Overweight and obesity in individuals with visual disability: Prevalence, associated factors, nutritional challenges, and recommended interventions

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ABSTRACT Insufficient or a lack of sight jeopardises the nutritional status of individuals with visual disability, making them vulnerable to overweight and obesity. Correspondingly, this review examines the prevalence, associated factors, and distinct challenges that individuals experience in achieving optimal nutrition, as well as the suitable interventions to address overweight and obesity in this population. In particular, the prevalence of overweight and obesity in this population from previous studies ranged between 29.3% and 77.7%. Concurrently, sociodemographic factors that include age, sex, living accommodation, level of education, employment status, monthly income, marital status, level of visual impairment, affinity for food and eating, self-reported general health, involvement in physical activity, consumption of food supplements, and water consumption are among the aspects associated with overweight and obesity in this population. However, dietary intake involving macronutrients and micronutrients among individuals with visual disabilities is not in line with the recommended consumption. The diet also lacks variety, in addition to having unusual mealtimes and erratic eating patterns. Furthermore, the effects of food on health are often not given priority when it is consumed. At the same time, nutritional challenges are often encountered during the process of buying or shopping for food, when preparing and cooking meals, and when eating out. Thus, effective nutritional interventions to address overweight and obesity in this population need to consider both personal and environmental factors, as well as address participation restrictions and activity limitations. In essence, individuals with visual disability need to be empowered about the issues of malnutrition, especially regarding overweight and obesity, which are prominent in this population. Their environment should be enabled to support a healthy lifestyle to achieve the goal of optimum health and well-being.

KEYWORDS: Overweight; Obesity; Visual disability; Inclusivity; Universal health coverage
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Review Article

INTRODUCTION

Approximately 1.1 billion people worldwide live with vision loss. Of this, 510 million people (46.4%) have problems with near vision, 258 million (23.5%) have mild visual impairment, 295 million (26.8%) have moderate to severe visual impairment, and 43 million (3.9%) are blind (IAPB, 2025). Accordingly, to measure the severity of visual impairment, visual acuity is often employed as it is a simple and non-invasive method. In particular, visual acuity is usually measured using a vision chart, which is placed at a distance of 6 metres (m). The smallest line that can be read is recorded as a fraction. Following this, the numerator signifies the distance at which the chart is viewed. At the same time, the denominator refers to the distance at which a normal, healthy eye is capable of reading the line from the vision chart. Notably, if a visual acuity is documented as 6/ 18, this indicates that at 6 m from where the chart is placed, the person can read a letter that someone with normal vision can read at 18 m (WHO, 2019).

While the terms “visual impairment” and “visual disability” are often used interchangeably, they have distinct meanings. Specifically, an impairment is defined as an absence or a significant difference

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in an individual's body structure or function. On the other hand, the term disability encompasses three dimensions: impairment (e.g., loss of vision), limitation of activities (e.g., difficulty seeing), and restriction of participation in normal daily activities (e.g., food shopping or cooking) (CDC, 2025). In other countries, such as the United States of America (USA), the term "legally blind" is used to describe a person with visual acuity of 20 feet/ 200 feet (equivalent to 6 m/ 60 m) in the better-seeing eye with the best conventional visual correction or a visual field of 20° or less. Such an individual is also eligible for disability benefits, rehabilitation, schooling, vocational training, low-vision equipment, and tax exemption (AFB, 2024). Interestingly, each country has its own disability act and laws to ensure that individuals with disabilities are included in society, not discriminated against, and their rights are preserved.

In Malaysia, the legislation in place to ensure the welfare of individuals with disabilities is the Persons with Disabilities Act 2008, which was established to provide for the registration, protection, rehabilitation, development, and well-being of individuals with disabilities (UN DESA, 2025). In the country, the sub-categories for visual disability are highlighted in Table 1 (JKM, 2023).

Table 1. Sub-categories of visual disability in Malaysia (JKM, 2023).

Sub-category	Details
Bilateral eye limitation	Visual acuity worse than 6/ 18 but equal or better than 3/ 60, even when a visual aid is used, or a visual field of less than 20° from a point of fixation
Unilateral blindness	Visual acuity less than 3/ 60 or visual field of less than 10° from a point of fixation in one eye
Bilateral blindness	Visual acuity less than 3/ 60 or visual field less than 10° from a point of fixation in both eyes
Other permanent visual disturbance	Diagnosed by an ophthalmologist, e.g., albinism

This review discusses the prevalence and associated factors for overweight and obesity in individuals with visual disability, their nutritional challenges, and the proposed interventions for the population. Specifically, this review applied a non-systematic narrative approach to identify relevant literature on overweight and obesity and their interventions among individuals with visual disability. As such, a broad search was conducted using PubMed, ScienceDirect, Scopus, and Google Search to identify relevant literature. Keywords included "visual disability," "blindness," "overweight," "obesity," "malnutrition," and "nutritional interventions." Note that no restrictions were applied regarding publication year or study design. Accordingly, research articles, review articles, and conference proceeding papers were included when relevant. The literature search was performed in a two-month period from October to November 2024. The inclusion criteria consisted of articles on the prevalence and associated factors for overweight and obesity in adults or the elderly with visual disability, nutritional challenges, and nutrition-related interventions in the population. However, the articles were limited to those written in English and available in open access. In addition, articles focusing on children and adolescents that were not related to nutrition in individuals with visual disabilities were excluded from the review.

Across all sections in this review, the interpretation of findings is constrained by small sample sizes in many of the included studies. Consequently, these reduce the generalisability of the evidence and make it challenging to establish consistent patterns across various populations and settings. In response, future research should prioritise larger, methodologically rigorous studies that use comparable outcome measures, which would also enable meta-analytical synthesis to more reliably quantify the associations and intervention effects in individuals with visual disability.

PREVALENCE OF OVERWEIGHT AND OBESITY IN INDIVIDUALS WITH VISUAL DISABILITY

The World Health Organisation (WHO) refers to malnutrition as deficiencies, imbalances, or excesses in energy or nutrient intake. Two major categories exist in malnutrition. At one end of the spectrum is "undernutrition," which consists of wasting, stunting, underweight, and insufficient micronutrients. Meanwhile, at the other end is "overnutrition," which encompasses overweight, obesity, and diet-related Non-Communicable Diseases (NCDs) (WHO, 2025). Nonetheless, research on the prevalence of malnutrition generally, and overweight and obesity specifically, in individuals with visual disability is limited.

In a cross-sectional study in Malatya, Turkey, involving 258 individuals aged 20 to 65 years old with various types of disabilities, 61 of them were those with visual disability. The prevalence of overweight was 52.5% (32 people), while the prevalence of obesity in individuals with visual disability was 21.3% (13 people). Accordingly, 26.2% or 16 people of those in this category have a normal Body Mass Index (BMI), and none were reported to be underweight. Those with visual disability have the largest proportion of overweight and obesity as compared to those with orthopaedic, hearing, and speaking disabilities in this study (Bozkir *et al.*, 2016). Another study in Asia, conducted in Saudi Arabia that comprised 75 female university students with visual disability with an average age of 26 years old, revealed that the prevalence for overweight was 25.3% and for obesity was 4.0% in the respondents (Mohamed Elshafie, 2024). Meanwhile, a study in Quezon City, the Philippines, with 51 respondents who were blind to determine their nutritional status, reported that 39.2% were overweight and 27.5% of them were obese (Flores *et al.*, 2017).

