

Determinant factors influencing the nutrition status of adolescents with intellectual disabilities: a scoping review

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Abstract

Purpose: This scoping review aims to explore the determinants influencing the nutritional status of adolescents with intellectual disabilities, including macronutrient intake, family income, and other contributing factors. **Methods:** A systematic search was conducted for articles published from 2012 to 2022 in PubMed, ScienceDirect, and Scopus databases, using keywords such as "nutritional status," "dietary intake," "family income," "intellectual disability," and "adolescent". Relevant studies were selected through title and abstract screening, followed by full-text review, resulting in nine articles for analysis. **Results:** The review found that inadequate dietary intake, particularly high consumption of unhealthy foods, significantly impacts the nutritional status of adolescents with intellectual disabilities. Family income, while affecting food security, does not independently determine dietary outcomes. Comorbid conditions like Down syndrome, autism spectrum disorder (ASD), and cerebral palsy, along with physical limitations and the use of psychotropic medications, further contribute to malnutrition risks. **Conclusion:** Adolescents with intellectual disabilities are at increased risk of malnutrition due to poor food intake. While family income influences food security, it is not the sole factor. The presence of comorbid conditions, physical limitations, and psychotropic medication use is also a key determinant of their nutritional status.

Keywords: adolescent; dietary intake; family income; intellectual disability; nutritional status

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INTRODUCTION

Intellectual disability is a condition characterized by limited intellectual functioning, adaptive behavior, and practical skills that can interfere with interpersonal and environmental relationships [1]. Intellectual disability is defined by an Intelligence Quotient (IQ) score below 70 as well as impaired adaptive skills [2]. Intelligence Quotient (IQ) is a measurement used to describe thinking abilities, including reasoning, planning, problem-solving, abstract thinking, concept recognition, language usage, and learning [3]. Genetic factors contribute between 17-50% of intellectual

disability cases, and the most common chromosomal abnormality causing intellectual disability is Down syndrome [4]. Intellectual disability can also manifest as a comorbidity of several disorders, such as fetal alcohol syndrome (FAS), Fragile X syndrome, and Prader-Willi syndrome [5].

The worldwide prevalence of people with intellectual disabilities is estimated to be 16.41/1000 people in low-income countries, 15.94/1000 people in middle-income countries, and 9.21/1000 people in high-income countries [6]. The results of studies found that the highest prevalence occurred in the child and adolescent population with male gender [7]. Indivi-

duals with intellectual disabilities have been reported to have a mortality rate 1.4 times higher than that of the general population. The leading causes of mortality for people with intellectual disability are vascular diseases, neoplasms, and respiratory diseases [8]. A quarter to half of people with intellectual disability are estimated to receive psychotropic medication to treat behavioural problems, such as aggression or self-injury [9].

A study showed that children and adolescents with intellectual disabilities tend to have abnormal diets and are at high risk of nutritional problems, especially overweight and obesity. These conditions were generally caused by a limited understanding of dietary principles and dependence on others (caregivers) in food selection. People with intellectual disabilities could also have structural and/or functional gastro-intestinal disorders, depending on the primary clinical diagnosis, which in turn affects food intake and nutrient absorption [4]. Some of the intake and feeding problems found in children and adolescents with intellectual disabilities included failure to develop independent eating habits, eating too much or too little, being very picky, vomiting, pica, obsession with the temperature or presentation of certain foods, dysphagia, malnutrition, and risk of dehydration [10].

Psychotropic medications used by adolescents with intellectual disabilities cause metabolic side effects, one of which is significant weight gain [11]. Many psychotropic medications are antagonists of H1, serotonin, and α 1-adrenergic receptors. The affinity of antipsychotics for these receptors is highly correlated with weight gain. Central appetite is increased due to the action of serotonin and histamine receptor antagonists, leading to increased food intake. Psychotropic drugs can affect body weight by disrupting the regulation of leptin and adiponectin [12].

