Report of the Scientific Committee of the Spanish Agency for Food Safety and Nutrition (AESAN) on the impact of visual disability on dietary habits and nutritional status

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Working group

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Abstract

The term visual disability encompasses all types of serious visual problems caused by congenital pathologies, chronic diseases related to aging, accidents of any type or infections. Given the significant impact of visual disability on quality of life, it seems necessary to have a better knowledge of the existing evidence regarding nutritional status, regularly consumed foods, and the dietary behaviour of people with this type of disability. The end goal is to prevent health problems caused by an inadequate diet in this section of the population.

The Scientific Committee of the Spanish Agency for Food Safety and Nutrition (AESAN) has conducted an assessment of the published research on the impact of visual disability on food habits and

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nutritional status, and it has specifically examined the current evidence for the Spanish population.

As yet, there is little scientific research on the links between visual disability, nutritional status and dietary behaviours. The studies have been conducted on highly varied sample sizes, although they are generally small and limited to specific geographical areas or very specific population groups, and therefore none have been representative of the population under study. Very different approaches have been used, mainly employing transversal quantitative designs, qualitative designs, and case-control studies. Additionally, no homogenous definition of visual disability has been used across the studies, therefore the results may not be applicable to the different degrees of visual disability. There is less scientific proof for the Spanish population than there is for populations in other nations, without any comparative study based on age or geographical areas.

The reviewed scientific literature suggests that the regular diet reported by persons with visual disability do not conform to the parameters of healthy foods as stated in current food guides, thus entailing a greater risk of obesity and/or malnutrition than in the population without visual disability.

With regard to dietary habits, people with visual disability have significant difficulties in performing the activities required to follow a suitable diet. In an attempt to mitigate this problem, non-governmental organisations that aid persons with severe visual disability or vision loss such as the Spanish National Organisation for the Blind (ONCE), have developed support programmes that cover all aspects related to diet: rehabilitation programmes to provide training in culinary techniques, adapting household appliances and kitchen utensils, teaching activities, and promoting the formation of member groups in order to share solutions.

The Scientific Committee of the AESAN proposes the following activities:

1. To promote studies that conduct a detailed exploration of the nutritional status of persons with slight and severe visual disability, and loss of vision, by means of nutritional surveys specially tailored to this collective, and the assessment of the diagnostic criteria of malnutrition.
2. To support scientific research on identifying the obstacles to leading healthy lifestyles that are faced by people with visual disability in Spain, with the goal of implementing public health policies that promote the best possible state of health in this section of the population.
3. To promote the development of digital tools that provide information on the nutritional content of foods, intended for use by people with visual disability.
4. To support measures for rehabilitation, training, innovation and other actions introduced by non-governmental associations, such as the ONCE, which have been shown to improve the ability of persons with visual disability to consume a healthy diet.

Key words

Visual disability, dietary habits, nutritional status.

Suggested citation

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1. Introduction

The term visual disability encompasses all types of serious visual problems caused by congenital pathologies, chronic diseases related to aging, accidents of any type or caused by viruses of different origins. In Spain, this term is used to refer to all conditions of total vision loss and visual deficiency, in different degrees of vision loss, as stated in the Glossary of Visual Disability published by Spanish National Organisation for the Blind (ONCE) (Cebrián, 2003).

Visual acuity is defined as the eye's ability to distinguish the details and shapes of objects, at short and long distances. To assess it, the degree of visual acuity in each eye is measured by the angle at which these objects are seen. For this, optotypes or panels with letters or symbols placed at a specific distance from the person (normally 6 metres) are used. There are three levels of visual disability, defined according to visual acuity: moderate visual disability (visual acuity <3/10), severe visual disability (<1/10), and blindness (<1/20). Additionally, we must consider the ability to identify objects located in front of us (central vision loss), or conversely, the ability to detect them when they are situated to the side, above or below the eyes (peripheral vision loss) (Gómez-Ulla and Ondategui-Parra, 2012).

