Assessment of body weight, maternal dietary knowledge and lifestyle practices among children and adolescents in north Jordan

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Abstract

Objective: To estimate the prevalence of overweight and obesity among children and adolescents in north Jordan and to evaluate the dietary knowledge of their mothers.
Design: Cross-sectional study.
Settings: Schools, Irbid, Jordan.
Subjects: Male and female participants (*n* 516) aged 6–18 years.
Results: Thirty per cent of our sample population was overweight or obese, and about 11 % was underweight. Males tend to have a higher BMI and waist circumference than females except in the age group ≥15 years. Children who ate in front of the television tended to have higher BMI and waist circumference. Forty per cent of the mothers answered four or more questions correctly out of six, which indicated a sufficient level of nutritional knowledge.
Conclusions: The study revealed that obesity is a growing health problem in children and adolescents in north Jordan. This finding is considered a serious concern for public health and calls for the creation of new prevention programmes at the individual, family and community level.

Obesity is the accumulation of body fat which has a negative effect on person's health. A person is considered obese if his/her body weight is 20 % higher than normal[1]. Growth charts have been constructed by observing the growth of large numbers of normal children over time[2]. The height, weight and head circumference of a child can be compared with the expected parameters of children of the same age and sex to determine whether the child is growing appropriately[3].

Childhood overweight and obesity is a health problem that needs effective approaches. Its prevalence is becoming a threat to public health worldwide, affecting both developed and developing nations. Overweight and obesity represent a rapidly growing risk to the health of people in an increasing number of countries[4]. For many developing countries, obesity and its consequences have become a challenge like hunger and undernutrition[5].

Recently, there has been an increase in prevalence of childhood obesity (5–19 years) due to rapid change in dietary practices and adoption of sedentary lifestyles in developing countries[6]. Prevalence of childhood overweight and obesity worldwide has increased from 4·2 % in 1990 to 6·7 % in 2010[7]. The trend is anticipated to reach 9·1 % in 2020. The estimated prevalence of childhood overweight and obesity in Africa in 2010 was 8·5 % and is expected to reach 12·7 % in 2020[7].

Overweight and obesity in children and adolescents is progressively being observed alongside improved access to technology that is associated with varying lifestyle of families due to increased purchasing power, luxurious living, increasing hours of inactivity due to increased watching of television (TV) and use of video games and computers, which seem to substitute for outdoor games and other social activities[8,9]. The trend of overweight and obesity is rising with urbanization, changes in lifestyle and social economic transition. Social economic transition is considered to be among the causes of overweight and obesity, in which residing in cities provides greater access to more fast foods and the emergence of people with high economic income who can afford these fast foods with high glycaemic index[10,11]. Children's physical and psychological health is highly affected by overweight and obesity. The mechanism of overweight and obesity is not well understood but is believed to be disorder of multiple causes. It is assumed to be a result of increasing intakes of energy and fat. According to experimental and observational

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studies, both diet and physical activity have a positive effect on decreasing obesity and controlling body weight[3].

Obesity and/or overweight are major risk factors for chronic diseases and play a central role in insulin resistance as well as the metabolic syndrome, which includes hyperinsulinaemia, hypertension, hyperlipidaemia and type 2 diabetes mellitus[12]. Obesity also correlates strongly with increased risk of atherosclerotic CVD, stroke, sleep apnoea syndrome and some forms of cancer[12–15]. However, little is known about the prevalence of childhood obesity and the paediatric metabolic syndrome in developing countries because of the limited number of studies, the variety of definitions and cut-offs used and the different age groups studied, which makes comparisons difficult[12]. Among developing countries, the prevalence of childhood obesity is highest in the Middle East and Central and Eastern Europe[16]. Due to a lack of statistics for overweight/obesity among schoolchildren in Jordan, the present study was conducted to assess the prevalence of overweight and obesity in Jordanian children and adolescents and to investigate the level of maternal nutritional knowledge and dietary information.

Methods

Study approval

Approval of the Institutional Review Boards of the Medical School of Jordan University of Science and Technology and King Abdullah University Hospital, Irbid, was obtained first before the study was initiated.

Participants

The study was of analytical cross-sectional design and conducted in autumn 2016. A convenience sample of 516 children and adolescents aged 6–18 years was recruited. The sample was selected randomly from four public and four private schools in different areas of Irbid city in the north of Jordan.

