ORIGINAL ARTICLE

Nutritional Status, Diet Diversity and Feeding Behaviour of Children with Disabilities in Kuantan, Pahang

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ABSTRACT

Background: In assessing the growth and development of children, proper nutrition plays a critical role, especially for vulnerable populations like children with special needs or with disabilities. It has long been known that children with disabilities are more likely to experience serious issues related to physical, mental or intellectual challenges that are related to their nutritional status. The purpose of this study is to determine the association between dietary diversity and nutritional status of children with disabilities in Kuantan, Pahang. **Methods:** A cross-sectional study was conducted involving 68 pairs of caregivers and children aged 3 to 18 years from four selected community-based rehabilitation centres in Kuantan. Online questionnaires were used to collect data on their sociodemographic information and children's eating behaviour. Anthropometric measurements and Individual Dietary Diversity Scores (IDDS) were determined on-site. Independent t-test was used to compare diet diversity and feeding behaviour between genders, whereas chi-square test was carried out to establish association between nutritional status and diet diversity. Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 29.0. **Results:** This study found that 37% of the children were underweight, 57% were stunted, 16% were wasted and 13% were overweight/obese. Approximately 10% of the children had low dietary diversity while 90% had high dietary diversity. Nonetheless, the majority (71%) were identified as picky eaters. **Conclusion:** There was no association between the nutritional status of children with disabilities and their dietary diversity. Children with disabilities, regardless of high or low diversity were more likely to be underweight and stunted.

INTRODUCTION

Over the past decade, there has been a growing number of people with disabilities. According to a report on Health Equity for Persons with Disabilities by the WHO, one out of every six people struggle with disabilities (WHO, 2022). Notably, the significance of disabilities is also no exception in children. Based on the findings from the Malaysian National Health and Morbidity Survey 2019 (NHMS), 4.7% of children experience disabilities which include Down syndrome, attention-deficit/ hyperactive disorder (ADHD), intellectual disabilities, autism, and cerebral palsy. Children with disabilities often face unique challenges when it comes to their intellectual, mental, and physical development. Their nutritional status, feeding behaviour, and dietary habits greatly impact their overall health.

According to Oly-Alawuba and Tibi (2022), 71% of children with disabilities had a normal body mass index (BMI). However, 17% were classified as overweight, and 2.4% were considered obese. Additionally, 5% of the children were underweight, with 5% being severely underweight. The low consumption of fruits, vegetables, milk, and dairy products contributed to these issues.

Ooka et al. (2012) found that children with disabilities often experience significant feeding problems, such as food selectivity, difficulties with self-feeding, and chewing issues. Among children with autism spectrum disorder (ASD), 56% reported food selectivity, while 35% of those with intellectual disabilities and 18% of those with Down syndrome faced similar challenges. Self-feeding problems were noted in 50% of children with ASD, 45% of those with intellectual disabilities, and 12% of those with Down syndrome. Chewing difficulties were also prevalent, with the highest rate (70%) seen in children with intellectual disabilities, followed by 44% of those with ASD and 29% of those with Down syndrome.

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Despite these known challenges, there remains a critical gap in understanding the interplay between nutritional status, dietary diversity, and feeding behaviour in children with disabilities, particularly in the Malaysian context. Hence, this study explores the nutritional status, diet diversity and feeding behaviour of children with disabilities. By examining these interrelated factors, the research seeks to provide valuable insights for developing targeted interventions to improve the overall health and well-being of this vulnerable population.

MATERIALS AND METHODS

Participants

A cross-sectional study was conducted whereby caregivers and their children with disabilities aged 3 to 18 were recruited using convenient sampling. Four Community-Based Rehabilitation Centres (CBR) in Kuantan district with the highest number of registered children were selected. The number of children accepted to these centres ranges from 11 to 27, which includes those with Down syndrome, cerebral palsy, autism and learning disabilities. Disabled children with any chronic diseases which may affect their food intake and children who are hospitalised were excluded.

Anthropometric Assessments

Children's anthropometric assessments included height and weight which were measured at the CBR. The height was measured in centimetres (cm) using a stadiometer and the weight was measured in kilograms (kg) using digital weighing scale at least two times. The body mass index (BMI) and sex-specific Z-scores for weight-for-age, height-for-age and BMI-for-age were assessed using WHO AnthroPlus Software. Their nutritional status categories were classified according to the WHO Child Growth Standard Chart 2006.