1.1 The prevalence and main causes of visual disability

Visual disability occurs at all stages of life, but children and elderly people are the most-affected sections of the population. Due to the aging of the population, the prevalence of visual disability is on the rise, and it has an increasing impact on public healthcare, given the high burden of disease associated with this pathology (Burton, 2021). According to the latest data published by the World Health Organisation (WHO), a billion people all over the world suffer from a visual disability that is preventable or may be treated in order to prevent blindness (WHO, 2019). According to the latest estimates of the National Statistics Institute (INE in Spanish), nearly one million people in Spain suffer from some type of visual disability and around 60 000 persons are legally blind (INE, 2008). It is important to point out that data compilation has just been finalised with regard to the new EDAD Survey on Disability, Personal Autonomy and Dependency Situations (INE, 2020), and therefore these figures will be updated shortly.

According to the available information on ONCE members, a non-profit body dedicated to improving the quality of life of blind people in Spain, there are approximately 71 000 members who have a visual acuity <1/10 or a reduced vision field of ≤10 degrees. The number of people who are affected by severe visual disability increases with age, and the number of people with blindness decreases as the latter increases, since the pathologies responsible for blindness are largely genetic in nature, compared to pathologies that cause visual disability, which are associated with chronic illnesses that develop at advanced ages (Gómez-Ulla and Ondategui-Parra, 2012).

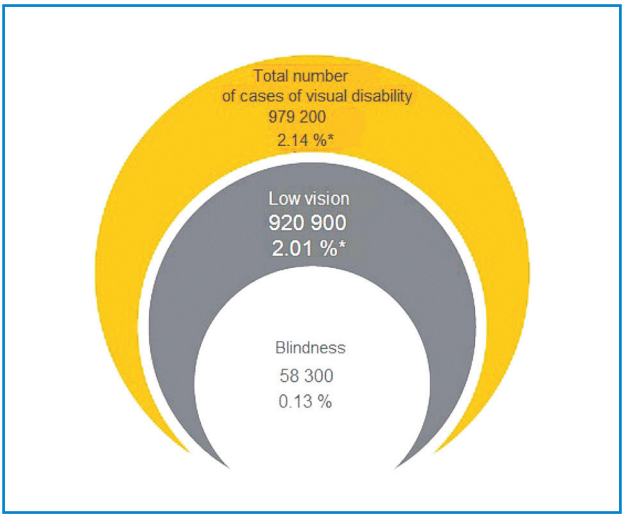

Figure 1. Prevalence of visual disability in Spain. Survey on Disability, Personal Autonomy and Dependency Situations, EDAD (INE, 2008). Extracted from Gómez-Ulla and Ondategui-Parra (2012).

The main causes of visual disability worldwide are cataracts, glaucoma, age-related macular degeneration (AMD), diabetic retinopathy and insufficiently corrected refractive errors (WHO, 2019). Serious visual deficiencies and blindness due to cataracts or refractive errors make up half of all cases of visual disability worldwide, although there is an established and generally effective treatment. On the other hand, glaucoma is the most common cause of blindness as it requires more complex treatment (WHO, 2019) (GBD 2019 Blindness and Vision Impairment Collaborators; Vision Loss Expert Group of the Global Burden of Disease Study, 2021). Diabetic retinopathy is the first cause of visual disability in adults of working age (Lanzetta et al., 2020) and AMD is the first cause of blindness in the elderly (Pondorfer et al., 2019). In any case, the prevalence of these diseases depends on screening and early diagnosis techniques, as in the case of diabetic retinopathy (Vujosevic et al., 2020). It must be mentioned that these diseases are becoming more frequent over the past years (Wong et al., 2014).

In Spain, the major pathologies that cause visual disability are AMD (31 %), retinitis pigmentosa (25 %), pathologic myopia (23 %), diabetic retinopathy (16 %) and glaucoma (6 %) (Gómez-Ulla and Ondategui-Parra, 2012). The available information on ONCE members also includes congenital pathologies, those of the optical nerve, the cornea, and those that involve retinal detachment. When we compare the trends in the organisation's member records, it is observed that pathologic myopia continues to be the primary cause of blindness, but AMD is increasing and it accounted for 23 % of new members in 2021. There is also an increase in members with inherited retinal dystrophies and a rebound in optical nerve pathologies (ONCE, 2021).