In addition, a pilot study in Newfoundland, Canada, involving 25 participants aged between 21 and 80 years old discovered that three of them (12.0%) had a BMI between the range of 25.0 to 27.0 kg/ m^2, and 13 of them (52.0%) had a BMI of 27.0 kg/ m^2 or above. Only four subjects (16.0%) had a normal BMI between 20.0 and 24.9 kg/ m^2 (Roebothan, 1999). The cut-off point was set at 27 kg/m^2 in this study, as it was the value that imposed the greatest risk of ill health. Overall, in the study by Roebathan (1999), the prevalence of overweight and obesity, when combined, was 64.0%. In a qualitative study using a semi-structured in-depth interview technique conducted by Bilyk *et al.* (2009) among nine adults aged 20 to 50 years with severe visual disability or blindness, four out of the nine informants (44.4%) were classified as being in the overweight category. Additionally, three out of the nine informants (33.3%) were in the obesity category. Only one informant (11.1%) had a normal BMI. In essence, this resulted in the prevalence of overweight and obesity in the study being 77.7% (Bilyk *et al.*, 2009).

Although research on overweight and obesity in those with visual disability remains limited, existing studies above indicate a substantial prevalence across diverse settings, ranging from 29.3% to 77.7%. An example is the study by Bozkir *et al.* (2016) in Turkey, in which it was revealed that the prevalence of overweight and obesity when combined was 73.8%. This was higher compared to the prevalence in the general adult population of the country, at 64.4% (WHO, 2018). Similarly, the study in the Philippines by Flores et al. (2017) discovered that the combined prevalence of overweight and obesity, at 66.7%, was higher than the national prevalence for the general adult population, which was 36.0% (National Nutrition Council Region IX, 2025).

These findings collectively indicate that visual disability may be associated with a higher risk of overweight and obesity, although the magnitude varies by population, setting, and sampling methods. Nonetheless, limitations of the current literature include a small sample size and sampling method. For example, the study by Roebothan (1999) was not based on random sampling, whereas

the study by Bilyk et al. (2009) was a qualitative study. Thus, the sample size was determined by the principles of reviewing prior qualitative studies and theoretical saturation. In addition, the study by Mohamed Elshafie (2024) employed convenience sampling, excluded male subjects, and was conducted specifically at a university. These limitations may reduce the generalizability of the study findings to the broader population with visual disabilities outside of the study settings. Overall, these highlight the need for larger, population-based, and longitudinal studies to better quantify the prevalence, identify at-risk subgroups, and subsequently design targeted interventions for the prevention and management of overweight and obesity for individuals with visual disability.

FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY IN INDIVIDUALS WITH VISUAL DISABILITY

Sociodemographic Characteristics Associated with Overweight and Obesity in Individuals with Visual Disability

In individuals with visual disability, among the sociodemographic characteristics influencing malnutrition include age, sex, living accommodation, level of education, employment status, monthly income, marital status, level of visual impairment, affinity for food and eating, self-reported general health, involvement in physical activity, consumption of food supplement and water consumption (Roebothan, 1999; Bilyk *et al.*, 2009; Mohamed Elshafie, 2024).

In the study by Roebothan (1999), the 25 respondents were aged between 21 and 80 years old, with an average age of 53 years old. Nine of the participants (36.0%) were aged 60 years or older. Thus, most of the participants were in the adult age group. The study by Bilyk *et al.* (2009) has a majority of the informants aged 30 years or older (66.7%). Meanwhile, the study by Flores *et al.* (2017) in the Philippines comprised 51 participants, aged between 30 and 71 years, of whom 76% were adults (30 to 59 years old). Additionally, the respondents in the study by Mohamed Elshafie (2024) have an average age of 26 years old. In the study by Mohamed Elshafie (2024), no association was found between age and BMI category.

In the visually blind, males were reported to have a higher prevalence of obesity compared to females (80% vs 33%) (Roebothan, 1999). In Quezon City, Philippines, where the study by Flores *et al.* (2017) was conducted, 40.9% of the male participants were overweight, compared to 28.6% of the females. In addition, 31.8% of the male participants were obese as compared to none of the females. However, the ratio of female to male participants in this study was 1:6 due to a lack of female blindness in the population. No further details were elaborated about the percentage of obesity in male and female informants in the study by Bilyk *et al.* (2009), while the study by Mohamed Elshafie (2024) did not include male students as respondents.

In terms of living accommodation, almost half (48.0%) of the respondents lived with family members or friends, 44.0% lived on their own, and 8.0% lived at boarding facilities (Roebothan, 1999). Regarding the level of education, 11 of the subjects in the Canadian study by Roebothan (1999) had less than a high school education, seven had completed high school, and two had completed university degrees. The remaining five respondents' level of education was not stated. Bilyk *et al.* (2009) reported that 66.7% of the participants attended either a college or a university, while the remaining individuals had a high school education or less. Among the 75 respondents in the study by Mohamed Elshafie (2024), the majority (78.7%) were enrolled in bachelor's degree programmes, and 21.3% were in post-bachelor's degree programmes. However, the association with BMI category was not further analysed.

In terms of occupation, more than half (56.0%) of the participants in Roebothan's study (1999) were unemployed. Only one participant (1.0%) was working, two (8.0%) were studying, while the rest were retirees. In the study by Bilyk *et al.* (2009), 55.6% of the informants were working, 11.1% were studying, and 33.3% were unemployed. All respondents in the study by Mohamed Elshafie (2024) were students at a university in Saudi Arabia.

Monthly income was divided into low, moderate, and high in the study by Mohamed Elshafie (2024). Concurrently, it was discovered that there was no association between monthly income level and BMI category. In view of marital or relationship status, in the study by Bilyk *et al.* (2009), 44.4.% of the informants were single. Similarly, 44.4% have partners, while 11.1% were widows.

Each study used specific definitions to categorise visual disability. Roebothan (1999) enrolled participants who were all legally blind. Meanwhile, Bilyk et al. (2009) divided visual disability based on level of visual acuity, which included severe visual impairment and blindness. Severe visual impairment in this study was defined as being capable of recognising the shape of a hand, with visual acuity worse than 20/ 600, or a visual field of less than five degrees. In particular, 55.6.% of the informants had severe visual impairment, and 44.4% were individuals with blindness in this study.

An affinity is described as a liking for something (Cambridge Dictionary, 2025). Affinity for food in the study by Bilyk *et al.* (2009) referred to the degree of liking or love for food and eating, categorised as none, moderate, or strong. Conversely, 77.8% of the informants reported having a strong affinity for food, 11.1% expressed a moderate affinity, and 11.1% reported having no affinity for food or eating.