Dietary Assessments

Caregivers were called to be interviewed for their children's 24-hour diet recall. Caregivers were asked to report their children's portion size in household measurements. Individual Dietary Diversity Score (IDDS) which includes 16 food groups was used to evaluate children's daily meals based on the dietary assessment. For each food category, a score of 1 (if consumed) or 0 (if not consumed) was recorded (Ali, 2019). The diet diversity score was calculated by adding the total number of food groups consumed by the children. Diets with less than five food groups (DDS < 5) were considered not diverse, while diets with five or more food groups (DDS ≥5) were considered diversified (Handiso, 2020).

Feeding Behaviour Assessments

Children Eating Behaviour Questionnaire

Feeding behaviour was assessed using the Children Eating Behaviour Questionnaire (CEBQ) consisting of 35 items that were divided into eight different subscales including food responsiveness, emotional over-eating, enjoyment of food, desire to drink, satiety responsiveness, slowness in eating, emotional under-eating, and food fussiness (Yasin, 2013). Caregivers were asked to answer the questions on a five-point Likert scale, where 1 stands for never, 2 for rarely, 3 for sometimes, 4 for often, and 5 for always. The results from each subscale were summed up and the items were grouped based on the subscales that they belong. Higher scores indicated problematic feeding behaviour.

Data Analysis

A descriptive analysis was conducted to analyse the data on sociodemographics, anthropometry, diet diversity and feeding behaviour of children with disabilities. An Independent t-test was used to compare diet diversity and feeding behaviour between genders. In contrast, a chi-square test was carried out to establish the association between nutritional status and diet diversity. The diet diversity score was categorized as low and high. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 29.0 whereby p-value <0.05 indicates significant values.

Ethical Approval

This study has been granted ethical approval by the International Islamic University Malaysia Research Ethical Committee (IREC) (IREC 2024-KAHS/DNS3) and the Social Welfare Department (JKM) (JKMM 100/12/5/2:2023/ 237).

Procedure

After obtaining ethics approval from the JKM, KPGRC and IREC, supervisors and PDK officers from the selected Community-Based Rehabilitation centres were briefed on the conduct of the study. Informed consent form was distributed to the caregivers prior to data collection. The anthropometric measurement was taken face-to-face. Meanwhile, the information on the children's

sociodemographic background, dietary assessment and feeding behaviour (CEBQ) was obtained through an online meeting via Google Meet or a phone call with the caregivers. Then, after obtaining all the responses, the extracted data was entered into SPSS for analysis and interpretation.

RESULTS

Participants Characteristics

The sociodemographic characteristics of the caregivers are presented in Table 1. Majority of the participants were Malay females (57%, n=39) aged between 40-49 years old (40%, n=27) and had completed high school (46%, n=31). Most caregivers were in the B40 category (78%, n=53) and were employed (46%, n=31).

Table 1: Sociodemographic characteristics of caregivers, N=68

Variables	N	(%)
Age of caregiver		
21-29 years old	2	(2.9)
30-39 years old	25	(36.8)
40-49 years old	27	(39.7)
50-59 years old	13	(19.1)
≥60 years old	1	(1.5)
Gender of caregiver		
Male	29	(42.6)
Female	39	(57.4)
Race		
Malay	67	(98.5)
Chinese	1	(1.5)
Indian	0	0
Relationship status		
Mother	39	(57.4)
Father	29	(42.6)
Caregiver	0	0
Level of education		
None	6	(8.8)
UPSR	1	(1.5)
PMR	3	(4.4)
SPM	31	(45.6)
Diploma	13	(19.1)
Degree/ Master/ PhD	9	(13.2)
Occupation status		
Employed	31	(45.6)
Self-employed	11	(16.2)
Pensioner	3	(4.4)
Not working	23	(33.8)
Household income		
≤ RM 5000	53	(78)
RM 5001 – RM 10000	10	(14.6)
≥ RM 10001	5	(7.4)

Meanwhile, 68 children aged 3 to 18 years old participated in this study, of which 57% (n=39) were boys and 43% (n=29) were girls (Table 2). The mean age of the children was 9 years old (SD±4.11). The most prominent disability is autism spectrum disorder (34%, n=23).

