES) was associated with their nutritional status with overweight & obese adolescents being significantly higher in the Middle- and rich SES group (78.4%) than in the poor and lower middle-class (61.4%). Neither dietary nor exercise behaviour was associated with the nutritional status of the respondents. Although the majority (84.2%) of normal & underweight adolescents preferred low to medium-calorie snacks, overweight and obese adolescents were more likely to choose high-calorie snacks. Fast walking and running were the more common forms of exercise behaviour and of longer duration among the overweight & obese cohort than those among normal & underweight cohorts.

Conclusion: The study concluded that the period of early adolescence is vulnerable to developing obesity. Adolescents belonging to middle and well-off SES are more prone to be overweight or obese than those belonging to lower middle & poor SES. However, exercise, physical activity, and dietary habits of adolescents do not influence their nutritional status.

Keywords: Rural adolescents, overweight/obesity, dietary behaviour, exercise, inactivity, factors, etc.

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Authors' information:

[1] ***Shakira Tur Rahman,*** *MSc in Business Administration, University of Northern British Columbia, Prince George, BC, Canada.*

[1] ***Dr. Md. Nurul Amin,*** *PhD Associate Professor (Epidemiology), Executive Editor, Ibrahim Cardiac Medical Journal, Dept. of Research & Development, Ibrahim Cardiac Hospital & Research Institute, Shahbag, Dhaka, Bangladesh.*

[2] ***Dr. Md. Jawadul Haque,*** *Professor & Head, Department Community Medicine, Rajshahi Medical College, Rajshahi, Bangladesh.*

[2] ***Dr. Md. Entekhab-Ul-Alam,*** *MBBS, DPH (DU), Associate Professor, Department of Community Medicine, Rajshahi Medical College, Rajshgahi.*

[3] ***Dr. Shathi Kumar Rawson Kamal Md. Abu Syem Shah Amanath Ullah,*** *Associate Professor, Institute of Health Technology, Rajshahi Medical College, Rajshahi.*

[3] ***Dr. Nelofar Yasmin, Lecturer,*** *Department of Community Medicine, Rajshahi Medical College, Rajshgahi.*

[3] ***Dr. Farhana Yasmin,*** *Asst. Professor, Department of Community Medicine, Rajshahi Medical College, Rajshgahi.*

[3] ***Dr. Asadur Rahman,*** *Lecturer, Department of Community Medicine, Rajshahi Medical College, Rajshgahi.*

[3] ***Dr. Shubhra Prakash Paul,*** *Lecturer, Department of Community Medicine, Rajshahi Medical College, Rajshgahi.*

[3] ***Shitil Ibna Islam,*** *Research Officer, Department of Research & Development, Ibrahim Cardiac Hospital & Research Institute, Shahbag, Dhaka, Bangladesh.*

Correspondence: ***Dr. Md. Nurul Amin,*** *Mobile: 01753178452, e-mail: mdamin01@yahoo.com*

INTRODUCTION:

Poor eating behaviors, inadequate physical activity, and obesity are some of the most pressing public health problems faced by young adults all over the world.[1] It is estimated that obesity affects more than 107 million children worldwide, with the prevalence of childhood obesity in high-income countries exceeding 20%[2] representing a 2-3-fold rise in obesity rates among children within the last 40 years. Although, primarily the problem was of high-income countries, it gradually affected the developing countries as well. Again, in developing countries, the problem was initially limited to urban areas, but as the rural people began to adopt an urban lifestyle with the development of infrastructure and rise in socioeconomic status, they also became the victims of the condition. But still, the factors predisposing to overweight and obesity among rural adolescents do not seem to be the same as those of their urban counterparts. By far studies on factors influencing childhood obesity are mostly conducted in urban settings. Plans for health promotion and obesity control among adolescents living in rural areas are hindered by the lack of information on the factors that contribute to obesity in these adolescents.