Procedures

The researcher met with school administrations to provide all details about the study and to explain its objectives. Random classes from elementary, secondary and high schools were selected to guarantee the participation of all age groups. Based on the school administration's preference, a specific time was chosen to let the researcher meet with all students and explain all the questions in the questionnaire. The researcher also mentioned the importance of the study and the privacy of the information to be collected. All participants were given a consent form and information sheet explaining the general background of the study and received a brief verbal explanation regarding the research objectives. All participants had the right to drop out during the study period.

Measures

Questionnaire

A trained researcher helped all students from all different age groups to fill out a pre-designed and pre-tested questionnaire; all questions were explained clearly to the students to guarantee understanding and accurate answers. The questionnaire was designed and circulated to three faculty members to review and it was modified based on their suggestions. Feedback comments were done to validate the questionnaire. The questionnaire had five sections. The first three concerned sociodemographic characteristics, general health and eating behaviours, which focused mainly on the number of meals taken daily, number of snacks, amount of water consumption and frequency of eating fast foods. The fourth section asked about lifestyle practices such as sleeping patterns, parental smoking habits, parents' weight and height, electronic devices and watching TV. The last section of the questionnaire focused on physical activity level. The parents' weight and height were recorded and then parental BMI was calculated to categorize them based on their BMI.

Anthropometric assessment

At the beginning of each class meeting, the researcher measured each student's body weight, height and waist circumference (WC). Body height was measured to the nearest 0·1 cm using a stadiometer and weight was measured to the nearest 0·1 kg using a standard weighing scale, with the child wearing light clothes and barefoot. WC was measured to the nearest centimetre using a non-stretchable circumference-measuring tape (SECA 203, Germany). The site of tape placement was determined according to the WHO's description of midway between the iliac crest and the lower rib border[4]. According to the WHO, there are no cut-off points for WC in children. Three measurements were recorded, and the average was taken. BMI was calculated as body weight in kilograms divided by the square of height in metres (kg/m^2). Age-specific cut-off points of BMI (with the age ranging from 2 to 18 years) for the diagnosis of overweight and obesity were used. Those between the 85th percentile and 95th percentile on the growth chart were considered overweight, while underweight was set to be ≤5th percentile[17,18].

Nutritional knowledge of mothers

To examine the nutritional knowledge of parents, especially mothers, a quiz specifically developed for this purpose was circulated to three faculty members who were professionals in this domain to guarantee the simplicity, accuracy and validity. Modifications were done to the quiz based on the reviewers' comments and suggestions. Six questions were included in the quiz. The questions focused mainly on the number of cups of water children need to consume, best fat/oil choices, which food items

may cause obesity, healthy snack choices, the number of meals children need and foods rich in vitamins and minerals.

The students were encouraged to bring back the quiz the next day. Students were told that they would be given a prize when they brought back the quiz from their mothers/guardians. The prize was a set comprising a pencil, eraser, sharpener and notebook. Parents who answered four or more questions correctly out of the six (more than half of the questions) were considered to have adequate dietary information, while those who answered three or fewer questions correctly were considered to have a low level of dietary knowledge. The children demonstrated that mostly their mothers had answered the quiz questions (95 %), while fathers answered the quiz in 5 % of the cases only.

Statistical analysis

Collected data were entered in a data sheet and analysed using the statistical software package IBM SPSS Statistics version 19. Data were initially examined by performing descriptive statistics for all categorical and continuous variables. Characteristics of the participants were expressed as number and percentage using frequency distribution for categorical variables. Means and standard deviations were used for continuous variables after a Shapiro–Wilk test was performed to check normality. Data were normally distributed and ANOVA was used to examine the impact of age, gender, sociodemographic status, eating behaviour and lifestyle characteristics on participants' BMI and WC. $P < 0.05$ was considered significant.

Results

The sociodemographic and health characteristics of the students included in the study are presented in Table 1, which shows that about two-thirds of the population were females while only one-third were males (68 % $v.$ 32 %). Age of the students ranged from 9 to 17 years; 46 % of male students were in the age group ≥15 years while 40 % of female students fell in that age group. Fifty-six per cent belonged to an extended family and about half of the participants had at least one working parent. Moreover, most of the students did not have any health problem except 19 % of them had allergy, and 58 % had healthy-weight parents.