Table 2: Sociodemographic characteristics of children, N=68

Variables	N	(%)	Mean ± SD
Age			9 ± 4.11
2-5 years old	16	(23.5)	
6-10 years old	30	(44.1)	
11-15 years old	16	(23.5)	
16-20 years old	6	(8.8)	
Gender			
Boy	39	(57.4)	
Girl	29	(42.6)	
Types of disabilities			
Autism Spectrum	23	(33.8)	
Cerebral palsy	14	(20.6)	
Down syndrome	20	(29.4)	
Learning disabilities	11	(16.1)	

Nutritional Status of Children with Disabilities

The anthropometric measurements and nutritional status of the children are presented in Table 3. Of 68 children, only 63 were measured due to non-compliance during the measurement session. Their average height was 115.9±19.49 cm, while the average weight was 23.71±11.28kg. The mean z-scores for weight-for-age, height-for-age, and BMI-for-age were 0.37±0.49, 0.57±0.50 and 0.41±0.71, respectively. According to the WHO growth chart, 37% (N=15) of the children were underweight, 57% were stunted (n=36), 16% (n=10) were wasted, and 13% (n=8) were overweight or obese.

In this study, girls had slightly higher scores for weight-for-age (0.43±0.51), height-for-age (0.65±0.49) and BMI-for-age (0.65±0.80) as compared to boys.

Table 3: Anthropometric assessment and nutritional status of children, N=63

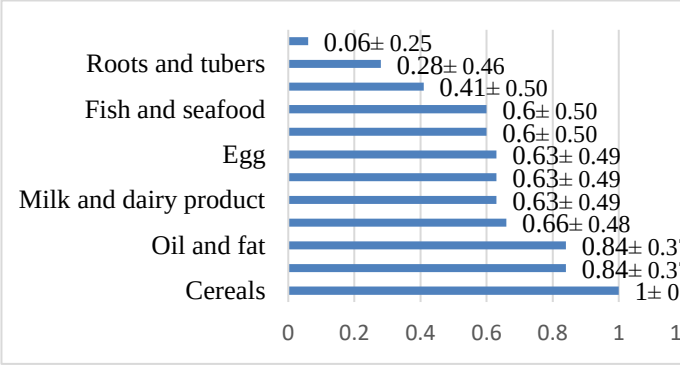
Variables	N	(%)	Mean ± SD
Height (cm)			115.96 ± 19.49
Weight (kg)			23.71 ± 11.28
BMI (kg/m)^2			17.01 ± 4.21
Weight-for-age (WAZ-score)			0.37 ± 0.49
Normal	26	(63.4)	
Underweight	15	(36.6)	
Height-for-age (HAZ-score)			0.57 ± 0.50
Normal	27	(42.9)	
Stunting	36	(57.1)	
BMI-for-age (BAZ-score)			0.41 ± 0.71
Normal	45	(71.4)	
Wasting	10	(15.9)	
Overweight/ Obese	8	(12.7)	

Diet Diversity Scores

Among the 68 caregivers, only 32 were interviewed for their diet recall due to caregivers' commitment. According to Figure 1, legumes, nuts and seeds are the least consumed food group among children with disabilities. Meanwhile, cereals are the most consumed food group.

In this study, most children (90%) reported high IDDS scores, while only 10% were in the low IDDS group. The mean IDDS score is 7.16.

Figure 1: Mean dietary diversity of the different food groups



Feeding Behaviour of Children with Disabilities

Seventy-one per cent of children with disabilities were identified as picky eaters using Steinsbekk's cut-off (Sandvik et al., 2018). The most problematic behaviour was observed in the level of enjoyment of food (3.73±0.92), while the least problematic behaviour was recorded in emotional over-eating (1.83±0.69).

Among the seven feeding behaviour domains assessed, only emotional over-eating showed a significant difference between genders, with girls scoring higher (2.09±0.72) than boys (1.60±0.61) (p=0.046).

Association between nutritional status and diet diversity among children with disabilities

Table 4 showed no significant association between nutritional status and diet diversity for underweight stunting and wasting or overweight/obese among children with disabilities.