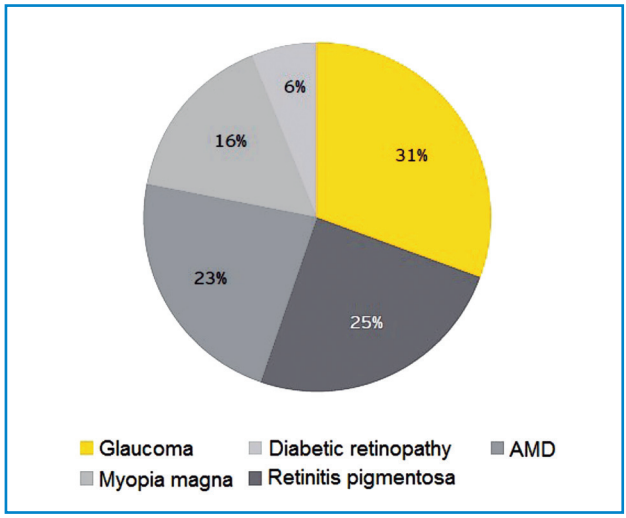

Figure 2. Main pathologies associated with visual disability. Survey on Disability, Personal Autonomy and Dependency Situations, EDAD (INE, 2008). Extracted from Gómez-Ulla and Ondategui-Parra (2012).

1.2 Pathogenic mechanisms of eye diseases

Due to the impact of visual disability on health, it is essential to better understand the pathogenic mechanisms of ophthalmic diseases and systemic disorders that are responsible for eye diseases so we may develop new diagnostic and treatment strategies, both from the pre-clinical point and clinical point of view (Pinazo-Durán et al., 2016).

The processes of inflammation, immune response, and neurodegeneration are pathogenic mechanisms associated with the most prevalent eye diseases. As a matter of fact, the eyes are exposed to environmental and endogenic agents that make them especially sensitive to oxidative stress by reactive oxygen species (ROS) [superoxide anion ($-O^{\cdot}$)], such as hydrogen peroxide (H_2O_2), which is the most harmful; the hydroxide radical (-OH)] and/or by reactive nitrogen species (RNS) [nitric oxide radical ($NO^{\cdot}$), peroxynitrite ($ONOO^{-}$) and the nitrogen dioxide radical ($NO_2^{\cdot}$)]. The involvement of these reactive species that cause cell damage in different physiological and pathological processes, including eye diseases, has been described, especially their role in the development of cataracts and glaucoma (Pinazo-Durán et al., 2013, 2014) (Nita et al., 2016). In relation to immune response, in recent years, different studies have identified a wide variety of proinflammatory cytokines in human and animal models, with a growing interest in the area of ophthalmic diseases (Benitez-del-Castillo et al., 2019) (Wooff et al., 2019) (Murakami et al., 2020).

1.3 Risk factors of visual disability

According to the World Health Organisation, the main risk factors associated with visual disability are advanced age, being a woman, and having a low socio-economic status (WHO, 2021a). Physiological changes occur in persons over 50, which include loss of retinal sensitivity to light, opacity and loss

of elasticity of the lens, vitreous degeneration and reduced lacrimal capacity (Grossniklaus et al., 2013). Regarding sex, a greater genetic predisposition towards visual disability has been observed in women, along with a greater prevalence of autoimmune diseases in them (Gipson and Turner, 2005). In terms of socio-economic level, the lack of healthcare and sanitation problems in developing countries are responsible for most visual disabilities in them (WHO, 2019). In developed countries, along with these factors, we must add the increased rate of Type 2 diabetes, which is responsible for cases of diabetic retinopathy (IDF, 2021).

1.4 Diet and visual disability

The impact of diet on visual disability has been the focus of much attention by the scientific community in recent years. The effects of vitamin A deficiency are well known, causing night blindness and vision loss, which are especially prevalent in Sub-Saharan Africa and South Asia (Stevens et al., 2015).

Large population studies such as the Nurses' Health Study, have observed that a healthy diet, rich in fruits and vegetables, is associated with a lower risk of eye diseases such as cataracts, AMD and glaucoma (Kang et al., 2016). However, intervention studies display discordant results (Evans and Lawrenson, 2017). There is a review that summarises the findings on the dietary determinants of diabetic retinopathy (Dow et al., 2018) and another on diet quality and the risk of cataracts (Wu et al., 2014), which indicate a lack of scientific evidence in this area. It is also worth mentioning a recent review conducted by Valero-Vello et al. (2021) which evaluates the works published on the benefits of different foods and their components for eye health, as well as against risk factors related to visual disability. In Spain, data from the study Prevention with a Mediterranean Diet (PREDIMED), which was conducted on elderly people with cardiovascular risk factors, revealed that individuals with Type 2 diabetes who maintained a habitual intake of 500 mg/day of omega-3 long-chain polyunsaturated fatty acids, ingested in two portions of oily fish per week for 6 years, had a lower risk of developing diabetic retinopathy than those who did not follow this recommendation (Salas-Salvadó et al., 2015). In this same study, it was also published that the consumption of low-fat yoghurt was associated with a lower risk of cataracts (Camacho-Barcia et al., 2019). Within Europe, a relevant initiative in this area is the EYE-RISK Consortium study that seeks to identify lifestyles, including diet, and biological factors associated with AMD, using information from different countries (EYE-RISK Consortium, 2021).