Another problem that people with intellectual disabilities face is financial. Children born with disabilities are more at risk of living in poverty than children without disabilities as a result of challenges during development [13]. Families with children with intellectual disabilities have increased health and education costs, a greater caregiving burden than children without disabilities, and a limited ability of parents to work outside the home [14]. Studies in the general population have shown a correlation between poverty and the incidence of malnutrition, with areas experiencing chronic poverty having higher rates of malnutrition [15]. Malnutrition is also associated with children with intellectual disabilities, as they have a higher probability than normal children. Children with intellectual disabilities have a limited understanding of

nutrition and health information [14]. A study in Padang, Indonesia, demonstrated that the most significant factors affecting the cognitive level of children with or without intellectual disabilities were nutritional status, followed by maternal education and parental income. However, this study was first conducted in Padang and only assessed the relationship between sociodemographics and the nutritional status of children. Therefore, further investigation is needed to elucidate the factors affecting the nutritional status of children and adolescents with intellectual disabilities [16].

Despite the growing body of research on individuals with intellectual disabilities, there is still limited attention to the nutritional issues within this specific population. Research on malnutrition in children with intellectual disabilities, particularly in adolescents, remains scarce. Most studies focus on the general population or specific conditions such as Down syndrome, while nutritional research addressing the needs of vulnerable populations like those with intellectual disabilities is still limited. This gap in the literature highlights the need for further research into the nutritional status of children and adolescents with intellectual disabilities, especially considering the influence of factors like family income, dietary intake, and psychotropic medication use.

The purpose of this literature review is to examine current research on the contribution of nutrient intake and family income to the nutritional status of children and adolescents with intellectual disabilities. This study also assessed the risk factors for malnutrition in children and adolescents with intellectual disabilities.

METHODS

This study employs a scoping review method to conduct a literature review. We used Arksey and O'Malley's framework, outlining five key phases when conducting a scoping review: (i) identifying the research question; (ii) identifying relevant studies; (iii) selecting studies; (iv) mapping data; and (v) compiling, summarizing, and reporting results [17]. This literature review discussed the following questions: 1) How does the dose of nutrient intake affect the nutritional status of children and adolescents with intellectual disabilities? 2) Does family income affect the nutritional status of children and adolescents with intellectual disabilities?. Literature selection was conducted on PubMed, ScienceDirect, and Scopus databases. The search was conducted by entering a combination of keywords: "nutritional status", "dietary intake", "family income", "intellectual disability", and "adolescent".

Eligibility criteria

The inclusion criteria were published between 2012 and 2022, in the English language. They pertained to observational studies that examined the relationship between dietary intake or family income and the nutritional status of children and adolescents with intellectual disabilities. The exclusion criteria were as follows: (1) Studies that focused on interventional or experimental designs, (2) Articles with incomplete full text, and (3) Studies not related to the nutritional status of children and adolescents with intellectual disabilities.

The screening process involved manually examining the titles and abstracts of relevant research articles, followed by a full-text review of the articles that met the inclusion criteria. The reference lists of each selected article were also manually reviewed to identify additional relevant articles.