Table 2 shows that most of the study population considered lunch as the main meal (86 %). Nearly all of them (93·8 %) got fewer than three snacks per day. Eighty per cent of the participants worried about the quality of food they eat and 81 % revealed that they usually eat home-made food only. Seventy-four per cent revealed they take fewer than four cups of water daily. About 57 % of males and 70 % of females slept more than 8 h/d.

Regarding lifestyle characteristics, the study showed that 88·6 % of the students had an electronic device at home, as shown in Table 2. Among the 516 students, 39 % of them

Table 1 Sociodemographic and health characteristics of the children and adolescents (n 516) by gender, Irbid, north Jordan, autumn 2016

	Total		Males		Females		
Variable	n	%	n	%	n	%	P value*
Age (years)							0·000
≤ 10	103	20·0	31	18·8	72	20·5	
11–14	174	33·7	34	20·6	140	39·9	
≥ 15	239	46·3	100	60·6	139	39·6	
Living place							0·613
Rural	355	68·8	116	70·3	239	68·1	
Urban	161	31·2	49	29·7	112	31·9	
No. of family members							0·786
≤ 6	224	43·4	72	43·6	152	43·3	
7–9	233	45·2	72	43·6	161	45·9	
≥ 10	59	11·4	21	12·7	38	10·8	
No. of working family members							0·064
1	252	48·8	93	56·4	159	45·3	
2	230	44·6	63	38·2	167	47·6	
> 2	34	6·6	9	5·5	25	7·1	
Allergy							0·806
Yes	97	18·8	30	18·2	67	19·1	
No	419	81·2	135	81·8	284	80·9	
Health problems							0·545
Yes	53	10·3	15	9·1	38	10·8	
No	463	89·7	150	90·9	313	89·2	
Parents' weight							0·842
Both normal	474	58·0	154	93·3	320	91·2	
Both obese	21	15·0	5	3·0	16	4·6	
Normal father and obese mother	11	15·1	3	1·8	8	2·3	
Normal mother and obese father	10	11·9	3	1·8	7	2·0	

*Values are significantly different between genders by the least significant difference test if $P < 0.05$.

Table 2 Lifestyle characteristics of the children and adolescents (*n* 516) by gender, Irbid, north Jordan, autumn 2016

Variable	Total		Males		Females		P value*
	n	%	*n*	%	*n*	%	
No. of meals daily							0·744
1	17	3·3	6	3·6	11	3·1	
2	84	16·3	23	13·9	61	17·4	
3	384	74·4	127	74·4	257	73·2	
>3	31	6·0	9	5·5	22	6·3	
Main meal							0·158
Breakfast	48	9·3	11	6·7	37	10·5	
Lunch	444	86·0	149	90·3	295	84·0	
Dinner	24	4·7	5	3·0	19	5·4	
Worry about food quality							0·274
Yes	414	80·2	137	83·0	277	78·9	
No	102	19·8	28	27·0	74	21·1	
Type of food							0·006
Homemade	418	81·0	127	77·0	291	82·9	
Restaurants	88	17·1	38	23·0	50	14·2	
Both	10	1·9	0	0·0	10	2·8	
No. of snacks daily							0·489
≤3	484	93·8	153	92·7	331	94·3	
≥4	32	6·2	12	7·3	20	5·7	
No. of cups of water daily							0·238
<4	383	74·2	117	70·9	266	75·8	
≥4	133	25·8	48	29·1	85	24·2	
Got an electronic device							0·353
Yes	474	88·6	143	86·7	314	89·5	
No	59	11·4	22	13·3	37	10·5	
Watching TV							0·033
Yes	501	97·1	164	99·4	337	96·0	
No	15	2·9	1	0·6	14	4·0	
Eating in front of TV							0·696
Yes	202	39·2	75	45·5	166	47·3	
No	314	60·8	90	54·5	185	52·7	
Sleeping (h)							0·003
≤8	176	43·1	71	43·0	104	29·7	
>8	340	65·9	94	57·0	246	70·3	
Physically active (≥60 min/d)							0·213
Yes	227	44·0	83	50·3	156	44·4	
No	289	66·0	82	49·7	195	55·6	

TV, television.
*Values are significantly different between genders by the least significant difference test if *P* < 0·05.

were eating while watching TV. Only 44 % of the participants reported that they consider themselves physically active (incorporate about 60 min of moderate exercising daily). Nearly 30 % of the study sample was overweight/obese (overall prevalence among the study group = 29·5 %) and thus obesity seems to be a common problem among children in north Jordan. On the other hand, 59 % of the participants had normal weight and almost 11 % were underweight.