On the other hand, visual disability affects the nutritional status of persons. A 2018 review (Jones and Bartlett, 2018) demonstrated that persons with visual disabilities are more prone to obesity and malnutrition. Additionally, these persons also displayed limitations in many areas related to diet. This evidence is based mainly on qualitative studies and some cross-sectional population studies, with a reduced sample size. Given the significant impact of visual disability on quality of life, it seems necessary to have a better knowledge of the existing evidence regarding nutritional status, regularly consumed foods, and the dietary behaviour of people with visual disabilities. The end goal is to prevent health problems caused by an insufficient diet in this section of the population. For all the reasons stated above, the Scientific Committee of the Spanish Agency for Food Safety and Nutrition (AESAN) has been requested to conduct an assessment of the published research on the impact of

visual disability on food habits and nutritional status, and to specifically examine the current evidence for the Spanish population.

2. Visual disability and nutritional status

The nutritional status of a person is the result of the balance between the nutrition that they receive and their nutritional requirements. In order to assess nutritional status, it is necessary to know the habitual energy and nutrient intake, the body structure and composition and certain biochemical markers of the intake of specific nutrients. The habitual nutrient intake may be assessed by means of different methods: dietary questionnaires for the prospective logging of intake, 24-hour diet recall, during successive days, or questionnaires on the frequency of consumption. With this information, the intake of specific nutrients may be estimated through food composition tables. Subsequently, the nutritional recommendation tables published by different bodies such as AESAN (2019), or the European Food Safety Authority (EFSA, 2017) provides the reference intake values for a population, which help to ensure a balanced nutritional intake to maintain good health status. It is necessary to take into account that the nutrient intake recommendations refer to a healthy population with a varied diet.

The Body Mass Index (BMI) is one of the most frequently used parameters to define levels of risk of disease and mortality associated with increased or decreased body weight in relation to height. The categories of underweight (BMI <18.5 kg/m^2), normal weight (BMI≥ 18.5 to 24.9 kg/m^2), overweight (BMI≥ 25.0 to 29.9 kg/m^2) and obesity (BMI≥ 30 kg/m^2) are universally recognised (Expert Panel on the Identification, Evaluation, and Treatment of Overweight in Adults, 1998). The waist circumference measurement is a parameter used to estimate visceral fat, which helps to identify abdominal obesity, associated with a higher metabolic risk. The cut-off points widely accepted in Western countries to define abdominal obesity are >102 cm for men, and >88 cm for women (Alberti et al., 2006). The criteria of overweight and obesity are modified for children and adolescents, according to age and sex (Cole et al., 2000, 2007) (Cook et al., 2003) (WHO, 2021b). Other anthropometric parameters such as the circumferences of the upper and lower extremities, or body composition techniques, help to complete the clinical evaluation of these patients (Piqueras et al., 2021).

The diagnosis of malnutrition is based on two types of criteria: etiological (reduced intake, poor digestion or malabsorption or the presence of a disease or inflammatory situation that increases nutritional requirements) and phenotypical (weight loss, reduced BMI, or reduced muscle mass) (Cederholm et al., 2019). Apart from clinical history, physical examination and classical anthropometry, nutritional assessment also includes the study of body composition, by means of techniques such as bioimpedanciometry or bone densitometry or DXA, and functionality, with grip force and specific questionnaires. These tools help to quickly identify patients in situations that compromise their nutritional status and who therefore require an effective intervention (Pérez et al., 2015).