In children and adolescents, the long-term health consequences of obesity may continue throughout their lifetime, which inter alia includes obesity persisting into adulthood, increased risk for chronic diseases such as cardiovascular disease and type 2 diabetes, and premature death.[2] Adolescents are at five times higher risk of having obesity in adulthood and are at higher risk of developing major chronic diseases.[3] Immediate and long-term psychosocial health consequences, such as reduced self-esteem and depression are also no less in children with overweight and obesity.[4,5] Hence, prevention of childhood overweight and obesity is of utmost priority. Identifying factors influencing adolescent obesity is the first step in promoting a healthy lifestyle and preventing overweight and obesity, with the ultimate aim of reducing its short- and long-term burden.[6] Due to the different stages of economic development in different countries, the results of socioeconomic status (SES) on overweight and obesity are not consistent. In developed countries such as the United States, the United Kingdom, and Germany, children in families with lower SES are at higher risk of obesity.[7–9] In contrast, in developing countries, children belonging to families with higher SES are at higher risk of being overweight and obese than those belonging to lower social classes.[9]

Although some studies investigated the factors influencing obesity among school-going adolescents, few initiatives have so far been taken to study the factors associated with overweight and obesity in Bangladeshi adolescents. Besides, the studies were mostly done in urban settings. A couple of research papers associate various factors with the prevalence of obesity in urban adolescents of Bangladesh.[10] Studies on factors influencing obesity among rural adolescents are scarce. We recently published a study on a large sample (n = 535 of rural school-going adolescents) at Puthia, Rajshahi, Bangladesh, and found that 18% of the rural adolescents were overweight or obese.[11] We described their dietary and exercise behavior as well; Now we are going to analyze the data to understand the factors influencing overweight and obesity among the rural adolescents of Rajshahi, Bangladesh with particular consideration of their socio-economic conditions, dietary behaviors, leisure time activity, and physical activities/exercise.

METHODS:

This cross-sectional analytical study was carried out on rural adolescents in Bangladesh to analyze the factors influencing overweight and obesity among them. On approval of the study by the Community Medicine Department of Rajshahi Medical College, Rajshahi, Bangladesh the data were collected by the 3rd year medical students as part of their RFST (Rural Field-site Training) in 2019 at Puthia, Rajshahi, Bangladesh. The data were collected from two secondary schools of Puthia, Rajshahi (Puthia Girls' High School, Rajshahi and P.N. Govt. High School, Puthia, Rajshahi), over a period 1 month from April-May 2019. Adolescent boys and girls studying in grades VI-X of the selected secondary schools were the study population. Having obtained verbal

consent from the School Authorities (Headmasters of the respective schools) on behalf of the students, a total of 535 rural school adolescents were consecutively included in the study. However, students with known chronic diseases like valvular heart disease or any other systemic diseases that may adversely affect their nutritional status and students who refused to participate in the study were excluded.

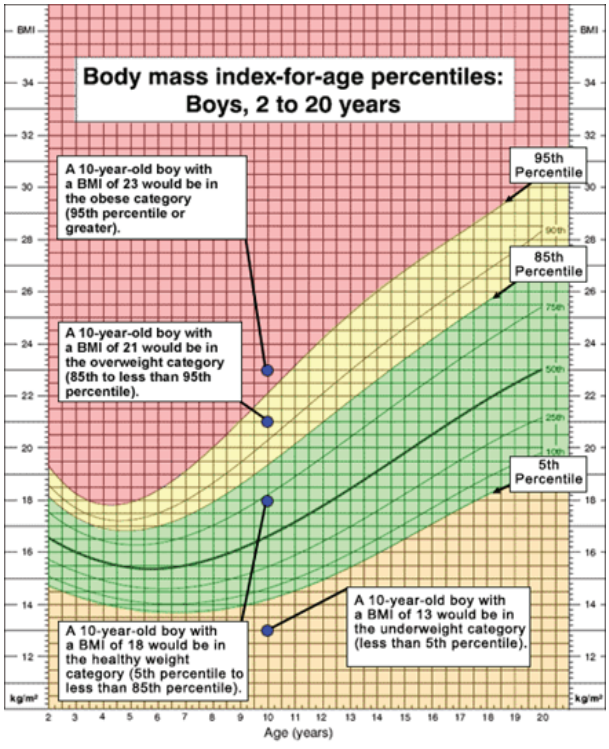

Fig. 1: Nutritional status based on BMI-for-age percentiles (Source: CDC, Atlanta)