Mohamed Elshafie (2024) assessed the self-rated general health status in female students with visual disabilities. While this status was partitioned into "healthy" and "has chronic disease," there was no association between self-rated general health status and BMI category. Physical activity, combined with a reduced calorie intake, is a method for treating obesity (Chin *et al.*, 2016). Mohamed Elshafie (2024) classified participation in sports activity into "no," "yes," and "sometimes." Notably, a large percentage of the respondents (64.0%) did not participate in sports activities. Nevertheless, there was no association between sports activity and BMI category in his study.

Food supplements are products that provide additional nutrients beyond those obtained from the diet, including vitamins, minerals, and amino acids, typically in the form of capsules, pills, tablets, or liquids (Hassan *et al.*, 2020). Most subjects (88.0%) in the study by Mohamed Elshafie (2024) did not take any dietary supplements. The researcher also discovered no association between food supplements and BMI category. Drinking water in an appropriate amount, for example, 1.5 litres (L) daily, was associated with a lower BMI, whereas an insufficient amount of water intake was associated with an increased BMI. These findings may be beneficial for weight management (Vij & Joshi, 2014; Chang *et al.*, 2016). Furthermore, in the study by Mohamed Elshafie, water consumption by the respondents was categorised into one to three cups per day, four to six cups per day, and seven to eight or more cups per day. While the majority of the respondents consumed only between one and three cups of water per day (57.3%), no association was identified between water consumption and BMI category.

The studies by Roebothan (1999) and Bilyk *et al.* (2009) only used descriptive statistics. Thus, the association between sociodemographic factors such as age, sex, living accommodation, level of education, employment status, marital status, level of visual impairment, and affinity for food and eating, as well as overweight and obesity, could not be established. While the study by Mohamed Elshafie (2024) employed inferential statistics, the study population was limited to female students

only. Therefore, the nutritional status and sociodemographic characteristics associated with BMI categories in male students could not be determined. Furthermore, no association was observed between all the sociodemographic characteristics and overweight and obesity, likely due to the small sample size. Nevertheless, it is imperative that the sociodemographic characteristics be studied as malnutrition and poor dietary intake are influenced by sociodemographic determinants (Agurs-Collins *et al.*, 2024).

Among individuals with visual disability, the role of sociodemographic factors in influencing overweight and obesity remains uncertain and inconsistently supported by existing evidence. The existing studies have limited statistical power due to their small sample sizes and the predominance of descriptive statistics. Although broader studies indicate that individuals with visual disabilities have higher rates of physical inactivity, as indicated by Mendez et al. (2022), this aspect was not consistently examined within the reviewed literature. This suggests that sociodemographic factors may be important but remain unexplored. Moreover, there is a need for larger, more diverse, and methodologically robust studies to clarify how sociodemographic factors influence overweight and obesity risk in this population.

Dietary Intake in Individuals with Visual Disability

Dietary intake is defined as all foods (including beverages) that are consumed by the oral route. Since it is determined through food consumption, it serves as a guide and indirect measure of the amounts of nutrients and energy required for metabolism (Rutishauser, 2005). Following this, an imbalance in dietary intake contributes to malnutrition in the form of either undernutrition, overnutrition, or micronutrient deficiency or excess (Kesari & Nole, 2023). The diet of individuals with visual disabilities often lacks variety, with some purchasing the same food products for years (Bilyk *et al.*, 2009; Kostyra *et al.*, 2017). These scenarios were attributed to inaccessible materials and an inconducive environment when purchasing food, during meal preparation and cooking, and when eating out (Baker *et al.*, 2002; de Faria *et al.*, 2012; Sahingoz, 2012).

In a pilot study with 25 respondents by Roebothan (1999), using 24-hour diet recalls, it was revealed that milk and dairy products, meats, and grains were consumed in lower amounts by those respondents aged 21 to 80 years old who were either blind or legally blind. This is compared to the recommendation made by Canada's Food Guide to Healthy Eating. Additionally, caloric values of the respondents' diets were also revealed to be lower than the national recommended amounts in the study. Despite this, this study lacked a control group for comparison. Instead, a comparison was made against the national dietary recommendation of the country.

A cross-sectional study was conducted to compare dietary consumption and eating behaviour in older adults aged 50 years and over with and without visual disability in the United Kingdom (UK). It was concluded that for men, the group with visual disability took lesser amounts of macronutrients (energy, carbohydrates, sugar, fat, saturated fat, and protein) and micronutrients (fibre, salt, calcium, and iron) compared to the group of men with normal vision. In contrast, females with visual disabilities were noted to consume smaller amounts of macronutrients (energy, carbohydrates, sugar, fat, saturated fat, and protein) and micronutrients (calcium, iron, cholesterol, and vitamins C and E) relative to their female counterparts with normal vision. Nonetheless, in both the groups with and without visual disability, regardless of sex, it was deduced that they were not meeting the recommended amounts of nutrients based on the national guidelines in the UK (Jones & Bartlett, 2020).

Furthermore, in the UK, Age-Related Macular Degeneration (AMD) is the leading cause of visual disability. In the cross-sectional study by Stevens *et al.* (2015), it was reported that in the AMD group, caloric values, carbohydrates, protein, fat, fibre, and calcium were taken in lesser amounts relative to the non-AMD group. Nonetheless, individuals with AMD in this study did not meet the national dietary recommendations for fibre, calcium, and vitamins D and E (Stevens *et al.*, 2015).

Overall, the available evidence consistently indicates that adults with visual disability tend to have inadequate nutrient intake, although the underlying reasons and methodological rigour vary across studies. For example, the study by Roebothan (1999) discovered reduced intake of key food groups. However, the absence of a control group limited the strength of the findings. At the same time, larger comparative studies from the UK indicated that both men and women with visual disability consumed lower amounts of macronutrients and micronutrients than their sighted peers. Despite this, neither group met the recommended dietary intake (Jones & Bartlett, 2020), and individuals with AMD also consumed lower amounts of several nutrients (Stevens *et al.*, 2015). Collectively, while these studies highlight consistent nutritional insufficiencies, they were limited by cross-sectional study designs, potential recall bias, and a lack of longitudinal assessment. To address this, future studies should aim to fill these gaps.

Dietary Practise and Meal Pattern in Individuals with Visual Disability

The majority of individuals with visual disabilities choose food based on their inclination, followed by the impact of the food on their health and its price (Jones *et al.*, 2019). For instance, Bilyk *et al.* (2009) discovered that the eating pattern in those with severe visual disability and blindness was erratic, and their mealtimes were unusual.

In terms of body image, this was experienced more in sighted women than in women who were either blind or had blindness later in their lives (Ashikali & Dittmar, 2010). In addition, eating disorders may be perceived as peculiar in those with visual disability, as body image is often linked to a visually driven culture of slimness. Note that cases of anorexia nervosa can still occur in those who are blind or have visual disability, as they would use other senses to examine the body and make comparisons with other people who were preoccupied with body image (Kocourkova *et al.*, 2011).