Table 4: Association between nutritional status and diet diversity. N=32

Variables	**IDDS category**				X^2	**df**	**p-value**
	Low Diversity		High Diversity				
	N	(%)	N	(%)			
Weight-for-age							
Normal	1	(5)	7	(35)	1.579	1	0.209
Underweight	0	0	12	(60)			
Height-for-age							
Normal	0	0	10	(31.3)	1.505	1	0.220
Stunting	3	(9.4)	19	(59.4)			
BMI-for-age							
Normal	2	(6.5)	21	(67.7)			
Wasting	1	(3.2)	4	(12.9)	0.956	2	0.620
Overweight/ Obese	0	0	3	(9.7)			

DISCUSSION

Nutritional Status

Our study found that 36.6% of children were underweight, a notably higher percentage compared to a Kelantan-based study where 11.9% of children with learning disabilities were underweight (Mohamed, 2022). Similarly, the prevalence of underweight among children with ASD aged 3 to 7 years in Kuala Lumpur was lower at 9.3% (Eow et al., 2021). This higher prevalence of malnutrition in our study could be attributed to factors like compromised immune responses, feeding difficulties, lower socioeconomic status, and limited access to nutrition programs (Rotenberg et al., 2023; Jahan et al., 2019).

Conversely, 12.7% of children in our study were overweight or obese, which is relatively lower than rates found in other studies. For instance, Oly-Alawuba et al. (2022) reported a prevalence of 17.1% overweight and 2.4% obese among children with disabilities, while Eow et al. (2021) found a 21.5% prevalence among children with ASD. In China, 18.2% of school-aged children with intellectual disabilities were overweight, and 14.4% were obese, with boys and urban residents showing higher rates (Yuan et al., 2021). Factors contributing to obesity in children with intellectual disabilities may include autism traits, maternal obesity, poor parenting practices, reduced sleep duration, sedentary lifestyles, and high consumption of sugary beverages and fried foods (Wang et al., 2018).

Additionally, the prevalence of stunting in children with disabilities in Kuantan, Pahang was 57.1%, significantly higher than UNICEF reported 34% among children with disabilities globally (UNICEF, 2021). Jahan et al. (2019) identified high rates of stunting among children with epilepsy (79.4%), visual impairments (73.4%), and physical disabilities (73.7%). The type and severity of a child's disability can impact growth and nutritional status, with children having more severe or digestive-related disabilities at a higher risk of stunting. This high stunting prevalence in Kuantan underscores the urgent need to understand contributing factors and design targeted interventions addressing specific dietary challenges across different disabilities.

Diet Diversity Scores

In our study, legumes, nuts, and seeds were the least consumed food group, whereas cereals were most frequently consumed. This could be linked to sensory sensitivities or oral-motor challenges among children with disabilities, which may hinder their ability to tolerate certain textures and flavours. Cappellotto et al. (2021) identified sensory traits, especially food texture, as a significant influence on eating behaviours among children, with textures like hard, lumpy, or gritty foods often causing aversion and rejection without tasting. These unpleasant textures in legumes, nuts, and seeds likely reduce their intake among children with disabilities. Additionally, nuts and seeds are not staples in the local diet, possibly contributing to their limited consumption in this population.

Feeding Behaviour

Emotional over-eating was among the least observed problematic behaviours in our study, suggesting a reduced tendency for children with disabilities to eat as a response to emotional causes. This might be perceived as a positive behaviour as involving in excessive eating due to emotions can result in undesirable weight gain and related health complications. A study on children with autism spectrum disorder revealed that 42% of them had problems with food refusal, while 19% had limited food repertoire (Bandini et al., 2010). Similarly, Ooka et al. (2012) found high prevalences of food selectivity in children with intellectual disabilities, autism and Down syndrome at 56%, 35% and 18% respectively.

Meanwhile, Sharp and colleagues (2011) reported that children with autism spectrum disorder exhibited strong food preferences and aversions during meals, resulting in a limited food intake and the possibility of nutritional deficiencies. Additionally, Cortese et al. (2008) found that children with attention-deficit/hyperactivity disorder (ADHD) commonly demonstrated impulsive eating behaviours, resulting in irregular meal patterns and possible nutritional imbalances. These comparisons demonstrate that mealtime behaviours, such as food fussiness or impulsive eating, occur frequently among various kinds of disabilities and have a big impact on dietary intake. These findings are consistent with this study, which highlights the necessity for focused interventions to address picky eating and ensuring appropriate nutrient intake in children with disabilities.