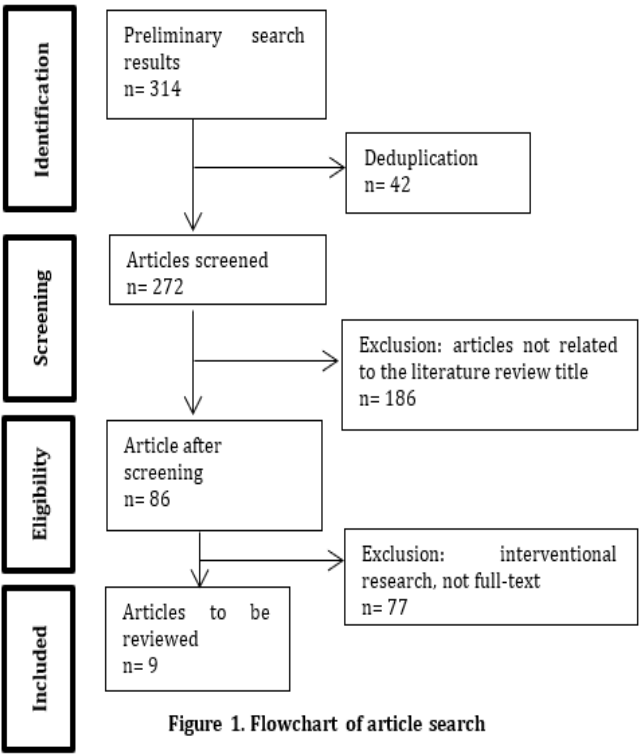


Figure 1. Flowchart of article search

The primary search, conducted using three electronic databases, identified 314 articles. A total of 42 duplicate articles were eliminated, leaving 272 articles for screening. From the 272 articles, 186 articles unrelated to the title of the literature review were eliminated. A total of 86 articles were screened

for eligibility. Articles containing interventional studies and those with incomplete full text were excluded, leaving nine articles that met the inclusion criteria and will be reviewed further (Figure 1).

RESULTS

The research articles reviewed in this literature study had samples of children and adolescents with intellectual disabilities with an age range of 1-21 years. The sample size varied from 70 to 2,404 children and adolescents with intellectual disabilities. Two studies had subjects with various levels of disability severity (mild, moderate, severe, and very severe). In comparison, the other three studies only mentioned that the research subjects were people with intellectual disabilities. Five studies investigated subjects with comorbid conditions such as Down syndrome, Autism Spectrum Disorder (ASD), and cerebral palsy. The research subjects were selected from various communities, including specialized schools, counseling research centers, and rehabilitation centers.

Table 1 presents a summary of all studies that fulfilled the inclusion criteria, including author information, study design, country of study, subjects, level of intellectual disability, methods of nutritional status assessment, reference standards, and study results. The term intellectual disability in this literature review refers to individuals identified as meeting two main criteria: (a) a Wechsler IQ score below 70 (mild, 55<IQ<69; moderate, 40<IQ<54; severe, 25<IQ<39; and very severe, IQ≤24), and (b) substantial limitations of adaptive behavioural aspects such as daily living skills, communication skills, social, emotional, and learning.

This review found that both nutrient intake and family income significantly impact the nutritional status of children and adolescents with intellectual disabilities. Inadequate nutrient intake, both in quantity and quality, was identified as a key factor contributing to malnutrition in this group. Additionally, lower family income, which affects food security and access to quality nutrition, was found to exacerbate nutritional deficiencies. These factors, along with comorbid conditions, play a crucial role in determining the overall nutritional health of children with intellectual disabilities.