Food and eating behaviour in individuals with visual disabilities are likely shaped by practical constraints and sensory-based decision-making rather than by visual cues or appearance-related motivation. Together, these findings underscore the significance of a more comprehensive understanding of how environmental accessibility, sensory cues, and social influences interact to shape food choice and eating behaviour in this population.

NUTRITIONAL CHALLENGES FACED BY INDIVIDUALS WITH VISUAL DISABILITY

Individuals with visual disability face challenges in terms of shopping for food, meal preparation, cooking, and eating out (Bilyk *et al.*, 2009; Jones & Bartlett, 2018; Li *et al.*, 2021).

Challenges During Shopping for Food in Individuals with Visual Disability

A qualitative study was conducted in Canada, involving six informants, to examine the obstacles encountered during shopping. One of the methods employed was ethnography, which involved shadowing a person with visual disabilities as they shopped at a supermarket. The researchers observed that one of the challenges of shopping is having to constantly speculate and verify, which requires full concentration and can be mentally exhausting. Notably, navigation in a supermarket or store requires the use of other senses, and small print can lead a person with a visual disability to

guess what a product is during grocery shopping. Another challenge is the need to constantly ask for help and to trust the helper, if any. Moreover, mistakes in finding the correct aisle and the need to constantly apologise, such as when a shopping cart is bumped, can be daunting. The same study, this time using semi-structured interviews with five informants via phone calls, also mentioned building environment barriers, especially when a store is visited for the first time. Navigating between aisles, finding a product, and addressing customer service can be challenging while shopping (Khattab *et al.*, 2015).

Challenges During Meal Preparation in Individuals with Visual Disability

A video content analysis by Li *et al.* (2021) examined the typical practices during meal preparation among individuals with visual disabilities. This is divided into during meal preparation and pertaining to recognition, tools, and environment.

During meal preparation, this commonly involves following general safe cooking practices, such as cutting and chopping, measuring, spreading, and pouring. To ensure a safe cooking practice, they should start with gentle actions, such as using a slow cooker instead of an open burner, placing food in a cold pan before putting it on a burner, and cooking at a low to medium heat. Other senses, such as auditory and tactile, are used to compensate for visual needs. They also need to memorise the environment in the kitchen, such as the kitchen layout and the corresponding knobs of the burner, to ensure it is safe to cook. During cutting and chopping, individuals with visual disabilities often find alternatives to using a knife, such as using a food processor or a garlic masher. They also separate cut and uncut food into different parts of a cutting board and have various ways of using a knife to cut objects. When measuring food ingredients, they would usually use their hands to weigh meat and spices, utilise measuring cups to measure liquid with hand assistance, and use the same containers or kitchen utensils to measure food (e.g., using the same can to attain a 1:1 ratio for water and soup, and using the broad side of a knife to measure the size of meat). Meanwhile, spreading butter or jam is usually performed using either hands, single-use plastic gloves, or utensils. In the case of pouring, an extra-large bowl comes in handy to reduce the difficulty in pouring. In addition, a finger is used over the spout and/ or in a container to know the exact quantity of the poured ingredients. Water is added to a food processor or container to ensure all ingredients are added to the dish. Consequently, the bowl is wiped with fingers to ensure that it is empty after pouring (Li *et al.*, 2021).

During cooking, typical activities include placing pans on a burner, baking, turning food, and checking for doneness. When placing pans on a burner, an electric stove is preferred over a glass or gas top, as individuals with visual disabilities will use their hearing or touch to confirm the position of the pan on the burner. When baking is involved, their hands are used to feel the texture of the batter, examine whether it is ready, and shape the dough. Furthermore, vigilant use of the oven is applied, and cleaning is given great emphasis (e.g., the edges of the pan are wiped to prevent burning on the edges). If food needs to be turned, several kitchen tools are used, such as a large two-prong fork, a spoon, a spatula, or two utensils. The food location is also kept track of, either through memorisation or the sense of touch. At the same time, testing for food doneness is achieved through the senses of touch, hearing, or smell, a timer, or intuition or memorisation (Li *et al.*, 2021).

In terms of tools, environment, and recognition, aspects such as using small appliances, navigating the kitchen space, and distinguishing between objects are vital for individuals with visual disabilities. To make the use of small appliances more effective, a virtual assistant is useful to help set timers, and speaking tools are used for various purposes. This includes utilising a talking scale to measure ingredients and speaking thermometers to indicate that the food has been cooked to the optimum temperature. Apart from that, specific tools are used for specific tasks (e.g., a tea strainer is used to

rinse off rice, and a spatula and chopsticks are used for mixing). In terms of navigation of the kitchen space, organisation of the area is paramount. For example, the space for cooking is separated from the area where food ingredients are stored, measuring cups are nested, and kitchen utensils are returned to their original place. Following this, various approaches to feeling the kitchen space are also practised, such as using a spatula to gauge the temperature of a hot grill. Similarly, to differentiate one object from another, the use of Braille labels on jars and containers is beneficial. Recognising the size of containers is also exercised to ensure that the storage location of different ingredients can be tracked. Moreover, the way containers are organised, such as using an alphabetical system and utilising the sense of smell to differentiate between different spices and ingredients, is among other methods used (Li *et al.*, 2021).

Despite these usual practises, as highlighted in the video content analysis, challenges persist during meal preparation and cooking for those with visual disability. Notably, semi-structured in-depth interviews that were held with 12 informants with visual disability revealed that the challenges are in the aspects of utilisation of tools, access to information, tactile sense, safety, accuracy and ambiguity, organisation and tracking system, item and quality inspection, and communication and collaborative cooking (Li *et al.*, 2021).

Utilisation of tools is difficult in several ways. Firstly, dirty hands and food may interfere with Braille labels on kitchen utensils. Secondly, there are too many kitchen tools used for different purposes. Thirdly, the available tools lack confirmation and feedback. Thus, it is challenging to tell whether the food has been cooked. There is also a problem with information access. In particular, there is a lack of detail in the guide manuals to describe kitchen appliances that can cater to those with visual disability. The recipe content also fails to consider the way a person with a visual disability cooks and is complicated by excessive information, which leads to confusion. When viewing a recipe online, difficulties arise from interacting with the computer while cooking, multiple advertisements, and concerns about getting the physical recipe or digital devices dirty (Li *et al.*, 2021).

Although using touch as a substitute for vision during cooking is described in the video content analysis, this is sometimes insufficient to inform about a specific cooking procedure. The use of the hand may also be unsafe and may lead to injury. The efficiency of cooking may also be reduced since the hand used for feeling or touch cannot be used for other tasks. The fourth challenge is safety. Apart from the risk of burns, there are also other risks of accidents, for example, accidentally dropping or knocking things over, and difficulty predicting a fire. In addition, the presence of other people in the kitchen can also impose safety concerns (Li *et al.*, 2021).