Knowing whether a person with visual disability has a proper nutritional status is important for the prevention of health problems related to obesity and malnutrition. A 2018 review summarised all the studies published until that date in this area of research (Jones and Bartlett, 2018). The authors found 14 works published between 1999 and 2017 in the PubMed, Web of Science, Science Direct and Wilson databases. The studied populations belonged to 11 different countries, with ages ranging

from children to elderly persons. The sample sizes were also highly varied, although generally they were very small (only 6 studies had more than 100 participants) and they were limited to specific geographical areas or very specific population groups (for example, enrolled in a school) and therefore were in no way representative of the population under study. There was no homogenous definition of visual disability, with studies that included persons with complete vision loss contrasting with studies that included different levels of disability. Finally, some of these studies used a quantitative methodology and others used a qualitative methodology. Apart from this review, other additional studies on visual disability and nutrition have been identified. All of these works have been summarised below and in Table 1.

2.1 Disability, nutritional intake and malnutrition

A pioneering study in this area, conducted with 25 legally blind participants of various ages, examined the habitual consumption of the main food groups by this population. It showed that the intake of some groups, specifically dairy products, was very low compared to the general population (Roebothan, 1999).

One of the most comprehensive works published is the one conducted on the Spanish population, with children between the ages of 8 and 18 with visual disabilities, all students at the Educational Resources Centres of the ONCE and the School of Physiotherapy of the Autonomous University of Madrid-ONCE (Montero, 2005). The nutritional intake of this population was quantified by means of a 24-hour recall questionnaire, on 3 different days of the week, and their adherence to the Mediterranean Diet was estimated using a specific index for children (the KIDMED index) (Serra-Majem et al., 2004). The results showed that these children had a high energy consumption (2605 ± 763 kcal/day in boys and 2160 ± 667 kcal/day in girls), of which a high percentage were from fats and a low percentage from carbohydrates, compared to the nutritional recommendations on current macronutrient intake (Montero, 2005). Adherence to the Mediterranean Diet was also found to be low: only 11.9 % of the participants reported an optimal adherence, in comparison with the results obtained in the enKid study, on a population of children without visual disabilities, where 49.4 % of the children displayed an optimal adherence (Serra-Majem et al, 2003). In his work, Montero (2005) suggested that this poorly balanced diet was due to a low consumption of fruits and vegetables and a high consumption of industrial foods, but he did not observe it to be a pattern associated with severe visual disability as the results were similar in children with various levels of disability. Montero (2005) also stated that the socio-economic level of these families could have an impact on the variables studied. This work is the only one in Spain to have quantified habitual nutritional intake in persons with visual disabilities.

A subsequent study, conducted on elderly persons with severe visual limitations (Muurinen et al., 2014) showed that women with this disability were classified as more malnourished than other women of the same age, in accordance with the screening questionnaire Mini Nutritional Assessment. Another work with nutritional information on a group of adults with AMD reported that this population displayed a low intake of antioxidants, specifically lutein and zeaxanthin, fibre, calcium, Vitamin D and E, and total energy in their daily diet (Stevens et al., 2015).

In Colombia, a study conducted in 2017 examined the nutritional status of schoolchildren with

visual disabilities and compared the results to those of children with hearing disabilities (Osorio et al., 2017). They measured the habitual diet with questionnaires on food consumption frequency, and conducted anthropometric measurements and a survey of food habits. They observed that the consumption of different food groups was similar between both groups of children but the percentages of malnutrition, measured by weight/age ratio, and stunted growth, measured by height/age ratio, were higher in children with visual disabilities than in the children with hearing disabilities. The authors hypothesised that children with visual disabilities had difficulty feeding themselves and they needed more time and help. When these were not available, problems of malnutrition may be detected, as observed in this study.

The most recent work was published in 2020. It consisted of a case-control study in the United Kingdom which examined the habitual nutritional intake of elderly persons with visual disabilities, measured with a 24-hour diet recall questionnaire, 3 days a week, and some dietary habits (food preparation, knowledge and attitudes regarding nutrition). It found that persons with visual disabilities had insufficient intakes of energy, total fats, proteins, salt, calcium, cholesterol and vitamin C, when compared to the nutritional recommendations for their age, and lower than the consumption observed in the control group. Other nutrients such as vitamin D, fibre or sugars, were similar to those of the control group (Jones and Bartlett, 2020).

Together, these works suggest that visual disability can have a detrimental impact on nutritional status.

2.2 Disability and obesity

In most of the works studied, visual disability has been associated with overweight and obesity, both in young adults (Roebothan, 1999) and in children (Montero, 2005) (Açıl and Ayaz, 2015) (Wrzesinska et al., 2016) (Osorio et al., 2017). Only one study, on adults of a very advanced age, found a link between visual disability and low BMI (Muurinen et al., 2014).