The data were collected from the respondents by face-to-face interview. Demographic characteristics (age, sex & socioeconomic status, and grade in the school) and anthropometric measurements like height and weight of all respondents were noted first on a semi-structured questionnaire containing the variables of interest. Height was measured bare-footed to the nearest centimeter using a ruler fixed to the wall, while weight was measured to the nearest 0.1 kg on a manually-adjusted bathroom scale with the subject wearing school dress only. Using weight and height data, body mass index (BMI) was determined with the help of the formula, BMI = (weight in kg)/(height in sq-meter). As the BMI of children and adolescents is age- and sex-specific, calculated BMI was plotted on a growth chart [developed and recommended by Centre for Disease Control, Atlanta] to find the percentile (Fig.1). Then the nutritional status of the respondents was determined based on their percentile status as underweight, normal, overweight and obese (shown in table I).

Table I. Nutritional status of the respondents based on BMI percentiles for age and sex

Percentile status	Nutritional status
< 5th percentile	Underweight
5th to < 85th percentile	Normal weight
85th to < 95th percentile	Overweight
≥ 95 percentiles	Obese

Then data were collected on the dietary and exercise behaviour of the respondents, which among others, included physical activity and lifestyle, healthy and unhealthy foods and dietary habits, the pastime chosen by the students to pass their leisure time, reasons for unwillingness to have exercise or to lead an active life and knowledge on nutrition. The dietary behaviour was considered healthy when the daily diet of the participating students consisted of a balanced mixture of proteins, carbohydrates, and fats along with plenty of vegetables, 3 or > 3 servings of fruits daily, and low to medium-calorie snacks. The dietary behaviour was considered unhealthy when the daily diet of the respondents consisted of high carbohydrates, fats, and proteins or inadequate fruits (< 3 servings a day) and fewer vegetables and high-calorie snacks. The respondents were considered active if they played any outdoor games or engaged in structured exercise at least five days a week, with each session lasting at least 30 minutes. The respondents were considered inactive if they didn't play any outdoor games or engage in structured exercise at least five days a week, with each session lasting at least 30 minutes. Snacks taken in between major meals if comprised of biscuits, breads, milk, yogurt, fruits, crackers etc., the snacks were termed low- to medium-calorie snacks. Snacks taken in between major meals when formed of burgers, Pizzas, fried chicken, grill, yogurt,

soft-drinks, sweetmeats, ice-cream chocolates, and so on, the snacks were called high-calorie snacks. Data were processed and analyzed using SPSS (Statistical Package for Social Sciences), version 25.0. The test statistics employed to analyze the data were descriptive statistics, a Chi-squared (χ^2) Test, and an Unpaired t-test with the level of significance being set at 5%. The p-value < 0.05 was considered significant.

RESULTS:

