Does severity of intellectual disability affect the nutritional status of intellectually disabled children and adolescents?

Hilal Sahin[1] and Nalan Hakime Nogay[2]

[1]Department of Nutrition and Dietetics, Faculty of Health Sciences, Erzincan Binali Yıldırım University, Erzincan, Turkey; [2]Department of Nutrition and Dietetics, Faculty of Health Sciences, Erciyes University, Kayseri, Turkey

Background: Balanced and adequate nutrition is important to improve the quality of life of children with intellectual disability but most of these children are negatively affected by nutritional problems.
Objective: This study was conducted to determine the nutritional status and effect of the severity of intellectual disability on nutritional status of children and adolescents with intellectual disabilities.
Methods: One hundred twenty-two intellectually disabled children aged 4–18 years from five different special education and rehabilitation centers were included in the study. Their socio-demographic characteristics, body weight, height, body mass index (BMI), mid-upper arm circumference (MUAC), and skinfold thickness were examined, and their three-day food consumption record was taken.
Results: Anthropometric scores did not differ significantly according to the severity of intellectual disability. According to evaluations made based on the World Health Organization's 2007 percentile curves, 61.4% of the subjects with mild intellectual disability (MID), 57.1% of those with moderate intellectual disability (MOID), and 53.3% of those with severe intellectual disability (SID) were within the normal BMI range for their age.
Conclusion: Rates of malnutrition and shortness in children and adolescents with SID were found to be higher than among children with MID and MOID, though the differences were not statistically significant.

Keywords: children, adolescent, intellectual disability, nutrition, nutrition assessment

Introduction

The American Association on Intellectual and Developmental Disabilities (AAIDD) defines intellectual disability as a condition originating in the developmental period characterized by significant limitations in both intellectual functioning and adaptive behavior, which covers many everyday social and practical skills, such as communication, self-care, familial life, social abilities, social utility, self-management, health and safety, functional academic skills, recreation, and significantly low general mental capacity, causing difficulty in learning, reasoning, problem solving, and the like (American Association on Mental Retardation 1992).

A report issued by the World Health Organization (WHO) in 2011 defined disability as a negative situation arising when subjects with health problems encounter difficulty in their interaction with personal and environmental agents. There are an estimated 200 million people in the world who experience serious difficulties in their day-to-day life due to disability and over a billion people with disabilities (WHO – World Report on Disability 2011). In developed countries, 10% of the total population are disabled and 12% in developing countries (WHO –Disability Prevention and Rehabilitation 1981). According to the 2002 Turkey Disability Survey, disability prevalence was 12.29% (8,431,937 persons); 11.1% of these were men, 13.45% of them were women, 4.15% were children in the 0–9 age group, and 4.63% in the 10–19 group (Turkey Disability Survey 2002).

Balanced and adequate nutrition is important to improve the quality of life of children with intellectual disability but most of these children are negatively affected by nutritional problems (Gal *et al.* 2011), which are often not discerned by the people who meet their basic needs (Stewart 2003). Failing to develop independent eating habits, presenting stressful behaviors, eating too much or too little, being extremely selective, rumination, vomiting, pica, taking food secretly between meals, and being obsessed with the

CONTACT Nalan Hakime Nogay nalanhakime@gmail.com/nalannogay@erciyes.edu.tr Department of Nutrition and Dietetics, Faculty of Health Sciences, Erciyes University, Kayseri, Turkey

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temperature or presentation of meals are among the problems presented by intellectually disabled people. Even if untreated nutritional problems do not lead to death, they can have serious consequences (Matson and Kuhn 2001).

Studies have shown that people with intellectual disability encounter at least one of the following problems: dysphasia and weight gain (Calis *et al.* 2008) associated with it, hypertension, obesity (Lin *et al.* 2010) related to elevated hunger, higher levels of plasma, glucose, and triglyceride than the general population of the same age, pica, malnutrition (Ali 2001), and risk of dehydration (Sengupta *et al.* 2019).