In the study by Montero, the prevalence of overweight was 26 % and obesity was 12 %, for both sexes, in the children examined. These percentages exceeded the values observed in populations of children without visual disabilities, in Spain and in other countries (Montero, 2005). The author suggests that the high prevalence of overweight and obesity may indicate a lack of physical activity in this group, as well as insufficient knowledge of basic concepts regarding nutrition and health. In the study also conducted by Açıl and Ayaz (2015), on children, 25.7 % of the sample were overweight or obese. Besides, 35.1 % of them had dental problems, which may indicate an insufficient diet, rich in fermentable carbohydrates (González et al., 2013).

A published work with data on a group of Polish children with visual disabilities found a prevalence of 21.3 % of overweight and 14.9 % of obesity; the prevalence of abdominal obesity was 27 % without differences between boys and girls (Wrzesinska et al., 2016). Finally, in the study conducted on children in Colombia, the joint prevalence of overweight and obesity was 37.1 % (Osorio et al., 2017). Together, these results display an insufficient energy balance in children with visual disabilities. There is no information on physical activity performed by children with visual disabilities, which may largely explain the link between disability and obesity.

Table 1. Summary of publications that have examined the links between visual disability and nutritional status

Reference/Country	Participants	Methods	Results
Roebothan (1999) Canada	25 legally blind persons. Age: 21-80 years	Cross-sectional study	Reduced intake of dairy products, cereals and meat, compared to the recommendations of food guides High prevalence of obesity
Montero (2005) Spain	229 children with different levels of visual disability	Cross-sectional study	High intake of energy and total fats Low adherence to the Mediterranean Diet High prevalence of overweight and obesity
Muurinen et al. (2014) Finland	245 persons with severe visual limitations. Average age: 83 years	Cross-sectional study	High prevalence of malnutrition in accordance with nutritional screening tests Low Body Mass Index (BMI)
Açıl and Ayaz (2015) Turkey	74 children with partial or complete vision loss	Cross-sectional study	High prevalence of overweight and obesity
Stevens et al. (2015) United Kingdom	158 persons with macular degeneration. Age: ≥50 years	Cross-sectional study	Low intake of antioxidants, fibre, calcium, vitamin D and E, and total energy
Wrzesinska et al. (2016) Poland	141 children with partial or complete vision loss	Cross-sectional study	High prevalence of overweight and obesity
Osorio et al. (2017) Colombia	34 children with visual disabilities	Cross-sectional study	High prevalence of malnutrition High prevalence of overweight and obesity
Jones and Bartlett (2020) United Kingdom	96 participants with visual disabilities and 50 controls. Age: ≥50 years	Case-control study	Insufficient intake of energy and other nutrients, in line with nutritional requirements for their age

3. Disability and food habits

Food habits are the set of activities performed with regard to the process of food intake. They range from ways of purchasing and preparing foods, to when and how they are consumed. Healthy food habits let us maintain an optimal nutritional status (CDC, 2021).

A person with visual disability has to learn certain techniques in order to perform even the simplest tasks related to cooking. Eating requires skills related to shopping, handling money, arranging the foods and being able to locate them, in addition to preparing and cooking the foods. Special utensils are required in order to place the ingredients, measure them, use electrical appliances, cut, serve and ingest the food. A sequential analysis of all these tasks reveals the fact that these are all predominantly visual skills. These skills must be explained and demonstrated in a manner that is adjusted

to persons with visual disabilities. On the other hand, it is well known that lack of time is one of the factors that is perceived as an obstacle to a healthy diet in the general population; persons with visual disabilities require additional time and effort, which makes it even more difficult to achieve the goal of a healthy diet.

Different works have examined the food habits of persons with visual disabilities, with different experimental designs, and in population groups of different ages. They are summarised in Table 2, and explained in this section.

In 1999, researchers in Japan examined the capacity of 37 elderly persons with visual disabilities to perform complex activities in daily living, compared to a group of persons of the same age. They observed that participants with visual disability had a high prevalence of limitations in performing daily activities related to shopping for food (Nakamura et al., 1999). These results were also observed in other elderly populations (Gopinath et al., 2014) (Pardhan et al., 2015).