Table 1. Characteristics of articles reviewed

Author (Year); Title	Study design	Location	Subject	Level of intellectual disability	Nutritional status assessment methods	Reference standards/classification criteria	Result
Pan, et al (2016) Prevalence of overweight and obesity among students with intellectual disabilities in Taiwan: A secondary analysis [18]	Cross-sectional	Taiwan	Children and adolescents aged 7-18 years old in public special education schools (n=1,936).	Mild, moderate, severe, and very severe	BMI	Growth charts for Taiwanese children and adolescents	Gender, age group, comorbidities, and level of intellectual disability were significantly associated with overweight and obesity.
Rintala, et al (2017) Association of poverty and social exclusion with body mass index among Special Olympics athletes in Europe [19]	Cross-sectional	Uni Eropa	Children and adolescents <12-18 years old participating in Special Olympics (n= 1,905).	Not specified	BMI	International Obesity Task Force (IOTF)	Higher AROPE levels are associated with underweight. Lower AROPE levels are associated with overweight and obesity. * AROPE: a risk of poverty and social exclusion (risiko kemiskinan dan pengucilan sosial)
Wang, et al (2018) Children with intellectual disability are vulnerable to overweight and obesity: A cross-sectional study among Chinese children. [20]	Cross-sectional	Hong Kong	Children and adolescents aged 6-21 years studying in special schools (n = 524).	Mild and moderate	BMI	International Obesity Task Force (IOTF)	Pressure to eat more was lower in overweight and obese subjects compared to non-overweight subjects. There was no significant relationship between physical activity and obesity.
Yuan, et al (2021) Prevalence of overweight and obesity in children and adolescents with intellectual disabilities in China [21]	Cross-sectional	China	Children and adolescents aged 6-18 years studying in special schools (n = 1,873).	Mild, moderate, severe, and very severe	BMI	Working Group for Obesity in China (Group of China Obesity Task Force)	There was no significant association between obesity and overweight and the severity of intellectual disability. Subjects living in urban areas are more likely to be overweight or obese compared to subjects living in rural areas.
Sari & Bahceci (2012) Nutritional status of children with an intellectual disability [22]	Cross-sectional	Turkiye	Children and adolescents 7-18 years old participating in the Counseling Research Center (n=70)	Mild and moderate	BMI	BMI percentile values according to the Turkish children's growth curve	Subjects did not consume adequate sources of animal protein, such as meat, fish, and chicken. Around 42.9% of mothers gave their children high-calorie foods as a reward for positive behavior.

Author (Year); Title	Study design	Location	Subject	Level of intellectual disability	Nutritional status assessment methods	Reference standards/classification criteria	Result
Nogay (2013) Nutritional status in mentally disabled children and adolescents: A study from Western Turkey [23]	Cross-sectional	Turkiye	Children and adolescents 10-18 years old from special schools and rehabilitation centers (n=77).	Mild, moderate, and severe	BMI-for-age Weight-for-age Height-for-age	Not specified	Subjects' protein consumption was higher than the recommended value in all age groups. The incidence of obesity increased with age and was more prevalent in males than in females.
Slevin, et al (2014) Obesity and overweight in intellectual and non-intellectually disabled children [24]	Cross-sectional	United Kingdom	Children and youth <8-19 years old studying in special schools. 218 people with disabilities, 229 people without disabilities.	Moderate and severe	BMI, waist circumference	International Obesity Task Force (IOTF)	Mean BMI was higher in subjects with intellectual disabilities compared to controls (non-disabled). Subjects with intellectual disabilities consumed fewer fruits and vegetables compared to control subjects.
Choi, et al (2012) Prevalence of overweight and obesity in children with intellectual disabilities in Korea [25]	Cross-sectional	South Korea	Children and adolescents aged 7-18 years studying in special schools (n = 2,404).	Not specified	BMI	Korean age- and sex-specific percentiles for BMI (KCDC 2007)	There was a significant relationship between gender and BMI status
Krause, et al (2016) Obesity in adolescents with intellectual disability: Prevalence and associated characteristics [26]	Cross-sectionoinal	Australia	Adolescents aged 13-18 years old, studying in special schools (n=261).	Not specified	BMI	International Obesity Task Force (IOTF)	There was no association between age, behaviour problems, mobility, use of psychotropic drugs, and family financial difficulties with BMI status.

DISCUSSION

Comorbid syndromes

The findings suggest that people with intellectual disabilities with comorbid syndromes are more predisposed to obesity as a result of physiological abnormalities. Various studies have shown that people with intellectual disabilities with Down syndrome are more likely to be obese than people with intellectual disabilities without Down syndrome, both in the age groups of children, adolescents, and adults [26-28]. People with Down syndrome have an extra copy of the gene on chromosome 21 (superoxide dismutase 1 / SOD1 and the gene encoding the enzyme cystathionine β -synthase / CBS), which causes metabolic disorders that increase the risk of cardiovascular disease, oxidative stress, and lipid and carbohydrate profile disorders [29]. Children with Down syndrome tend to consume food excessively. This leads to high consumption of energy, protein, and carbohydrates, putting children with Down syndrome at risk of vitamin and mineral deficiencies [30]. Another study on individuals with Prader-Willi Syndrome (PWS) showed that the main factor causing obesity is a malfunction in the hypothalamus that regulates the hormone ghrelin. The hormone ghrelin plays a role in regulating appetite and satiety. This explains why individuals with PWS are constantly hungry [31,32].