This study aimed to determine the nutritional status and effect of the severity of intellectual disability on nutritional status of children and adolescents with intellectual disabilities.

Methods

This study aimed to determine the nutrition status of children with intellectual disability and was carried out in five special education and rehabilitation centers between June and December of 2016. The study was conducted pursuant to the Helsinki declaration. Considering that the first margin of error and power would be 0.05 and 0.90, respectively, 113 intellectually disabled subjects were thought to be enough for the research sample. Ultimately, the study was carried with 122 subjects, 57 of whom had mild (MID), 35 moderate (MOID), and 30 severe (SID) intellectual disability. They were previously diagnosed with intellectual disability by a pediatric psychiatrist.

Socio-demographic characteristics of the children were obtained from their mothers through face-to-face interview. Their body weight, height, mid-upper arm circumference (MUAC), triceps skinfold thickness (TST), and subscapular skinfold thickness (SST) were measured using appropriate methods (WHO Technical Report Series 1995). Body mass index (BMI; kg/m^2) was calculated by dividing body weight by the square of the height in meters. All anthropometric measurements were assessed according to the WHO's percentile curves (WHO – Child Growth Standards 2019, WHO-Growth Reference Data 2007).

A three-day food consumption form was given to the children's mothers and they were asked to complete it noting the food their children had consumed on three days, one weekend day and two weekdays. The amount of food consumed during this period was then confirmed and recorded through face-to-face interview with the mothers. The mothers were also asked about the dimension of plates, glasses, and bowls to help define the amounts of food and drink; exact amounts were determined in grams and milliliters using a photographic atlas containing food portion scores (Rakı cı oglu *et al.* 2015). The mean of macro- and micro-food element intake and energy were calculated using the BEBIS 7 software (Nutrition Information Systems 2007). The results were compared with Recommended Daily Allowances (RDA). Food intake that represented less than two-thirds of the RDA was considered inadequate consumption (Otten *et al.* 2006).

Body weight and height

These were measured while the subject stood upright and motionless, their heels side by side, using digital scales with a sensitivity of ±0.1 kg (DENSI-S200, TR). The instrument was calibrated by placing it in an empty room on a non-sloping hard tiled floor. The subjects were weighed barefoot, wearing light clothes. Each subject was made to stand on the device without touching any other objects or using any support. Their weight and height were measured at the same time while their feet and back touched a Frankfort plane. *BMI:* This was calculated by dividing body weight (kg) by the square of the height in meters (m) (Cole *et al.* 1995). *MUAC:* This was taken twice by the researcher while the subject stood upright and free, using an inflexible measure with a sensitivity of ±1 mm. The mean score of the two measurements were used for the analysis (Kondrup *et al.* 2003). *TST*: The distance between the end point of the acromion process of the scapula and the olecranon process of the ulna was measured while the elbow was at 90° flexion and the midpoint was marked. Skinfold thickness was measured 1 cm under the marked point while the subject stood with their hands hanging freely (Norgan 1988). *SST*: This was taken by making a 45° angle between the inferior side of the scapula to the spine on the macro medialis line (just below the bottom line of the bone along the natural separation line underneath the scapula) while a subject stood with their arms hanging freely (Van der Kooy and Seidell 1993). Percentile comparisons of the anthropometric measurements were made according to the WHO scales determined for males and females aged 4–19 (WHO – Child Growth Standards 2019).

Statistical analysis

The data were analyzed using the IBM SPSS Statistics 22.0 (IBM Corp., Armonk, New York, ABD) software. The number of units (n), percentage (%), mean standard deviation ($\bar{x} \pm sd$), minimum value (min v), maximum value (max v), median (M), and 25th ($Q1$) and 75th percentiles ($Q3$) were used as descriptive statistics. The Shapiro–Wilk normality test and Q–Q graphs were used in the evaluation of the numerical variables normal distribution. In two-group comparisons, t test was used for parametric variables and Mann–Whitney U test for non-parametric variables. In comparison of three or more groups, *one-way analysis of variance* (*one-way ANOVA*) was used for parametric variables, and the Kruskal–Wallis test for non-parametric variables. When

Table 1. Socio-demographic characteristics of children and adolescents with intellectual disability.