Children and adolescents in the present study were divided into three groups based on their age as follows: the first group included children aged ≤10 years, the second group included adolescents aged 11–14 years old and the third group included adolescents aged ≥15 years. The children's and adolescents' anthropometric characteristics based on their age group showed that there was a significant increase in mean BMI, WC, height and weight in general, as shown in Table 3. This increase in BMI and WC is expected because children grow fast during this stage of their lives.

Examination of the means of BMI and WC according to gender, age, place of living and eating while watching TV showed that there was a significant difference ($P < 0.05$) by BMI and gender among all age groups (Table 4). Males tended to have a higher BMI than females ($P < 0.05$) in all age groups except the ≥15 years group, where females had a higher BMI mean than males (22·73 (sd 7·30) *v.* 22·57 (sd 5·56) kg/m^2, respectively; $P < 0.05$). A similar trend was also observed concerning WC between males and females, where males had a significantly higher mean WC compared with females in the age groups ≤10 years and ≥15 years ($P < 0.05$). Mean BMI and WC among children and adolescents according to urban or rural residency showed that children living in urban areas had significantly a higher mean BMI than those living in rural areas in all three age groups ($P < 0.05$). Likewise, mean WC for urban children aged ≤10 years and ≥15 years was significantly higher than that of their counterparts living in rural areas ($P < 0.05$). Both mean BMI and WC were significantly higher in children who ate in front of the TV

Table 3 Anthropometric characteristics of the children and adolescents (n 516) by age group, Irbid, north Jordan, autumn 2016

	≤ 10 years		11–14 years		≥ 15 years		
Variable	Mean	SD	Mean	SD	Mean	SD	P value*
BMI (kg/m)^2	19·1	4·1	19·4	3·2	22·7	4·3	0·000
WC (cm)	69·5	12·3	74·2	10·8	83·7	15·2	0·000
Height (cm)	141·5	10·6	149·5	10·2	164·2	9·9	0·000
Weight (kg)	38·4	10·0	43·6	12·1	61·4	15·6	0·000

WC, waist circumference.
*Values are significantly different between age groups by the least significant difference test if $P < 0.05$.

Table 4 Mean BMI and waist circumference of the children and adolescents (n 516) by age, gender, place of living and eating in front of the television, Irbid, north Jordan, autumn 2016

		BMI (kg/m^2)			WC (cm)		
Age group	Variable	Mean	SD	P value*	Mean	SD	P value*
≤ 10 years	Males	19·6	4·39	0·032	76·4	11·14	0·032
	Females	18·2	3·47		69·2	10·69	
11–14 years	Males	20·8	5·57	0·036	88·6	11·78	0·61
	Females	20·3	2·81		79·2	7·81	
≥ 15 years	Males	22·6	5·56	0·014	95·2	11·44	0·021
	Females	22·7	4·25		75·9	12·04	
≤ 10 years	Rural	18·3	3·91	0·031	68·9	10·83	0·046
	Urban	18·7	3·34		74·2	11·04	
11–14 years	Rural	20·5	3·99	0·041	75·9	12·22	0·61
	Urban	20·2	2·88		74·7	11·18	
≥ 15 years	Rural	22·0	4·59	0·012	82·4	15·33	0·013
	Urban	24·1	5·04		87·4	14·22	
≤ 10 years	Eat in front of TV	18·9	3·91	0·72	69·6	10·85	0·46
	Do not eat in front of TV	19·3	3·34		70·2	10·07	
11–14 years	Eat in front of TV	19·4	3·99	0·050	75·9	12·22	0·041
	Do not eat in front of TV	19·1	2·88		72·7	11·18	
≥ 15 years	Eat in front of TV	23·2	4·59	0·050	82·4	14·31	0·012
	Do not eat in front of TV	22·1	5·04		80·3	14·22	

WC, waist circumference; TV, television.
*Values are significantly different between genders, living places and eating in front of the TV or not by the least significant difference test if $P < 0.05$.

compared with those who did not eat while watching TV, except in the group of children aged ≤10 years ($P = 0.46$).