Other works have taken a qualitative approach, by means of personal interviews, in order to understand the impact of visual disability in food habits. Baker (2006) explained that, for a satisfactory shopping experience, the participants with visual disabilities in her study required stores to have suitable access technology, specific tools so they could make purchases independently, and feel that their condition was normalised. Bilyk et al. (2009) interviewed 9 persons with visual disabilities and found that participants reported the existence of numerous obstacles to daily shopping, food preparation and eating out. De Faria et al. (2012) reported that, in accordance with the preferences of a group of persons with severe disability, an ideal restaurant would be one that offered the possibility of having the menu read out by an employee, a low level of light and ambient noise, and round tables, facilitating interaction with the other diners. In another study on the American population, different interviews were conducted with the carers of children born with optic nerve hypoplasia, over a period of 3 years. Their conclusions indicated that providing support to these carers would enable the children to be more independent at the time of eating, with less eating difficulties as they grew older, and adopting healthier food habits (Smyth et al., 2014). Similar conclusions were reached in communities in developing countries (Gladston et al., 2017).

In Spain, Martin-Almena et al. (2016) examined the risk of eating disorders in a sample of Spanish sportspersons with high levels of disability. 60 participants with physical or visual disabilities reported their food habits through the survey Eating Attitudes Test-26. They found a low prevalence of the risk of eating disorders, although participants with visual disabilities had lower scores in the survey compared to athletes with other disabilities.

The most recent studies have included bigger sample sizes and they are all quantitative in nature. Kostyra et al. (2017) studied a sample of 250 participants to distinguish the factors that dictate the choice of foods by persons with different levels of visual disability, and the obstacles they encounter when performing food-related activities. They found that their shopping decisions were conditioned by the possibility of receiving assistance from salespersons, product labelling in Braille, scanners that enable the reading of labels, and a permanent place for products on the shop shelves. They also reported difficulties in peeling, slicing and frying foods. More than half of the participants ate outside their homes and they agreed that the existence of menus in Braille and the specific assistance of the

establishment's staff were necessary for an optimal experience.

Jones and Bartlett et al. (2020), in their aforementioned study, observed that persons with visual disabilities who lived with family members had a higher energy intake than those who lived alone. Those who stated that they received assistance in cooking had a greater intake of carbohydrates and total fats. The researchers calculated that 50 % of the participants with disability could not cook independently and only 29 % went shopping alone. Additionally, only 59 % were satisfied with their current health status, and only 30 % were able to name the five food groups required for a balanced diet, in accordance with current food guides. They also stated that their food choices were not related to scientific knowledge of what constitutes a healthy diet.

To sum up, visual disability has been linked to difficulties in shopping and preparing foods. It is also linked to difficulties in eating in restaurants. An additional difficulty for elderly people is handling tableware. In the case of children, the need to train parents has been described. Some works have identified a lack of knowledge regarding what constitutes an optimal diet. Finally, it has been demonstrated that certain interventions are able to improve the food habits of persons with disabilities.

Table 2. Summary of publications that have examined the links between disability and food habits

Reference/ Country	Participants	Methods	Results
Nakamura et al. (1999) Japan	37 persons with visual disabilities. Age: 64-95 years	Case-control study	High prevalence of difficulty in shopping
Baker (2006) United States	21 persons with different levels of visual disability. Age: 20-80 years	Qualitative study	A situation of "normalcy for the disabled customer" is defined as one that consists of being able to access the marketplace, being able to make purchases, and being perceived as an equal
Bilyk et al. (2009) Canada	9 persons with severe visual disability. Age: 30-50 years	Qualitative study	There are obstacles to shopping, food preparation and eating in restaurants
De Faria et al. (2012) Brazil	224 participants with severe visual disability	Qualitative study	A suitable restaurant would include menus read out by the serving staff, low-intensity light and sound, round tables, and the possibility of asking for help
Smyth et al. (2014) United States	30 children with optic nerve hypoplasia	Qualitative study	Supporting carers helps to increase children's independence when eating
Gopinath et al. (2014) Australia	761 persons with central vision loss. Age: ≥60 years	Cross-sectional study	High prevalence of difficulty in shopping and food preparation
Pardhan et al. (2015) United Kingdom	14 persons with central vision loss. Age: ≥75 years	Cross-sectional study	Lower ability to perform essential activities related to diet: filling a glass of water, using a fork

Table 2. Summary of publications that have examined the links between disability and food habits