Socio-demographic characteristics	n	%
Gender		
Female	54	44.3
Male	68	55.7
Age group		
4–6	20	16.4
7–9	32	26.2
10–13	34	27.9
14–18	36	29.5
Severity of intellectual disability		
Mild	57	46.7
Moderate	35	28.7
Severe	30	24.6
Location of the family		
Village	32	36.2
Town	13	10.7
City center	77	63.1
Caregiver(s)		
Mother	75	61.5
Mother and father	32	26.2
Mother and grandmother	15	12.3

a difference was found by the Kruskal–Wallis test, the Dunn–Bonferroni test was used as a multiple comparison test. Relationships between categorical variables were examined by Fisher's exact test on 2 × 2 and RxC tables. The value of $p < .05$ was considered statistically significant.

Results

The sample was 44.3% female and 55.7% male; 16.4% were aged 4–6, 26.2% were 7–9, 27.9% were 10–13, and 29.5% were 14–18. In examining care givers, 61.5% of children were cared for by their mother, helped in 26.2% of cases by their father and in 12.3% of cases by their grandmother (Table 1).

The distribution of the anthropometric measurements according to age and gender is shown in Table 2. The mean height of the boys in the 14–18 age group was 160.69 ± 10.10 cm; that of the girls was 154.04 ± 6.65 cm and there was a statistically significant difference between the genders ($p = .029$). The mean TST in the same age group was 8.00 mm (5.65–12.85) among the boys and was 12.30 mm (8.00–19.20) among the girls, and the gender difference was statistically significant ($p = .038$). The mean SST of the boys in the 10–13 age group was 9.10 mm (6.00–13.00) and 12.10 mm (9.10–16.30) among the girls, and the gender difference was statistically significant ($p = .040$). The mean height of the girls in the 4–6 age group was 100.57 ± 7.41 cm and that of the boys was 111.73 ± 10.68 cm, and there was a statistically significant difference ($p = .025$).

The mean nutrient intake and energy of the subjects according to the severity of their intellectual disability are shown in Table 3. The SID group's mean energy intake was 1458 (1313–1709) calories, and this was lower than those of the other two groups though the difference was insignificant ($p = .807$). There was no significant difference in protein intake between the groups ($p = .562$). Oil consumption in the SID group was 60.95 g (51.65–73.77), which was lower than in the two other groups ($p = 0.493$). The fiber consumption was similar in all the groups. There was no significant difference between the different groups in vitamin intake. The MID group had the highest intake for vitamin A, vitamin C, thiamin, riboflavin, folic acid, and vitamin B12 intake. The SID group had the lowest intake of vitamin A, vitamin B6, and vitamin C. There was no significant difference in calcium, iron, and zinc intake between the groups (Table 3). The percentages of the subjects' daily energy and nutrient intake needs being met according to RDA are shown in Table 4. Daily fiber intake need was met at low levels in all groups. The intake of all nutrients, except fiber, was satisfactory.

Table 5 shows the subjects' nutritional status according to their intellectual disability. It was found that the severity of intellectual disability made no significant difference to anthropometric measurements. The percentage of subjects with SID who were stunted and suffered malnutrition (severe thinness) according to their BMI was higher than those with MID and MOID. There was a higher percentage of malnourishment in tall children in all groups. Most children had a normal BMI in all groups. In examining the MUAC, it was found that nearly half of the subjects in all groups were in the normal percentile. It was determined that 23.3% of the subjects with SID, 19.3% of those with MID, and 14.3% of those with MOID were thinness in terms of TST ($p = .056$). According to the anthropometric measurements, the percentage of subjects with MID in the normal percentile was higher than those of the subjects with MOID and SID.