Table 5 shows that half of the parents knew the minimum water requirements for their children. However, about 80 % of those parents did not know the best oil to be consumed. Among the 516 participants, only 39 % of the parents know nutrients and food items that could contribute to obesity. Nearly 57 % of them realized that salad is a healthy food choice and about 60 % of mothers revealed that they mostly gave unhealthy options to their children when they are hungry as snacks. On the other hand, half of the mothers knew that fruits and vegetables are high in vitamins and minerals.

Table 6 shows that 40 % of the mothers answered four or more questions correctly out of six, which indicates a sufficient level of nutritional knowledge, while 20 % of the mothers were considered to have a moderate level of nutritional knowledge (three out of six questions answered correctly) and 40 % had a low level of nutritional knowledge (fewer than three of the six questions answered correctly). We found a significantly decreased

mean WC in the children and adolescents whose mothers had a moderate and high level of nutritional knowledge, compared with those whose mothers had a low level of nutritional knowledge.

Discussion

The purpose of the present study was to estimate the prevalence of overweight and obesity among children and adolescents in north Jordan and to explore the risk factors associated with such crucial phenomena. The major finding of the study was that overweight and obesity are serious health problems that may be common in all age groups including children and adolescents in both genders. The prevalence of overweight/obesity was 29·5 %, while about 11 % of the study population was underweight. Our findings are similar to those of Mahajan et al.[19] in India, who found that the prevalence of childhood overweight and obesity ranged from 3 to 29 % and indicated that the prevalence was higher in urban than

in rural areas among children aged 6–12 years. A similar trend was also reported in Taiwan based on a cross-sectional study conducted among schoolchildren. In that survey of 1366 school-aged Taiwanese children, it was found that the prevalence of obesity has steadily increased from 1980 to 1994, from 12·4 to 16·4 % for boys and from 10·1 to 11·1 % for girls[20].

Underweight has also been reported among school-children (6–11 years) and adolescents (12–18 years) in many Arab countries. Studies in Egypt, Lebanon, Tunisia, Jordan, Yemen and Arab Gulf countries showed that the prevalence of underweight ranged from 10 to 35 % among schoolchildren and from 5 to 25 % among adolescents. Despite the fact that most of these studies were not national baselines, they give a good indicator that a high percentage of underweight exists in these age groups in the region. Unhealthy dietary habits such as skipping breakfast, low intake of nutritious foods (such as milk,

fruits and vegetables), high intake of 'empty-calorie' foods (such as soft drinks and some sweets) and lack of nutritional knowledge are the main factors for the high proportion of underweight among schoolchildren and adolescents in the majority of Arab countries[21].

In the present study, a significant difference ($P < 0.05$) in BMI was found between boys and girls in the age groups ≤10 years and 11–14 years, with higher BMI in males than females. This agrees with Jeffry and Voss[22] who found in 2015 that parents of obese boys were not aware about the weight of their children; on the other hand, girls and their parents were under more cultural pressure about their perfect body shape. Our findings are also in agreement with Geer and Shen[23] who found that male children have larger WC because they have more abdominal fat than female children, which distributed in an apple shape. However, our study findings revealed that females at age ≥15 years had higher BMI than males of the same age. This could be due to hormonal changes, which are considered the main cause of weight changes at this age, and is in concordance with Waters *et al.*[24], who found that women tend to crave foods high in fat and carbohydrate during specific phases of the menstrual cycle. Women also tend to have higher energy intake during their period and/or during premenstrual syndrome. Women with premenstrual syndrome suffer from any of a complex of symptoms including emotional tension and fluid retention in the days immediately before menstruation. Those symptoms change females' appetite and energy-rich food craving, which contributes to weight gain.