Physical limitations

Children and adolescents with intellectual disabilities have sedentary lifestyles because they are less involved in social activities due to low cognitive levels [33]. Cognitive impairment in people with intellectual disabilities results in limited active participation in physical activities and a higher appetite than that of normal people. This can lead to difficulty in controlling body weight and an increased risk of obesity [34]. Research on people with intellectual disabilities with Down syndrome shows that they dislike activities such as walking and running because they are complex and tiring [35]. People with severe intellectual disabilities (profound) have motor and sensory impairments, causing limitations in self-care, continence, and mobility, so that they require assistance and supervision in carrying out their daily activities [36].

Use of psychotropic medications

People with intellectual disabilities are highly vulnerable to psychological disorders such as anxiety, bipolar disorder, and schizophrenia. One of the inter-

ventions to prevent the condition from getting worse is the prescription of psychotropic medications to treat mental disorders in general and to manage challenging behavioural disorders such as aggressiveness and irritability. The most commonly prescribed psychotropic medications are antipsychotics, followed by antidepressants, antiepileptics or mood stabilizers, and stimulants [37]. These medications may affect weight gain on average if used over a long period in pediatric patients.

Long-term use of antipsychotics can lead to the development of metabolic syndrome, type 2 diabetes mellitus, hyperlactaemia, and decreased bone mineral density. A decrease in growth rates and bone mineral density occurs with long-term antidepressant treatment. Long-term prescription of mood stabilizers such as divalproex causes polycystosis, decreased bone density, and weight gain; and renal and thyroid monitoring is necessary in patients treated with lithium [38].

Nutrient intakes

Research showed that the diets of children and adolescents with intellectual disabilities were high in fried foods and sugary drinks, and lacked fruit and vegetable intake [20,24,39]. Such diets were significantly associated with the incidence of overweight and obesity in childhood. Research conducted in Hong Kong explained that a higher risk of overweight and obesity also occurred in children who consumed more meat, fish, and eggs [20]. A possible interpretation of this study is that these foodstuffs are processed by frying, resulting in additional calories due to the oil absorbed during the frying process [24].

Another study in Turkey showed that children with intellectual disabilities generally have a high-carbohydrate diet, less intake of fruits and vegetables, and less intake of animal protein, especially meat. The subjects in the study consisted of children with intellectual disabilities who had a disadvantaged socioeconomic status [22]. As many as 42.9% of the mothers of the study subjects chose to give high-calorie foods, such as chocolate, cakes, soda, and candy, as rewards when their children showed good behavior. It can be assumed that high-carbohydrate diets are influenced not only by family income but also by family behaviors, particularly those of mothers [22,40]. Rewarding behaviors are known to increase the consumption of fried foods, consumption of sugar-sweetened beverages, consumption of snacks, and breakfast skipping in children with intellectual disabilities [41].

The effect of family income on the nutritional status of children and adolescents with intellectual disabilities

The high cost of accessing medical care and support services needed by people with intellectual disabilities can reduce levels of economic stability, which in turn affects other areas of well-being, such as food security [42]. Existing studies show that families with children with intellectual disabilities are at increased risk of poverty due to the financial and social impacts of caregiving [43]. Insufficient family income results in limited access to healthy food choices and is an essential factor influencing the incidence of obesity [22,44].