Respondents stratified by their nutritional status (based on BMI for age and sex) showed that two-thirds (66.7%) of them were of normal nutritional status, 15.1% were underweight, 9.2% overweight and 9% were obese (Table I). The age distribution of the respondents between the two groups shows that overweight and obese adolescents were younger (12.9 ± 1.4 years) than the normal and underweight adolescents (13.4 ± 1.4 years) (p = 0.023). However, no significant difference was found between the groups in terms of sex (p = 0.800). Over three-quarters (78.4%) of the overweight and obese group belonged to the middle and rich socioeconomic class compared to 61.4% from the normal, underweight cohort (p = 0.002) (Table II). Approximately 95% of the respondents from the overweight and obese group reported having breakfast more often as compared to 92.5% of the normal cohort with the risk of having overweight and obese among respondents taking breakfast more often being 1.5(95% CI= 0.57-3.95) times higher than that among respondents taking breakfast less often (p = 0.409). More than half (54.6%) of the respondents from each group did not take fruits regularly. Taking plenty of vegetables every day was relatively higher in the overweight and obese cohort (64.9%) than in the normal or underweight cohort (58.9%) (p = 0.272). High carb, high protein, or high fat were more preferred by overweight & obese adolescents than by their normal counterparts (50.2%) (p=0.547). High-calorie snacks were more often taken by the overweight and obese cohort (21.6%) than those by their normal & underweight counterpart (15.8%) with the risk of preferring high-calorie snacks by the former cohort being nearly 1.5(95% CI = 0.85-2.55) times higher than that by the latter cohort (Table III). About two-thirds of the respondents from both groups practiced some sort of sports or physical exercise with no significant difference between the groups (p=0.587). Football, cricket, cycling, running, and fast walking were the most common forms of sports or exercises practiced by both groups. The mean number of days of sports and exercises practiced each week was similar for both heavier and normal groups (5.32 ± 2.03 vs. 5.34 ± 1.97 days, p=0.945). The mean duration of practice each day was 69.0 ± 38.3 minutes in the overweight and obese group and 63.2 ± 37.3 minutes in the normal & underweight group (p = 0.277) (Table IV).

Watching television was the predominant form of leisure-time activity (more than 85% of the respondents in both groups), followed by listening to music (about 80% in both groups) and reading a book (>70% in both groups). Around 60% of the adolescents in both groups loved playing games or doing other activities on mobile with no significant intergroup difference (p=0.510). The mean duration of screen-time (watching television, computer, or mobile) was 1.4 ± 0.9 hours and 1.3 ± 0.9 hours for overweight & obese and normal & underweight groups respectively (p = 0.485) (Table V). Table VI shows that neither dietary behaviour nor activity/ exercise behaviour was found to be associated nutritional status of the respondents. The respondents who did not take part in activities or formal exercises mentioned several reasons for such unhealthy behaviours. The majority (90%) mentioned that there was no playing field in the school. Nearly 70% said that they had no leisure time to play and nearly 80% said that they had to go to private tutors or coaching centers after school hours. Over 40% mentioned the absence of a playing field in the vicinity of their home or school and 35.5% informed that their teachers do not encourage them to play (Table VII). However, cross-tab analyses revealed none of these reasons to be associated with the nutritional status of the respondents (p > 0.05) (Table not shown).

Table I. Distribution of respondents by their nutritional status

Nutritional status	Frequency	Percentage
Underweight	81	15.1
Normal	357	66.7
Overweight	49	9.2
Obese	48	9.0

Table II. Distribution of respondents between groups by their demographic characteristics:

Demographic Characteristics	Nutritional Status: Overweight & Obese (n = 97)	Nutritional Status: Normal & Underweight (n = 438)	OR (95% CI of OR)	p-value
Age#	12.9 ± 1.4	13.4 ± 1.4	---	0.023
Sex*				
Male	45(46.4)	197(45.0)	1.06(0.68-1.65)	0.800
Female	52(53.6)	241(55.0)		
Socio-economic Status*				
Middle-class & rich	76(78.4)	269(61.4)	2.27(1.35 – 3.83)	0.002
Poor & lower middle-class	21(21.6)	169(38.6)		

Figures in the parentheses indicate corresponding percentage.
Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD**.
***Chi-squared** (χ^2) **Test** was employed to analyze the data.