In terms of accuracy and ambiguity, the challenge lies in testing to obtain a precise amount of ingredients. It is also challenging to learn new cooking methods. Therefore, some individuals will stick to the style of cooking they are familiar with. Steps of cooking are also more demanding to follow with the presence of visual disability. Due to the mental load of cooking, finding previously used kitchenware can be a challenging task. The status of tasks during cooking and organising parts of the food is also hard to keep track of when there is a problem affecting the vision. Remembering when to clean during cooking is also a task that can be difficult to recall. In essence, these describe the obstacles faced in view of the organisation and tracking system in the kitchen (Li *et al.*, 2021).

Regarding item and quality inspection, determining whether the food has gone bad is challenging, as there is uncertainty about whether the food has been cleaned properly. There is also a risk of accidental mixing of unwanted items, such as a piece of eggshell that can mix with flour. Another challenge comes in the form of communication and collaborative cooking. Hence, there is a need for

continuous communication when cooking with someone else. When cooking is done alone, the use of virtual assistance may introduce technical issues, and in a shared kitchen, modifying kitchen appliances can be challenging (Li *et al.*, 2021).

Challenges when Eating Out for Individuals with Visual Disability

Bilyk *et al.* (2009) conducted semi-structured, in-depth interviews with nine individuals who had severe visual disabilities or blindness and found that at least 40.0% of each informant's meals were consumed by eating out at restaurants or eateries. This was due to the dislike of cooking. Conversely, while eating out, the main barriers they encountered were unfriendly or unhelpful servers and menus that came in an inaccessible format, causing them to order with incomplete knowledge of the food they chose (Bilyk *et al.*, 2009).

Overall, individuals with visual disability encounter multifaceted nutritional challenges that extend across food shopping, meal preparation and cooking, and eating out, driven by both environmental barriers and limitations in accessible information. During grocery shopping, navigating supermarket aisles is cognitively demanding and exhausting, and requires constant verification, verbal assistance, and reliance on other senses, while product labels often remain inaccessible. As such, emotional stress has been demonstrated, with autonomic measures indicating higher frustration and cognitive load in those with visual disability (Balconi *et al.*, 2022). Accessibility of food information further complicates matters. For instance, many individuals with visual disabilities struggle to interpret packaging and labels, which can restrict their dietary variety and increase their dependence on familiar or repetitive foods (de Boer & Schrijnemaekers, 2023). In the home kitchen, they face substantial risks and inefficiencies when cooking. They need to rely heavily on memory, other senses, and assistive technologies. They also confront challenges in safely handling utensils, navigating spatial layouts, verifying food doneness, and reading recipes (Li *et al*, 2024). Furthermore, eating out introduces its own barriers, including inaccessible menus, unhelpful staff, and the need for continuous assistance, which undermine independence and optimum nutrition. Collectively, these cumulative challenges emphasise that nutritional interventions for individuals with visual disability need to extend beyond conventional dietary advice.

RECOMMENDED INTERVENTIONS TO ADDRESS OVERWEIGHT AND OBESITY IN INDIVIDUALS WITH VISUAL DISABILITY

Limited literature is available on the nutritional interventions done in addressing overweight and obesity in individuals with visual disability. In a pilot study involving 28 legally blind individuals in the USA, aged between 24 and 67 years old, a nutritional intervention of eight weeks' duration comprising four components was implemented. This includes dietary recommendations, tracking of dietary strategy, physical activity, and self-weighing (Depuy *et al.*, 2023). Accordingly, the dietary recommendation advised was to reduce calorie consumption from calorically dense foods, which have low nutritional value and are consumed daily. The categories of food that received attention were sweets, baked goods, fast food, junk food (food with a low nutrient profile), fried foods, and sugary drinks. Following this, the frequency of eating these categories of food was initially identified. The participants worked with the research staff to select a food category and strive to have "zero days," or days without consuming any food from that category. To achieve "zero days," strategies such as avoiding the purchase of food, knowing menu substitutes, identifying alternatives, and adding low-calorie replacements to the shopping list were employed. Moreover, a nightly text-based prompt was used to enable participants to respond, allowing for tracking of the food and drink they consumed (Depuy *et al.*, 2023).

The second component is tracking of the participant's dietary strategy. Several methods were employed, including text-based dietary tracking, weekly automated text messages tailored to each individual, and weekly e-mails also tailored to each individual. Additionally, at the baseline and at week four of the study period, participants received Word documents containing weight loss recommendations and strategies. A 20-minute video-based problem-solving session was offered to any participant who had not experienced initial weight loss for two consecutive weeks. The third component in the intervention was physical activity. The participants were advised to increase physical activity up to 150 minutes/week. Physical activity was self-reported via the Godin-Shephard Leisure-Time Physical Activity Questionnaire. Following this, the fourth component was self-weighing, in which participants received a scale that utilised cellular technology to transmit weight data to a database. Text messages were sent to the participants every time they used the scale, and they would weigh themselves under the same conditions each day. Correspondingly, they were requested to send five daily weights during a seven-day period at the baseline, week four, and week eight of the study period. In terms of weight loss, significant weight losses were observed at week four and week eight during the study period compared to the baseline weight. However, this study was a pilot study that has not been validated. The usability and usefulness of the programme were remarked as high by the participants. This research was also a single-arm trial without a control group. Therefore, a comparison between the group that received intervention and the group that did not receive intervention could not be made. It was suggested that a longer-duration study with a larger sample size be conducted in the future to determine the effectiveness of the programme (Depuy *et al.*, 2023).

Capella-McDonnall (2007) recommended that health promotion for individuals with visual disabilities be improved in the areas of personal factors, environmental factors, participation restrictions, and activity limitations. In terms of personal factors, health promotion activities performed should have a positive impact on fitness, lifestyle habits, self-efficacy, other health conditions, and health-related Quality of Life (QoL). A supportive environment, for example, encouragement from family members, friends, community members, and professionals, as well as the provision of transportation, is crucial to ensure that individuals with visual disabilities can participate in physical activities. In addition, areas that require attention to participation restrictions and activity limitations include diet management, fitness, involvement in recreational and leisure activities, and engagement in community life. Notably, the setting in which health promotion can be implemented can be either in rehabilitation (e.g., residential rehabilitation facilities or vocational training agencies) or a community setting (e.g., a partnership between a local disability organisation and a community programme that is run for the public) (Capella-McDonnall, 2007).

The recommendation by Capella-McDonnall (2007) was in line with the proposed framework to improve health and reduce secondary conditions, including weight problems, in persons with disability by Rimmer and Rowland (2008), in which a person with disability (including visual category) is empowered. The environment is designed to ensure that personal and environmental barriers can be removed, enabling individuals with disabilities to achieve a healthy lifestyle. Figure 1 illustrates the conceptual framework for health promotion programmes in persons with disabilities (Rimmer & Rowland, 2008).