Discussion

On hundred twenty-two intellectually disabled children and adolescents participated in this study; 55.7% were male and 43.3% were female, and their mean age was 10.63 years. They were divided into three groups according to the severity of their intellectual disability.

The participants' BMI in this study were measured at 18.78 kg/m^2, 19.22 kg/m^2, and 19.41 kg/m^2 in the MID, MOID, and SID groups, respectively. There was no significant difference between anthropometric measurements based on gender in Nogay's (2013) study which was including children with ID. In our study, however, the height of the boys in the 14–18 age group and the SST of the girls in the 10–13 age group were significantly high. There was no significant difference among the anthropometric measurements in other age groups by gender.

A study conducted by Tuncer (2004) with healthy primary school students found that the body weight, height, MUAC, and skinfold thickness of children of a

Table 2. Distribution of anthropometric scores of intellectually disabled children according to age and gender.

Anthropometric measurements	Age group	Male		Female		p
		$\bar{x}\pm sd$	M (Q_1–Q_3)	$\bar{x}\pm ss$	M (Q_1–Q_3)	
Body weight (kg)	4–6	21.28 ± 6.79	20.35 (16.40–24.22)	16.80 ± 3.47	16.20 (14.30–19.30)	.122
	7–9	27.93 ± 6.48	26.74 (25.25–31.70)	25.00 ± 4.65	24.55 (20.65–28.72)	.172
	10–13	37.66 ± 14.25	31.65 (27.40–44.45)	38.61 ± 11.15	35.50 (31.15–48.15)	.834
	14–18	57.07 ± 14.65	55.35 (46.07–64.60)	51.81 ± 11.31	46.60 (42.30–62.70)	.233
Height (cm)	4–6	111.73 ± 10.68	109.00 (105.00–117.00)	100.57 ± 7.41	101.00 (94.00–104.00)	.025*
	7–9	122.67 ± 10.79	125.00 (120.00–127.00)	119.09 ± 7.94	120.00 (110.50–125.65)	.316
	10–13	141.12 ± 13.93	140.10 (128.40–152.00)	142.90 ± 9.12	144.00 (136.00–151.20)	.672
	14–18	160.69 ± 10.10	160.70 (152.70–169.55)	154.04 ± 6.65	153.00 (149.00–157.00)	.029*
BMI (kg/m^2)	4–6	16.69 ± 2.45	16.61 (14.97–17.69)	16.50 ± 2.14	16.53 (14.97–18.19)	.869
	7–9	18.40 ± 3.47	17.64 (16.08–20.29)	17.57 ± 2.40	17.51 (15.87–19.21)	.460
	10–13	18.36 ± 3.41	17.72 (16.07–20.42)	18.63 ± 3.85	17.40 (16.46–19.78)	.829
	14–18	21.93 ± 4.46	20.97 (18.85–23.57)	21.78 ± 4.30	19.62 (18.66–25.52)	.915
MUAC (cm)	4–6	18.39 ± 2.57	18.00 (16.20–20.00)	17.00 ± 1.39	17.00 (15.80–18.00)	.204
	7–9	18.92 ± 2.41	19.00 (18.00–21.00)	19.42 ± 2.47	20.00 (17.15–21.00)	.572
	10–13	21.24 ± 3.02	21.00 (18.70–23.00)	21.24 ± 2.62	21.00 (20.00–23.00)	.996
	14–18	25.44 ± 3.99	25.00 (21.50–28.60)	24.10 ± 3.85	23.10 (21.00–26.00)	.313
TST (mm)	4–6	9.63 ± 5.35	7.50 (6.00–11.75)	7.21 ± 1.88	7.00 (6.00–8.00)	.485
	7–9	10.33 ± 3.52	11.00 (7.00–13.00)	11.43 ± 3.55	12.50 (7.15–14.60)	.323
	10–13	10.45 ± 5.41	9.10 (6.00–13.00)	12.26 ± 4.25	12.10 (9.10–16.30)	.120
	14–18	9.62 ± 5.35	8.00 (5.65–12.85)	13.61 ± 6.54	12.30 (8.00–19.20)	.038*
SST (mm)	4–6	6.94 ± 3.38	6.00 (4.65–8.25)	5.07 ± 1.58	4.60 (4.20–7.00)	.183
	7–9	7.20 ± 2.25	7.20 (4.30–9.10)	7.51 ± 2.34	8.20 (4.90–9.60)	.650
	10–13	10.45 ± 5.41	9.10 (6.00–13.00)	12.26 ± 4.25	12.10 (9.10–16.30)	.040*
	14–18	9.89 ± 5.61	8.00 (6.40–13.60)	12.19 ± 5.71	11.00 (7.00–17.00)	.208