Table III. Distribution of respondents between groups by their dietary behavior

Dietary Behaviour*	Nutritional Status: Overweight & Obese (n = 97)	Nutritional Status: Normal & Underweight (n = 438)	OR (95% CI of OR)	p-value
Taking Breakfast				
More often	92(94.8)	405(92.5)	1.50(0.57 – 3.95)	0.409
Less often	5(5.2)	33(7.5)		
Taking Fruits				
Yes	44(45.4)	199(45.4)	0.99(0.64 – 1.55)	0.990
No	53(54.6)	239(54.6)		
Taking Plenty of Vegetables				
Yes	63(64.9)	258(58.9)	1.30(0.82 – 2.04)	0.272
No	34(35.1)	180(41.1)		
Diet				
High Carb/Protein/Fat	52(53.6)	220(50.2)	1.14(0.74 – 1.78)	0.547
Balanced Diet	45(46.4)	218(49.8)		
Snacks				
High-Calorie Snacks	21(21.6)	69(15.8)	1.48(0.85 – 2.55)	0.160
Low/Medium Calorie Snacks	76(78.4)	368(84.2)		

Figures in the parentheses indicate corresponding percentage.
***Chi-squared** (χ^2) **Test** was employed to analyze the data.

Table IV. Distribution of respondents between groups by their habits of physical activities:

Physical Activity / Exercise behaviour	Nutritional Status: Overweight & Obese (n = 97)	Nutritional Status: Normal & Underweight (n = 438)	p-value
Sports/Physical Exercise practiced*	63(64.9)	297(67.8)	0.587
Football*	35(55.6)	170(57.2)	0.806
Cricket*	39(61.9)	188(63.3)	0.835
Volleyball*	6(9.5)	27(9.1)	0.914
Table-tennis*	5(7.9)	10(3.4)	0.193
Any indigenous outdoor games*	20(31.7)	129(43.4)	0.087
Cycling*	36(57.1)	194(65.3)	0.220
Jogging*	15(23.8)	94(31.6)	0.219
Running*	43(68.3)	189(63.6)	0.487
Fast Walking*	37(58.7)	149(50.2)	0.217
Any Formal Exercise*	11(17.5)	56(18.9)	0.796
Days of exercise per week#	5.3 ± 2.0	5.3 ± 1.9	0.944
Duration of exercise each day# (min)	69.0 ± 38.3	63.2 ± 37.3	0.267

Figures in the parentheses indicate corresponding percentage.
Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD**.
***Chi-squared** (χ^2) **Test** was employed to analyze the data.

Table V. Distribution of respondents between groups by their leisure activities:

Leisure-time activities	Nutritional Status: Overweight & Obese (n = 97)	Nutritional Status: Normal & Underweight (n = 438)	p-value
Watching Television	83(85.6)	373(85.2)	0.919
Playing games or other activities on mobile	60(61.9)	255(58.2)	0.510
Using Computer	14(14.4)	74(16.9)	0.554
Listening to Music	77(79.4)	351(80.1)	0.866
Reading a book	72(74.2)	313(71.5)	0.583
Shopping	55(56.7)	226(51.6)	0.362
Gardening	49(50.5)	227(51.8)	0.815
Average duration of screen time (hours/day)	1.4 ± 0.9	1.3 ± 0.9	0.504

As the difference was not statistically significant, Odds of being overweight & obese for a particular factor was not computed.

Table VI. Distribution of respondents between groups by their food and exercise behaviour:

Food and exercise behaviour	Nutritional Status: Overweight & Obese (n = 97)	Nutritional Status: Normal & Underweight (n = 438)	OR (95% CI of OR)	p-value
Diet Quality*				
Unhealthy diet	69 (71.1)	313 (71.5)	0.984 (0.6-1.59)	0.949
More or less healthy diet	28 (28.9)	125 (28.5)		
Activity*				
Inactive	56 (57.7)	259 (59.1)	0.944 (0.6-1.47)	0.800
Active	41 (42.3)	179 (40.9)		

Figures in the parentheses indicate corresponding percentage.
***Chi-squared** (χ^2) **Test** was employed to analyze the data.