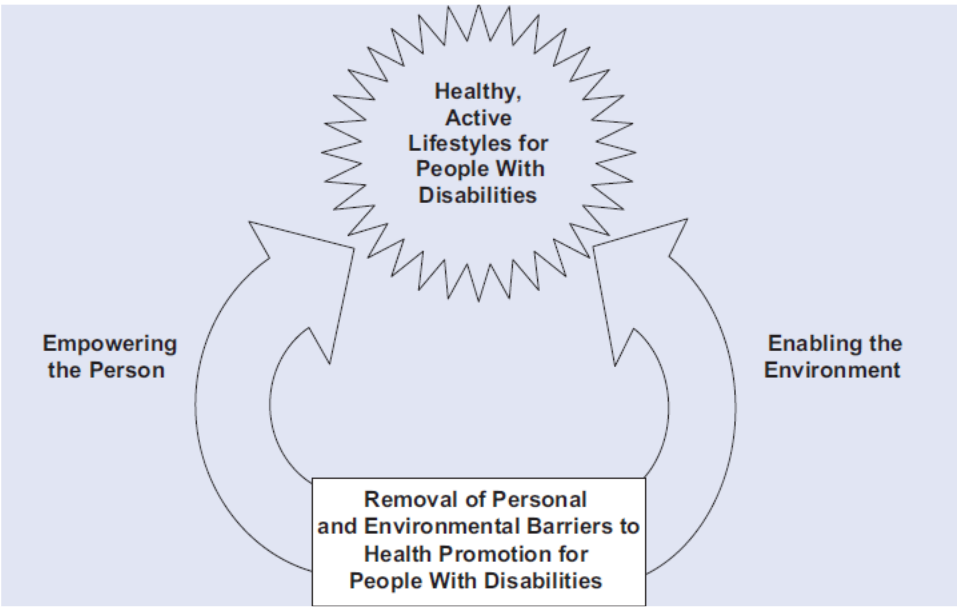

Figure 1. Conceptual framework for health promotion for individuals with disabilities (Rimmer & Rowland, 2008).

Evidence on nutritional interventions for overweight and obesity in individuals with visual disability is scarce, with only a few studies conducted to date. The study by Depuy *et al.* (2023) demonstrated that a multi-component intervention that combined dietary modification, physical activity, and self-monitoring was feasible and associated with short-term weight loss in legally blind adults. However, the study was a single-arm trial without a control group, which limits the generalisability of the findings. This highlights the requirement for larger, controlled studies and the development of customised interventions. In short, the challenges faced by individuals with disabilities in facing malnutrition problems, such as overweight and obesity, should be addressed by creating nutritional interventions that are co-created with individuals with disabilities. This includes acknowledging and understanding their needs within the broader context of nutritional security and considering the diverse accessibility needs of individuals with disabilities (Hollis-Hansen *et al.*, 2024).

RECOMMENDATIONS FOR ADDRESSING OVERWEIGHT AND OBESITY IN INDIVIDUALS WITH VISUAL DISABILITY IN MALAYSIA

Previous studies on visual disability in Malaysia were concentrated on the prevalence and causes of visual impairment (Chew *et al.*, 2018; Reddy *et al.*, 2008; Tang *et al.*, 2024; Zainal *et al.*, 2002). Still, there is limited data regarding malnutrition status in those with visual disability in Malaysia and in the state of Sabah. Furthermore, the rising prevalence of overweight and obesity in the country underscores the urgency of integrating disability-inclusive nutrition policies into national public health strategies. Building on this, the Third National Plan of Action for Inclusive Health Care for Persons with Disabilities (2024-2030), as endorsed by the WHO, provides a timely framework to mainstream nutrition into disability health services (WHO, 2024). Aligning this with Malaysia's National Action Plan for Nutrition III (2016-2025), which already emphasises malnutrition and NCDs, can help ensure that policy interventions, such as healthy food environment reforms, weight management programmes, and dietary education, are adapted for individuals with disabilities (MOH, 2016). More specifically, incorporating accessible nutritional guidance, such as in the form of Braille or audio, and community-based nutrition programmes will help promote equity in nutrition.

In addition, removing structural barriers for those with visual disability is imperative. For example, Malaysia's food environment policies face hurdles in restrictions on unhealthy food marketing (Ng *et*

al, 2018). By considering individuals with visual disabilities in food policy design, such as mandating accessible food labelling and menu formats, this will help increase accessibility for better-informed decision-making on nutrition. At the same time, the healthcare workforce requires greater capacity, such as training programmes that include disability-specific dietary needs. Given that those with disabilities in the country are reportedly more likely to have risk factors for NCDs, physical inactivity, and socioeconomic disadvantages (Ahmad *et al.*, 2017), strengthening prevention and integrating nutrition services into routine disability care could reduce long-term morbidity and health inequities.

There is a pressing need for robust, representative studies on overweight and obesity in individuals with visual disability in Malaysia. As the societal relevance of the topic of overweight and obesity increases, this issue has become a priority research area in Malaysia (MOH, 2020). In addition, existing research on obesity management in the country primarily focuses on the general population, highlighting significant gaps in awareness, stigma, and access to treatment (Nor Hanipah *et al.*, 2025). Nonetheless, such studies in individuals with visual disability are scarce. Therefore, future research should investigate anthropometric measurements, dietary behaviour, and physical activity in individuals with visual disabilities through longitudinal studies. Additionally, intervention trials are required to test the effectiveness and acceptability of tailored weight management programmes, ideally co-designed with individuals with visual disabilities and supported by related organisations. Moreover, the development and evaluation of assistive technologies, such as voice-guided nutrition applications and accessible weighing scales, for supporting self-monitoring and healthy behaviour should be prioritised. Such evidence could directly inform national policy, enabling the country to build inclusive and equitable nutritional interventions and address the issues of overweight and obesity in individuals with visual disability in the country.

CONCLUSION

The review discusses the nutritional status of individuals with visual disabilities. Through the review, it was reported that in Malaysia generally and in Sabah specifically, there is a lack of data regarding the nutritional status of those with visual disability and insufficient interventions available to cater to the population. This is especially true regarding overweight and obesity, which are prevalent in this population. In line with this, sociodemographic characteristics, dietary intake, dietary practices, and meal patterns are among the factors associated with overweight and obesity in the population. In addition, barriers related to shopping for food, meal preparation, and cooking, and inconvenient circumstances when eating outside, add to the problems faced by those with visual disability to achieve optimum nutrition.

It is crucial to build a nutritional intervention module tailored to the population, as this is one of the underserved populations in the country. A roadmap for such a module should begin with structured stakeholder engagement that includes individuals with visual disabilities, caregivers, organisations for visual disability, and nutritionists to ensure relevance and acceptability. Additionally, content development should prioritise accessible formats, for example, audio-based lessons, Braille or tactile materials, and high-contrast visuals. Topics covered should emphasise healthy eating, meal planning, food portioning, and safe physical activity adapted for individuals with visual disabilities. Following this, behavioural change strategies, including goal setting, self-monitoring, and guided problem-solving, should be incorporated. At the same time, pilot testing in selected community settings, such as Non-Governmental Organisations (NGOs) serving individuals with visual disabilities, is recommended to evaluate feasibility, usability, and acceptability, with findings guiding iterative refinement. Finally, structured training for facilitators and long-term monitoring plans are essential to ensure the sustainability and effectiveness of the intervention.