We also evaluated BMI in children and adolescents living in urban and rural settlements. Those living in a city had a higher BMI compared with those who lived in villages. Children who live in a village are known to be more active and tend to play more with their peers in the neighbourhood. Children also practise outdoor play and sports, which have been substituted by video games, TV, computers and mobile devices by children who live in a city, which makes urban children at higher risk of becoming overweight and obese[12]. Furthermore, children who live in a village spend less time at school and walk to school, instead of using school buses or private cars, that makes them less obese than city children[25]. On the other hand, frequent walking

Table 5 Parent's answers to the nutritional knowledge quiz (*n* 516), Irbid, north Jordan, autumn 2016

Question (correct answer)	*n*	%	*P* value*
Water requirements for children (≈6 cups/d)			1·000
Correct	258	50·0	
Incorrect	258	50·0	
Best oil to be consumed (olive oil)			<0·001
Correct	119	23·1	
Incorrect	397	79·6	
Nutrients and food items that could contribute to obesity (carbohydrates, rice, bread)			<0·001
Correct	202	39·1	
Incorrect	314	60·9	
Healthy food choices (salad)			0·002
Correct	223	43·2	
Incorrect	293	56·8	
Children preference when hungry (homemade cooked meals)			<0·001
Correct	207	40·1	
Incorrect	309	59·9	
High sources of vitamins and minerals (vegetables and fruits)			0·725
Correct	254	49·2	
Incorrect	262	50·8	

*Values are significantly different between correct and incorrect answers by the least significant difference test if $P < 0.05$.

Table 6 Mean BMI and waist circumference of children and adolescents (*n* 516) by their mothers' level of nutritional knowledge, Irbid, north Jordan, autumn 2016

Level of nutritional knowledge	*n*	%	BMI (kg/m²)			WC (cm)		
			Mean	SD	*P* value	Mean	SD	*P* value
High	207	40	19·5	3·61	0·076	74·2[a]	10·42	0·045
Moderate	103	20	19·8	3·24		74·7[a]	11·15	
Low	206	40	20·7	4·25		77·9[b]	12·21	

WC, waist circumference.
[a,b]Mean values within a column with unlike superscript letters were significantly different by the least significant difference test ($P < 0.05$).

or cycling to school makes city children more active than those children who are living in villages and less likely to be overweight/obese[26].

The WHO[27] reported that several environmental factors, including low air quality, pollution and high-density traffic, lack of parks and sidewalks, violence and absence of recreational facilities due to increased urbanization, might discourage participation in physical activity in both adults and children, thus increasing the rate of overweight and obesity[28].

Our results confirmed that children older than 11 years who eat in front of the TV tend to have higher BMI and higher WC. These findings agree with a study conducted on 523 children who ate in front of the TV, which found that 49 % of these children were obese[29]. Commercials and mass media have a significant effect on eating habits. The amount of time spent in front of the TV and the content watched can be a reason for developing obesity. TV not only contributes to physical inactivity, but also commercials and other programmes encourage viewers to eat more[1]. In addition, watching TV goes hand in hand with eating snacks, most of which contain a large amount of energy. In the current study, among children aged ≤ 10 years, those who ate in front of the TV did not have a significantly different BMI or WC compared with those who did not tend to eat while watching TV. This is likely explained because most hormonal changes occur at about 15 years of age, which may make the older group more susceptible to obesity than younger children[30]. Also, younger children tend to be more physically active and interested in playing more than older children and adolescents.

Parental nutritional knowledge level was generally low in the present study, as most of the mothers (60 %) did not answer an adequate number of questions correctly. Also, children of mothers having a high/moderate level of knowledge tended to have a decreased WC compared with children of mothers having a low level of nutritional knowledge. This may indicate that mothers or parents may pass on wrong behaviours and information to their children, which may affect their choices and dietary practices later in life and in turn affect their weight and health in adulthood.

Conclusion

The current study revealed that obesity is a growing health problem in child and adolescent school students in Irbid city, which requires an appropriate intervention, especially considering the alarming rates of obesity and its associated co-morbidities among Jordanian schoolchildren. Public health efforts in Jordan should be directed towards the creation of new prevention programmes at the individual, family and community level to promote schoolchildren's health.

More research is required on the behavioural and biological causes of overweight and obesity, and on the prevalence among different regions, ages and settings. Appropriate health policies are urgently needed to prevent or reduce the obesity problem. Parents should learn more about proper nutrition and should be advised to monitor the dietary habits of their children and to correct any unhealthy habits as early as possible. Moreover, parents should play an important role in motivating their children to practise different sports in- and outside home. It is recommended that schoolteachers must be engaged in healthy nutrition training workshops to emphasize the importance of balanced nutrition for all school students in the north of Jordan.

Acknowledgements

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