*$p < .05$

Table 3. Daily energy and nutrients intake.

Energy and nutrients	MID ($n = 57$) M (Q_1–Q_2)	MOID ($n = 35$) M (Q_1–Q_2)	SID ($n = 30$) M (Q_1–Q_2)	p
Energy	1556 (1300–1785)	1594 (1218–1718)	1458 (1313–1709)	.807
Protein	58.80 (49.80–67.00)	53.50 (39.90–71.10)	56.55 (47.07–66.87)	.562
Fiber	17.90 (13.45–20.70)	15.70 (13.30–19.70)	16.50 (13.87–19.65)	.650
vitamin A	867 (566–1386)	645 (514–1237)	637 (497–1048)	.139
Vitamin B1	0.70 (0.60–0.80)	0.60 (0.60–0.70)	0.60 (0.50–0.70)	.500
Vitamin B2	1.20 (1.00–1.35)	1.10 (0.70–1.30)	1.15 (0.90–1.30)	.290
Vitamin B6	1.10 (0.90–1.25)	1.10 (0.80–1.20)	1.05 (0.80–1.22)	.761
Vitamin B12	3.56 (2.41–4.39)	3.03 (1.85–4.21)	3.43 (2.13–5.05)	.538
Folic acid	205.20 (167.55–235.75)	189.70 (163.50–221.50)	196.20 (164.70–237.27)	.596
Vitamin C	84.80 (50.40–109.65)	73.50 (49.80–119.50)	73.25 (50.65–110.60)	.849
Calcium	621.3 (530.9–757.2)	548.9 (378.7–703.1)	591.3 (455.3–765.5)	.207
Iron	8.00 (7.75–9.90)	7.90 (7.10–9.60)	8.20 (7.20–9.50)	.154
Zinc	8.10 (6.90–9.00)	7.20 (5.80–8.60)	7.50 (6.60–8.62)	.206

MID, mild intellectual disability; MOID, moderate intellectual disability; SID, severe intellectual disability.
*$p < .05$.

Table 4. Meeting energy and nutrients needs according to DRIs.

Energy and food element	Percentage of the needs being met (%)		
	MID ($n = 57$) x ± SD	MOID ($n = 35$) x ± SD	SID ($n = 30$) x ± SD
Energy	75.69 ± 21.10	75.13 ± 19.29	72.26 ± 19.14
Protein	197.84 ± 74.85	199.14 ± 83.93	195.68 ± 79.05
Fiber	63.42 ± 21.26	60.43 ± 17.55	59.26 ± 18.83
Vitamin A	207.10 ± 172.64	173.98 ± 163.89	190.07 ± 278.73
Vitamin B1	80.51 ± 28.51	82.65 ± 30.55	77.07 ± 28.67
Vitamin B2	136.18 ± 53.56	130.05 ± 51.00	133.90 ± 60.03
Vitamin B6	123.46 ± 49.97	126.17 ± 56.65	125.61 ± 61.24
Vitamin B12	279.63 ± 282.34	249.23 ± 330.04	225.75 ± 127.01
Folic acid	73.74 ± 24.20	71.88 ± 20.38	72.86 ± 26.69
Vitamin C	213.87 ± 124.75	224.76 ± 151.34	197.55 ± 111.02
Calcium	72.49 ± 41.97	74.90 ± 40.59	75.19 ± 43.17
Iron	92.94 ± 29.41	76.32 ± 24.13	85.60 ± 36.52
Zinc	110.19 ± 32.13	107.34 ± 35.86	109.75 ± 36.86