Improving the malnutrition status of those with visual disability is one of the ways to address the needs of this group to promote inclusion and Universal Health Coverage (UHC). Accordingly, people of all backgrounds and sociodemographic attributes can access a full spectrum of quality health services that they require, at any time, and without facing financial hardship while receiving these services. This has been outlined in Goal 3.8 of the Sustainable Development Goal (SDG) 3.0 (Good Health and Well-being).

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REFERENCES

[1] Ahmad, N. A., Mohamad Kasim, N., Mahmud, N. A., Mohd Yusof, Y., Othman, S., Chan, Y. Y., Abd Razak, M.A., Yusof, M., Omar, M., Abdul Aziz, F. A., Jamaluddin, R., Ibrahim Wong, N. & Aris, T. 2017. Prevalence and determinants of disability among adults in Malaysia: results from the National Health and Morbidity Survey (NHMS) 2015. *BMC Public Health*, 17(1), 756.

[2] AFB (American Foundation for the Blind). 2024. *Low Vision and Legal Blindness Terms and Descriptions* (https://www.afb.org/blindness-and-low-vision/eye-conditions/low-vision-and-legal-blindness-terms-and-descriptions). Last accessed on 24 November 2025.

[3] Agurs-Collins, T., Alvidrez, J., Ferreira, S. E., Evans, M., Gibbs, K., Kowtha, B., Pratt, C., Reedy, J., Shams-White, M. & Brown, A. GM. 2024. Perspective: Nutrition Health Disparities Framework: A Model to Advance Health Equity. *Advances in Nutrition*, 15(4), 100194.

[4] Baker, S. M., Stephens, D. L. & Hill, R. P. 2002. How can retailers enhance accessibility: giving consumers with visual impairments a voice in the marketplace. *Journal of Retailing and Consumer Services*, 9(4), 227–239.

[5] Ashikali, E.M. & Dittmar, H. 2010. Body image and restrained eating in blind and sighted women: A preliminary study. *Body Image*, 7(2), 172–175.

[6] Balconi, M., Acconito, C. & Angioletti, L. 2022. Emotional Effects in Object Recognition by the Visually Impaired People in Grocery Shopping. *Sensors*, 22(21), 8442.

[7] Bilyk, M. C., Sontrop, J. M., Chapman, G. E., Barr S. I. & Mamer, L. 2009. Food experiences and eating patterns of visually impaired and blind people. *Canadian Journal of Dietetic Practice and Research*, 70(1), 13–18.

[8] Bozkir, Ç., Özer, A. & Pehlivan, E. 2016. Prevalence of obesity and affecting factors in physically disabled adults living in the city centre of Malatya'. *BMJ Open*, 6, p. 10289.

[9] Cambridge Dictionary. 2025. *affinity* (https://dictionary.cambridge.org/dictionary/english/affinity). Last accessed on 24 November 2025.

[10] Capella-Mcdonnall, M. 2007. The Need for Health Promotion for Adults Who Are Visually Impaired. *Journal of Visual Impairment & Blindness*, 101(3), 133–145.

[11] CDC (Centers for Disease Control and Prevention). 2025. *Disability and Health Overview* (https://www.cdc.gov/disability-and-health/about/?CDC_AAref_Val=https://www.cdc.gov/ncbddd/disabilityandhealth/disability.html). Last accessed on 24 November 2025.

[12] Chang, T., Ravi, N., Plegue, M. A., Sonneville, K. R. & Davis, M. M. 2016. Inadequate hydration, BMI, and obesity among US adults: NHANES 2009-2012. *Annals of Family Medicine*, 14(4), 320–324.

[13] Chew, F. L. M., Salowi, M. A., Mustari, Z., Husni, M. A., Hussein, E., Adnan, T. H., Ngah, N. F., Limburg, H. & Goh, P. P. 2018. Estimates of visual impairment and its causes from the national eye survey in Malaysia (NESII). *PLoS ONE*, 13(6), e0198799.

[14] Chin, S. H., Kahathuduwa, C. N. & Binks, M. 2016. Physical activity and obesity: what we know and what we need to know. *Obesity Reviews*, 17(12), 1226–1244.

[15] de Boer, A. & Schrijnemaekers, A. 2023. Food Information Is Mostly Not Well Accessible to Consumers with a Visual Impairment - An Exploratory Phenomenological Study. *Proceedings*, 91(1), 184.

[16] de Faria, M. D., da Silva, J. F. & Ferreira, J. B. 2012. The visually impaired and consumption in restaurants. *International Journal of Contemporary Hospitality Management*, 24(5), 721–734.

[17] Depuy, J., Molina-Morales, J., Conover, A. J. & Jerome, G. J. 2023. Accessible weight loss program for adults who are legally blind: A pilot study. *Disability and Health Journal*, 16(4), 101502.

[18] Flores, A., Draper, J. L., Garcia, M. A. S., Salvador, R. M. R., Samonte, K. A. L. & Palomo, K. C. 2017. Nutritional Status of Blind Adults in a Community for Persons with Disabilities (PWD) in Quezon City, Philippines. *Journal of the Nutritionist-Dieticians' Association of the Philippines*, 31(1 & 2).

[19] Hassan, S., Egbuna, C., Tijjani, H., Ifemeje, J. C., Olisah, M. C., Patrick-Iwuanyanwu, K. C., Onyeike, P. C. & Ephraim-Emmanuel, B. C. 2020. Dietary Supplements: Types, Health Benefits, Industry and Regulation. *In:* Egbuna, C. & Dable-Tupas, G. (Eds.). *Functional Food and Nutraceuticals*. Cham: Springer Nature Switzerland.

[20] Hollis-Hansen, K., Vogelzang, J., Bode, B., Markworth, A., Rivera, R. L., Heydarian, N., Russell, R. & Emily Watt Clarke, E. W. 2024. The Need to Prioritise People With Disabilities in Nutrition Education. *Journal of Nutrition Education and Behavior*, 56(3), 119–120.

[21] IAPB (International Agency for the Prevention of Blindness). 2025. *Global data - How many people have sight loss?* (https://visionatlas.iapb.org/global-data/). Last accessed on 24 November 2025.

[22] JKM (Jabatan Kebajikan Masyarakat). 2023. *Pendaftaran Orang Kurang Upaya (OKU) – Kategori OKU* (https://www.jkm.gov.my/main/article/pendaftaran-orang-kurang-upaya-oku). Last accessed on 24 November 2025.

[23] Jones, N. & Bartlett, H. 2018. The impact of visual impairment on nutritional status: A systematic review. *British Journal of Visual Impairment*, 36(1), 17–30.