Research conducted on Special Olympic participants explains that children and adolescents with disabilities who were primarily underweight came from countries with high levels of poverty and social exclusion. However, this was not universal [19]. This was in line with another study conducted on Special Olympic athletes, which found higher rates of obesity in athletes from high-income countries and in adolescent athletes aged 8-13 years [45]. Other studies in Australia and Morocco have shown that there is no correlation between nutritional status and financial difficulties, as well as socioeconomic status [26,46]. This suggests that family income, as part of socioeconomic status, cannot be considered in isolation to influence the nutritional status of individuals [47]. Figure 2 illustrates the mechanism underlying the relationship between nutrient intake, family income, and the nutritional status of children and adolescents with intellectual disabilities, as well as other factors that influence this relationship.

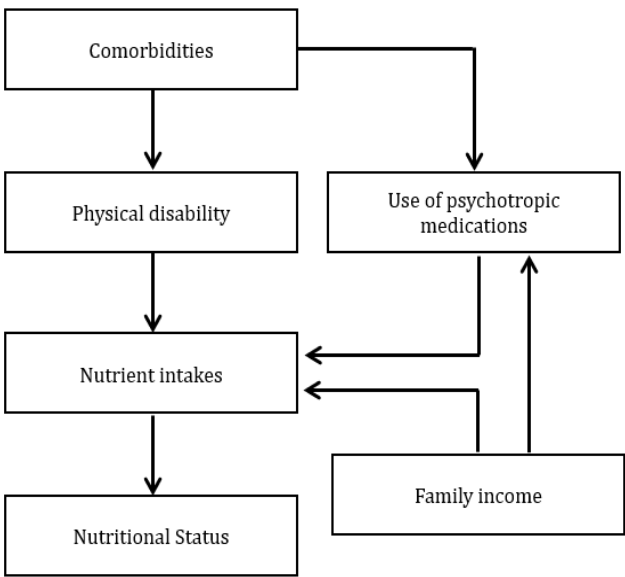


Figure 2. Mechanism of the relationship between nutrient intake and family income with nutritional status and other influencing factors

Implications for public health

The findings suggest the need for targeted public health programs that focus on improving the nutritional status of children and adolescents with intellectual disabilities. Such programs should focus on nutrition education, access to healthy food, and promoting physical activity, especially for individuals with comorbid conditions or physical limitations. According to studies, children and adolescents with intellectual disabilities often have sedentary lifestyles due to cognitive impairments, which result in limited participation in physical activities and a higher appetite than that of normal people, thus increasing their risk of obesity [33,34].

Additionally, their diets tend to be high in fried foods and sugary drinks, and low in fruits and vegetables, which is significantly associated with the incidence of overweight and obesity [20,24,39]. Education on healthy eating habits can dramatically reduce the incidence of obesity in children with disabilities, as demonstrated by Sadowsky et al. (2020) and Bandini et al. (2021) [39,45]. Furthermore, health interventions should incorporate family-centered approaches that consider the socioeconomic challenges and family behaviors that influence food choices. Programs aimed at improving food security and providing access to psychotropic medications with fewer metabolic side effects could also help reduce obesity rates in this vulnerable population [45].

Limitations of the study

While this review provides valuable insights into the factors affecting the nutritional status of children and adolescents with intellectual disabilities, there are several limitations. First, the studies included in the review primarily focus on specific syndromes, such as Down syndrome and Prader-Willi syndrome, which may not represent the entire population of children with intellectual disabilities [26-28]. Additionally, the review is limited by the lack of longitudinal studies that could provide deeper insights into how these factors interact over time. Further research is needed to explore the impact of cultural practices, healthcare accessibility, and the long-term effects of psychotropic medications on the nutritional status of children and adolescents with intellectual disabilities [37,38].

CONCLUSION

People with intellectual disabilities are at higher risk of malnutrition compared to the general population. Inadequate food intake in both quantity and quality is a determinant of the nutritional problems experienced by the population of children and adoles-

cents with intellectual disabilities. Family income as part of socioeconomic status affects food security at the family level. Still, it cannot stand alone in influencing the nutritional status of children and adolescents with intellectual disabilities. Other factors, such as comorbid syndromes, physical limitations, and the use of psychotropic medications, are known to influence the nutritional status of children and adolescents with intellectual disabilities.

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