MID, mild intellectual disability, MOID, moderate intellectual disability, SID, severe intellectual disability.

high socioeconomic level were higher than those of children of a low socioeconomic level. The anthropometric measurements of the female children with intellectual disability in our study were more similar to those of the low socioeconomic group, but the anthropometric measurements of the boys were closer

Table 5. Evaluation of nutritional status according to severity of intellectual disability.

		MID ($n = 57$)		MOID ($n = 35$)		SID ($n = 30$)		
		n	%	*n*	%	*n*	%	*p*
Body weight (kg)	Severe thinness	5	8.8	3	8.6	4	13.3	.485
	Thinness	7	12.3	8	22.9	6	20.0	
	Normal	18	31.5	6	17.1	6	20.0	
	Overweight	14	24.6	6	17.1	9	30.0	
	Obesity	13	22.8	12	34.3	5	16.7	
	Total	57	100	35	100	30	100	
Height (cm)	Stunted	9	15.7	8	22.8	7	23.3	.380
	Short	14	24.6	10	28.6	8	26.7	
	Normal	31	54.4	13	37.1	13	43.3	
	Tall	3	5.3	1	2.9	0	0.0	
	Very tall	0	0.0	3	8.6	2	6.7	
	Total	57	100	35	100	30	100	
BMI (kg/m^2)	Severe thinness	1	1.8	1	2.9	1	3.3	.599
	Thinness	3	5.3	1	2.9	5	16.7	
	Normal	35	61.4	20	57.1	16	53.3	
	Overweight	8	14.0	5	14.3	2	6.7	
	Obesity	10	17.5	8	22.8	6	20.0	
	Total	57	100	35	100	30	100	
MUAC (cm)	Severe thinness	11	19.3	8	22.9	7	23.3	.580
	Thinness	7	12.3	6	17.1	5	16.7	
	Normal	33	57.9	15	42.9	15	50.0	
	Overweight	4	7.0	2	5.7	3	10.0	
	Obesity	2	3.5	4	11.4	0	0.0	
	Total	57	100	35	100	30	100	
TST (mm)	Severe thinness	5	8.8	1	2.9	2	6.7	.056
	Thinness	11	19.3	5	14.3	7	23.3	
	Normal	38	66.6	22	62.8	13	43.3	
	Overweight	2	3.5	5	14.3	8	26.7	
	Obesity	1	1.8	2	5.7	0	0.0	
	Total	57	100	35	100	30	100	

MID, mild intellectual disability; MOID, moderate intellectual disability; SID, severe intellectual disability; BMI, body mass index; MUAC, mid-upper arm circumference; TST, triceps skinfold thickness.

*$p < .05$.

to the high socioeconomic group. Comparison of the two studies shows that the scores of boys with intellectual disability were closer to those of the healthy children in Tuncer's study than the girls were. In the study they conducted with healthy children, Pietrobelli et al. (1998) found that body weight, height, and BMI of boys in the 7–11 age group were lower than those of their female counterparts. Body weight, height, and BMI of boys in the 13–17 age group were higher than those of the girls in the same study. Although the height, body weight, and BMI of boys with intellectual disability in the 7–9 age group were higher than those of the girls in this study, all the of the girls in the 10–13 age group were higher than those of the boys. Body weight, height, and BMI mean of the boys in the 14–18 age group were higher than those of their female counterparts. Therefore, considering the differences between age groups, it is seen that the anthropometric measurements of children with intellectual disability in our study are similar to those of the healthy children. In a study conducted with 225 children aged between 11 and 15 years with intellectual disability, unlike our study, BMI of females was found to be higher than males (Pise *et al.* 2019).