Table VII. Reasons of not taking exercise or playing any outdoor games (n = 175*)

Reasons	Frequency	Percentage
No leisure-time to play (n = 168)	116	69.0
Private tuition or coaching (n = 169)	134	79.3
No playing field in the school (n = 170)	153	90.0
No playing field nearby home or school (n = 169)	72	42.6
School teachers do not encourage playing (n = 169)	60	35.5
Parents do not encourage playing (n = 114)	01	0.9

*Multiple response

DISCUSSION:

In the present study almost one-fifth (18.2%) of the respondents was either overweight or obese and the rest (81.8%) was normal or underweight. As their demographic characteristics, food and exercise behaviour were compared between the two nutritional groups, we found overweight & obese respondents to be relatively young indicating early adolescents are more prone to be overweight and obese than their older counterparts. Respondents who belonged to middle and rich socioeconomic classes were more likely to be overweight and obese than those who belonged to lower middle and poor classes. A growing body of research shows that obesity and socioeconomic level have inverse relationships in wealthy nations, but direct relationships in developing countries.[12-14] Consistent with the above pieces of evidence, the present study showed a positive relationship between SES and adolescent obesity with obese or overweight adolescents being considerably higher (78.4%) in the middle and rich socioeconomic groups compared to the poor and lower-middle-class groups. However, a sizable proportion (15.1%) of adolescents was underweight as well indicating that developing countries like ours suffer from a dual burden of overnutrition and undernutrition and the necessity of intervention in the rural population under study. Our findings confirm the rising incidence of overweight and obesity among teenage girls in rural parts of Central and Latin America, with the most recent rates ranging from 16.7 to 34.6 percent.[15] None of the dietary behaviours was observed to be associated with the nutritional status of the respondents. However, consumption of high-calorie snacks (containing high carbohydrates and high fat) was considerably higher among overweight and obese respondents than their normal peers.

Exercise behaviour was not associated with the nutritional status of the respondents. However, the prevalence of fast walking & running with the duration of each day's exercise was comparatively long among overweight & obese cohorts than that in normal & underweight cohorts. The perception of being overweight and actual overweight status are both strongly associated with weight loss behaviors. Arlene and associates[16] demonstrated that children (both girls and boys) of all ages who perceived themselves as overweight were more likely to engage in weight loss behaviors. Bhurtun & Jeewon[17] in a Mauritanian study showed that the majority (88.5%) of teenagers who were engaged in weight-loss behaviour perceived themselves as overweight even though only 19.2% of them were overweight. A recent study conducted by Roy et al.[10] among urban adolescents studying in schools and colleges demonstrated a significant association between adolescents' physical activity and the prevalence of obesity, with only 1.8% of the overweight or obese adolescents leading an active lifestyle, one-fourth of a sedentary lifestyle and the remaining proportion (more than three-fifth) were moderately active. However, the study population was not representative of the entire adolescents of Bangladesh.[10] In our study, no significant association existed between adolescents' physical activity/ exercise, dietary behavior and their nutritional status, although, in terms of snacking, overweight and obese adolescents were more likely to have high-calorie snacks, the majority (84.2%) of the normal & underweight adolescents chose low to medium-calorie snacks. Before concluding, the limitations of the study deserve mention. The study used a self-reported questionnaire, which among others, included dietary patterns, physical exercise/ activity behaviors, & social class of the respondents. Thus, bias may have been incorporated due to inaccurate self-reporting, misinterpreting of the questionnaire items, or social status.

CONCLUSION:

Summarizing the findings of the study, it appears that the period of early adolescence is vulnerable to developing obesity. Adolescents belonging to middle and affluent socioeconomic strata are more likely to be overweight or obese than those belonging to lower middle and poor social classes. However, exercise, physical activity, and dietary behaviour of adolescents do not have any influence on their nutritional status. A nationwide survey is needed to generalize the findings to the reference population as well as to develop a national plan to promote a healthy lifestyle for rural adolescents.

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