[24] Jones, N. & Bartlett, H. E. 2020. Comparison of the eating behaviour and dietary consumption in older adults with and without visual impairment. *British Journal of Nutrition*, 123(6), 712–720.

[25] Jones, N., Bartlett, H. E. & Cooke, R. 2019. An analysis of the impact of visual impairment on activities of daily living and vision-related quality of life in a visually impaired adult population. *British Journal of Visual Impairment*, 37(1), 50–63.

[26] Kesari, A. & Noel, J. Y. 2023. *Nutritional Assessment* (https://www.ncbi.nlm.nih.gov/books/NBK580496/). Last access on 15 November 2025.

[27] Khattab, D. A., Buelow, J. & Saccuteli, D. 2015. Understanding the barriers: Grocery stores and visually impaired shoppers. *Journal of Accessibility and Design for All*, 5(2), 157–173.

[28] Kocourkova, J., Soltysova, M., Mohaplova, M. & Hrdlicka, M. 2011. Anorexia nervosa in a blind girl. *Neuroendocrinology Letters*, 32(6), 748–750.

[29] Kostyra, E., Zakowska-Biemans, S., Sniegocka, K. & Piotrowska, A. 2017. Food shopping, sensory determinants of food choice and meal preparation by visually impaired people. Obstacles and expectations in daily food experiences. *Appetite*, 113, 14–22.

[30] Li, F.M., Dorst, J., Cederberg, P. & Carrington, P. 2021. Non-Visual Cooking: Exploring Practices and Challenges of Meal Preparation by People with Visual Impairments. *ASSETS 2021: The 23rd*

International ACM SIGACCESS Conference on Computers and Accessibility. 18-22 October, 2021, Virtual Event, USA. pp 1-18.

[31] Li, F.M., Liu, M. X., Kane, S.K. & Carrington, P. 2024. A Contextual Inquiry of People with Visual Impairments in Cooking. *Proceedings of the CHI Conference on Human Factors in Computing Systems*, May 11-16, 2024, Honolulu, Hawaii. pp 1-14.

[32] Mendez, I., Kim, M., Lundeen, E. A., Loustalot, F., Fang, J. & Saaddine, J. 2022. Cardiovascular Disease Risk Factors in US Adults with Vision Impairment. *Preventing Chronic*, 19, E43.

[33] MOH (Ministry of Health Malaysia). 2016. *National Plan of Action for Nutrition of Malaysia III (2016-2025)*. Putrajaya: National Coordinating Committee on Food and Nutrition (NCCFN).

[34] MOH (Ministry of Health Malaysia). 2020. *Nutrition Research Priorities in Malaysia for 12th Malaysia Plan (2021-2025)*. Putrajaya: Technical Working Group on Nutrition Research for National Coordinating Committee on Food and Nutrition (NCCFN).

[35] National Nutrition Council Region IX. 2025. *Overweight and Obesity Remain a Serious Health Concern in the Philippines* (https://nnc.gov.ph/mindanao-region/overweight-and-obesity-remain-a-serious-health-concern-in-the-philippines/). Last accessed on 24 November 2025.

[36] Ng, S., Swinburn, B., Kelly, B., Vandevijvere, S., Yeatman, H., Ismail, M.N. & Karupaiah, T. 2018. Extent of implementation of food environment policies by the Malaysian Government: gaps and priority recommendations. *Public Health Nutrition*, 21(18), 3395-3406.

[37] Nor Hanipah, Z., Abdul Ghani, R. & Mohd Efendy Goon, M. D. 2025. ACTION Malaysia—perception and barriers to obesity management among people with obesity and healthcare professionals in Malaysia. *BMC Public Health*, 25(1), 835.

[38] Mohamed Elshafie, M. 2024. Diet Quality and Nutritional Status among Visually Impaired and Blind University Students. *Medical Journal of Cairo University*, 92(1), 71–78.

[39] Reddy, S. C., Tajunisah, I., Low, K. P. & Karmila, A. B. 2008. Prevalence of eye diseases and visual impairment in urban population-A study from University of Malaya Medical Centre. *Malaysian Family Physician*, 3(1), 25–28.

[40] Rimmer, J. H. & Rowland, J. L. 2008. Health Promotion for People with Disabilities: Implications for Empowering the Person and Promoting Disability-Friendly Environments. *American Journal of Lifestyle Medicine*, 2(5), 409–420.

[41] Roebothan, B. V. 1999. Preliminary Assessment of Nutritional Status in a Group of Persons with Visual Impairments. *Nutrition Research*, 19(12), 1731–1740.

[42] Rutishauser, I. H. 2005. Dietary intake measurements. *Public Health Nutrition*, 8(7a), 1100–1107.

[43] Sahingoz, S. A. 2012. Visually Impaired Consumers and Food Shopping. *British Journal of Humanities and Social Sciences*, 7(1), 63-74.

[44] Stevens, R., Bartlett, H. & Cooke, R. 2015. Dietary analysis and nutritional behaviour in people with and without age-related macular disease. *Clinical Nutrition ESPEN*, 10(3), e112–e117.

[45] Tang, K. X. H., Iqbal, T., Lott, P. P. W. & Reddy, S. C. 2024. Prevalence of visual impairment and eye diseases in Malaysia: A cross-sectional prospective study at the University of Malaya Medical Centre. *Malaysian Family Physician*, 19, 30. PMID: 38855397.

[46] UN DESA (United Nations Department of Economic and Social Affairs). 2025. *Disability Laws and Acts by Country/ Area* (https://www.un.org/development/desa/disabilities/disability-laws-and-acts-by-country-area.html). Last accessed on 24 November 2025.

[47] Vij, V. A. K. & Joshi, A. S. 2014. Effect of excessive water intake on body weight, body mass index, body fat, and appetite of overweight female participants. *Journal of Natural Science, Biology and Medicine*, 5(2), 340–344.

[48] WHO (World Health Organization). 2018. *National Household Health Survey in Turkey – Prevalence of Non-communicable Health Disease Risk Factors 2017*. Ankara: WHO Regional Office for Europe.

[49] WHO (World Health Organization). 2019. *World report on vision*. Geneva: World Health Organization.

[50] WHO (World Health Organization). 2024. *Designing Disability-Inclusive Health Systems* (https://www.who.int/news-room/feature-stories/detail/designing-disability-inclusive-health-systems). Last accessed on 24 November 2025.

[51] WHO (World Health Organization). 2025. *Malnutrition* (https://www.who.int/news-room/questions-and-answers/item/malnutrition). Last accessed on 24 November 2025.

[52] Zainal, M., Ismail, S. M., Ropilah, A. R., Elias, H., Arumugam, G., Alias, D., Fathilah, J., Lim, T. O., Ding, L. M. & Goh, P. P. 2002. Prevalence of blindness and low vision in Malaysian population: results from the National Eye Survey 1996. *British Journal of Ophthalmology*, 86(9), 951–956.