Lopes *et al.* (2008) evaluated the body weight and height of 138 children with Down syndrome. The body weight and height of the children under 14 in our study are similar to those of Lopes *et al.* (2008) children with Down syndrome in the same age group. In comparison of the adolescents in the 14–17 age group, the body weight of the subjects with Down syndrome in Lopes' study was higher, but their height was smaller. This could have been because there was a small number of children with Down syndrome who were short and overweight in that age group in our study.

Calis *et al.* (2010) found that there was no relation between the energy intake of children with ID due to cerebral palsy and their nutritional state. In this study, in which the energy and micro/macronutrient intake of 138 children who had cerebral palsy and intellectual disability (MID, MOID, SID) was examined, daily energy and protein intake were lower than our study. In our study, however, the vitamin B6, folic acid, vitamin B12, and calcium intake of children with MID, MOID, and SID were lower than in Calis *et al.* (2010). In our study, differently, the effect of the severity of intellectual disability on food intake was also evaluated, and although it was not statistically significant, those with mild intellectual disability, compared to those with moderate and severe intellectual disability, daily energy, protein, fiber, vitamin A, vitamin B2, vitamin B12, Ca, and zinc intakes were higher. This may be because those with mild intellectual disability have a better food preparation and independent feeding skills.

In a study in which they investigated the nutritional status of adolescents living in an orphanage, Gümüş *et al.* (2011) found energy intake similar to our study. However, the daily energy intake of the adolescents living in the orphanage was lower that of the subjects with intellectual disability in our study. The adolescents' daily intake of vitamin B1, vitamin B2, vitamin B6, vitamin B12, and vitamin C was higher than those of the subjects in our study. Daily potassium, calcium, iron, and zinc intake of the adolescents living in the orphanage was also higher than the subjects in our study. As a result, the findings of these two studies on the daily intake of nutrients support each other.

Adequate intake of energy and nutrients in children is important for growth and development. Some micronutrients can play an important role in children's brain development. The intellectual function is mostly related to iron, zinc, iodine, folic acid, and vitamin B12 deficiency (Warthon-Medina *et al.* 2015). Insufficient intake of zinc can lead to behavioral problems such as attention deficit and hyperactivity disorder in children. Iron deficiency is one of the major causes of impairment in motor skills and cognitive function (McAfee *et al.* 2012). B6, B12, and folic acid are required for the synthesis of some neurotransmitters. Adequate intake of micronutrients is also necessary for optimal immune function (Singh 2004). Micronutrient insufficiency in intellectual disability individuals can increase the already existing focus and behavioral problems, as well as disrupt their general health status (such as to be catching infectious diseases frequently) and negatively affect their quality of life and education processes. Therefore, it is very important to ensure an adequate intake of micronutrients. Mathur *et al.* (2007) compared the nutritional state of 117 children and adolescents with intellectual disability in the 7–18 age group with 100 normal children and adolescents. The iron and riboflavin intake of boys with intellectual disability in the 10–18 age group was lower than that of the healthy subjects. The inefficacy of iron intake was most serious in boys in the 10–15 age group. The potassium intake of the subjects in our study and that of those with intellectual disability in Mathur and colleagues' (2007) study are similar. In a study conducted with children aged 3–10 years with intellectual disability, daily energy, Ca, Fe, zinc, vitamin B2, vitamin B6 intake was found to be insufficient according to RDA (Kavitha *et al.* 2018). In another study conducted on this subject, daily Ca, vitamin C, vitamin B1, and folic acid intake of intellectually disabled children and adolescents between the ages of 10–18 were below the recommended values (Nogay 2013). In our study, only the daily fiber intake was found to be insufficient according to RDA. When evaluated according to the severity of intellectual disability, fiber intake according to RDA was less in the group with severe intellectual disability than the groups with mild and moderate intellectual disability. Intake of nutrients other than fiber was found to be sufficient in our study. The reasons for this may be that the intellectual disabled children and adolescents included in the study did not have selective eating, eating behavior problems such as picky eaters, they did not have gastrointestinal problems that would affect their food intake, and the majority of those was engaging with livestock rearing and farming in the city so this situation facilitated access to healthy foods.