Association between nutritional status and diet diversity

No significant association was observed in our study between diet diversity and nutritional status based on weight-for-age, height-for-age and BMI-for-age metrics. Despite having good diet quality, malnutrition persists for a variety of reasons unrelated to their nutritional consumption. According to a study by Guerrant et al. (2008), it was reported that children with disabilities

frequently experience gastrointestinal problems that result in impaired absorption of nutrition. Persistent gastrointestinal conditions can hinder the absorption of nutrients, resulting in malnutrition. Moreover, Dostmohammadian and colleagues (2013) highlighted that children with disabilities are often dependent on their caregivers for assistance with feeding, which can have an impact on their nutritional well-being. Improper feeding methods and a lack of nutritional understanding among caregivers can lead to malnutrition, regardless of whether the overall quality of the diet is satisfactory.

Malnutrition in children with disabilities is complex and multifactorial, influenced by issues like impaired nutritional absorption, inadequate meal composition, feeding challenges and reliance on carers. Addressing these underlying causes through comprehensive care and tailored interventions is crucial for improving nutritional outcomes in this population.

CONCLUSION

The study found no association between the nutritional status of children with disabilities in Kuantan, Pahang and their dietary diversity. Children with disabilities, regardless of high or low diversity, were more likely to be underweight and stunted. Therefore, nutrition advocacy for this population must extend beyond merely addressing dietary diversity and quantity. It should focus on enhancing parental feeding practices, addressing feeding difficulties, and improving food accessibility to ensure holistic nutritional support.

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REFERENCES

Ali, N. B., Tahsina, T., Hoque, D. Md. E., Hasan, M. M., Iqbal, A., Huda, T. M., & El Arifeen, S. (2019). Association of food security and other socio-economic factors with dietary diversity and nutritional statuses of children aged 6-59 months in rural Bangladesh. *PLOS ONE*, *14*(8), e0221929. https://doi.org/10.1371/journal.pone.0221929

Bandini, L. G., Anderson, S. E., Curtin, C., Cermak, S., Evans, E. W., Scampini, R., Maslin, M., & Must, A. (2010). Food Selectivity in Children with Autism Spectrum Disorders and Typically Developing Children. *The Journal of Pediatrics*, *157*(2), 259–264. https://doi.org/10.1016/j.jpeds.2010.02.013

Cappellotto, M., & Olsen, A. (2021). Food Texture Acceptance, Sensory Sensitivity, and Food Neophobia in Children and Their Parents. *Foods*, *10*(10), 2327. https://doi.org/10.3390/foods10102327

Cortese, S., Angriman, M., Maffeis, C., Isnard, P., Konofal, E., Lecendreux, M., Purper-Ouakil, D., Vincenzi, B., Bernardina, B. D., & Mouren, M.-C. (2008). Attention-Deficit/Hyperactivity Disorder (ADHD) and Obesity: A Systematic Review of the Literature. *Critical Reviews in Food Science and Nutrition*, *48*(6), 524–537. https://doi.org/10.1080/10408390701540124

Dostmohammadian, A., Neyestani, T., Abtahi, M., Dadkhah-Piraghaj, M., Haydari, H., Zowghi, T., Nikooyeh, B., Houshyar-Rad, A., Nematy, M., & Maddah, M. (2013). Dietary intake among physically disabled children. *Iranian Journal of Nutrition Sciences and Food Technology*, *7*(5), 327–333. https://nsft.sbmu.ac.ir/article-1-1020-en.html

Eow, S. Y., Gan, W. Y., & Awang, H. (2021). Body weight status and dietary intake of Malaysian children with Autism Spectrum Disorder. *Research in Autism Spectrum Disorders*, *84*, 101768. https://doi.org/10.1016/j.rasd.2021.101768

Guerrant, R. L., Oriá, R. B., Moore, S. R., Oriá, M. O., & Lima, A. A. (2008). Malnutrition as an enteric infectious disease with long-term effects on child development. *Nutrition Reviews*, *66*(9), 487–505. https://doi.org/10.1111/j.1753-4887.2008.00082.x

Handiso, Y., Belachew, T., Abuye, C., & Workicho, A. (2020). Low dietary diversity and its determinants among adolescent girls in Southern Ethiopia. *Cogent Food & Agriculture*, *6*(1), 1832824. https://doi.org/10.1080/23311932.2020.1832824

Jahan, I., Karim, T., Al Imam, M. H., Das, M. C., Ali, K. M., Muhit, M., & Khandaker, G. (2019). Childhood Disability and Nutrition: Findings from a Population-Based Case Control Study in Rural Bangladesh. *Nutrients*, *11*(11), 2728. https://doi.org/10.3390/nu11112728

Lee, W. S., Jalaludin, M. Y., Khoh, K. M., Kok, J. L., Nadarajaw, T., Soosai, A. P., Mukhtar, F., Fadzil, Y. J., Anuar Zaini, A., Mohd-Taib, S. H., Rosly, R. M., Khoo, A. J., & Cheang, H. K. (2022a). Prevalence of undernutrition and associated factors in young children in Malaysia: A nationwide survey. *Frontiers in Pediatrics*, *10*.

https://doi.org/10.3389/fped.2022.913850

Md. Yasin, S. F. (2013). Perkaitan antara pengetahuan pemakanan, sikap terhadap berat badan, dan amalan pemberian makanan dengan tingkah laku makan dan berat badan anak prasekolah di Gombak, Malaysia. Retrieved from http://psasir.upm.edu.my/id/eprint/39178/1/FEM%202013%2016.pdf

Mohamed, S. F. (2022). *Diet Quality and Predictor Factors of Body Weight Status among Children with Learning Disabilities in Kelantan*. http://eprints.usm.my/57828/1/SITI%20FATHIAH%20BINTI%20MOHAMED-FINAL%20THESIS%20P-SKM000420%28R%29%20-24%20pages.pdf

National Health and Morbidity Survey (2019). Non-communicable diseases, healthcare demand and health literacy. https://iptk.moh.gov.my/images/technical_report/2020/FactSheet_BI_AUG2020.pdf

Oly-Alawuba, N., & Tibi, G. (2022). Nutritional Status of Disabled Children (8–10 years) in Oshimili South Local Government Area, Delta State, Nigeria. *Current Developments in Nutrition*, *6*, 152. https://doi.org/10.1093/cdn/nzac051.068

Ooka, T., Takahashi, M., & Mukai, Y. (2012). The relationship between feeding characteristics and feeding function in children with intellectual disability. *Pediatric Dental Journal*, *22*(2), 145–154. https://doi.org/10.1016/S0917-2394(12)70265-3

Rotenberg, S., Chen, S., Hunt, X., Smythe, T., & Kuper, H. (2024). Are children with disabilities more likely to be malnourished than children without disabilities? Evidence from the Multiple Indicator Cluster Surveys in 30 countries. *BMJ Nutrition, Prevention & Health*, e000779. https://doi.org/10.1136/bmjnph-2023-000779

Sharp, W. G., Jaquess, D. L., Morton, J. F., & Miles, A. G. (2011). A Retrospective Chart Review of Dietary Diversity and Feeding Behavior of Children With Autism Spectrum Disorder Before and After Admission to a Day-Treatment Program. *Focus on Autism and Other Developmental Disabilities*, *26*(1), 37–48. https://doi.org/10.1177/1088357609349245

Wang, J., Gao, Y., Kwok, H. H. M., Huang, W. Y. J., Li, S., & Li, L. (2018). Children with Intellectual Disability Are Vulnerable to Overweight and Obesity: A Cross-Sectional Study among Chinese Children. *Childhood Obesity*, *14*(5), 316–326. https://doi.org/10.1089/chi.2018.0015

World Health Organization. (2022). Global report on health equity for persons with disabilities. https://books.google.com.my/books?hl=en&lr=&id=mK2tEAAAQBAJ&oi=fnd&pg=PR3&ots=TNXeuZgwf9&sig=t4K1D3j860Jn87lBs3P30ClwPqQ&redir_esc=y#v=onepage&q&f=false

Yuan, Y. Q., Liu, Y., Wang, M. J., Hou, X., Zhang, S. H., Wang, X. L., Han, Y. N., Sang, P., Bian, Y., & Roswal, G. (2021). Prevalence of overweight and obesity in children and adolescents with intellectual disabilities in China. *Journal of Intellectual Disability Research*, *65*(7), 655–665. https://doi.org/10.1111/jir.12840