Malnutrition is an important health problem in both typically developing and disabled children. However, the dependence of intellectually disabled children on others for nutrition and food preparation increases their susceptibility to malnutrition. In addition, severity of intellectual disability and the presence of other comorbid conditions (such as autism, down syndrome, epilepsy) also affect malnutrition (Mohamed *et al.* 2021). In a study conducted with children with intellectual disability, it was observed that individuals with severe intellectual disability were more likely to be unable to feed independently than those with mild and moderate intellectual disability (Rezaei *et al.* 2011). It was found in a study conducted in China that 8.1% of children with autism suffered from malnutrition. The frequency of malnutrition in children with intellectual disability in our study was less than that of these children with autism (Xia *et al.* 2010). In their study, Abdallah *et al.* (2007) found that anthropometric measures of boys with intellectual disability were higher than those of girls. This result supports our study. Again, while 14.7% of the children in Abdallah *et al.* (2007) study were below the 5th percentile and 4.5% were above the 95th percentile, in our study those below the 5th percentile represented 2.5% of the total and those above the 95th percentile represented 19.7%. Both studies show that malnutrition and obesity are frequently observed problems in children with intellectual disability. In another study conducted on this subject, it was found that the rate of malnutrition according to BMI is higher in mild and moderate intellectual disabled people compared to severe intellectual disabled people (Kavitha *et al.* 2018). In our study, differently, the rate of malnutrition according to BMI is higher in those with severe intellectual disability compared to those with mild and moderate intellectual disabilities, and it was not statistically significant.

Children with intellectual disabilities are also more susceptible to obesity than their healthy peers. Some of the reasons are their tendency to be less physically active, their inadequate adaptation to a healthy life and healthy food preferences, and the level of intellectual disability (Hinckson and Curtis 2013). In a study conducted with 524 children with intellectual disabilities between the ages of 6 and 13, although not statistically significant, the incidence of obesity was found to be lower in children with moderate intellectual disabilities than in children with mild intellectual disabilities (Wang *et al.* 2018). In our study, the rate of obesity in children with moderate intellectual disabilities was higher than those with mild and severe intellectual disabilities, but it was not statistically significant. The reason for this is that the categorization of children according to their intellectual disability level further reduced the sample size and limited the analysis of the effect of disability level on obesity.

Study limitations

Our study has some limitations. The first of these is that dividing our sample into subcategories reduces the sample size even more, and so the difference between variables was not found to be significant. Secondly, in the questionnaire form used to learn about children's information, there were not questions about children's gastrointestinal problems and feeding behavior problems, and this information was learned by asking families during the interview.

Conclusion

Rates of malnutrition and shortness in children and adolescents with SID were found to be higher than among children with MID and MOID, though the differences were not statistically significant. Children and adolescents with intellectual disabilities are at higher risk for micronutrient deficiencies because they have difficulties in food preparation and feeding independently and have higher incidence of malnutrition and obesity compared to the general population. The diet of children with intellectual disability should be adjusted to their level of physical activity, their daily energy and nutrient intake must be organized according to their age, and normal growth and development should be targeted. Alternative foods in the same category should be provided to avoid deficiency of nutrient if subjects are disturbed by certain foods.

Disclosure statement

The authors have no conflicts of interest to declare.

Ethical statement

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Erzincan University Ethics Committee. The necessary approvals were obtained from the provincial directorate of national education to which the study schools were affiliated. Written informed consent was obtained from parents.

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ORCID

Nalan Hakime Nogay http://orcid.org/0000-0002-9435-5755

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