Reference/ Country	Participants	Methods	Results
Martin-Almena et al. (2016) Spain	90 participants with physical and visual disability. Average age: 23 years	Cross-sectional study	Greater risk of eating disorders, in comparison with physical disability
Kostyra et al. (2017) Poland	250 persons with severe visual disability. Age: ≥16 years	Cross-sectional study	High prevalence of difficulty in shopping; peeling, slicing and frying foods; eating in restaurants
Gladstone et al. (2017) Malawi	42 parents of children with low and severe visual disabilities	Qualitative study	Need to support parents in order to enable the children's correct diet
Jones and Bartlett (2020) United Kingdom	96 participants with visual disabilities and 50 controls. Age: ≥50 years	Case-control study	50 % of the participants with disabilities could not cook independently; only 29% went shopping alone. Participants with disability made food choices without being aware of their nutritional value

4. Initiatives for improved diet in persons with visual disabilities

There are different non-governmental institutions in many countries that work to help people with visual disabilities. These institutions are part of the World Blind Union (WBU) which represents 253 million persons in 190 countries. The WBU is a member of the International Disability Alliance with which it shares the values and principles to promote the rights of persons with disabilities (WBU, 2021). Some of the institutions that focus on visual disability are ONCE in Spain, the Royal National Institute of Blind People (RNIB) in the United Kingdom and the American Foundation for the Blind (AFB) in the United States.

The following section lists the initiatives conducted by some of these organisations to mitigate the adverse effects of visual disability on diet.

4.1 Initiatives proposed by the ONCE and other Spanish entities

The ONCE offers its members different alternatives to promote the adoption of good food habits (Ortiz et al., 2011).

4.1.1 Rehabilitation programmes

The goal of this rehabilitation is to achieve personal autonomy in performing daily living activities. It benefits children and adolescents with congenital vision problems, as well as adults of all ages, who receive aid when they are first affected by visual disability or later, when they have new autonomy requirements.

These programmes are customised and designed according to the needs, abilities and interests of each person, and the specific aspects that deal with diet, are:

- Learning techniques to safely travel to shopping establishments.
- Using online shopping systems.

- Social skills to request cooperation during purchases.
- Handling money and different payment systems.
- Organisation and storage of foods, tableware, kitchen utensils.
- Strategies to minimise risks and hazards (burning, hitting, cutting, slipping).
- Using the cooking range: switching it on, placing the utensil correctly.
- Training in techniques for washing, peeling, slicing, as well as cooking techniques (boiling, dusting with flour, frying, basting).
- Measuring techniques.
- Adapting electrical appliances and labelling in order to locate products.
- Recommending facilitating materials.
- Advice on adapting workstations (ergonomics, lighting and contrast).
- Eating techniques, with reference to different elements (slicing a fillet, peeling fruit).

4.1.2 Electrical appliances and materials

Currently, electrical appliances and other utensils do not fulfil the conditions of universal usability. In fact, the use of digital control panels that only provide visual information is becoming increasingly more frequent, rendering them unusable for people with significant problems of vision.

Taking this into account, the ONCE:

- Conducts assessments of the accessibility and useability of electrical appliance prototypes.
- Communicates to manufacturers the requirements of persons with visual disabilities, making them aware of the importance of including all measures for accessibility in the initial blueprints.
- Creating templates by means of 3D printing or other methods, which are tailored to each user's electrical appliance, so they may use most of its functions.
- Exploring specific innovations in utensils available in the market: talking scales, adapted measuring cups, timers.
- It sells these specific materials through its exhibition-stores.
- Provides advisory services regarding the most suitable utensils.

4.1.3 Braille Labelling

The Spanish Braille Committee (CBE), a body affiliated to the ONCE and which is the highest authority in Spain on setting standards of use and development of the Braille system, as well as symbols in relief and colour, published its technical document B 13: Braille labelling of consumer products, in order to provide information to brands and companies that seek to label its products in Braille (Comisión Braille Española, 2021). Likewise, the CBE provides consultancy services on all aspects of including information in Braille in product packaging: readability, most efficient modes of printing, amount of information to be included and its placement, etc.

4.1.4 Actions for innovation, campaigns, workshops and informative talks

ONCE centres periodically conduct:

- Actions for innovation: group activities that seek to reinforce skills, provide information on useful

resources and incentivise habits, through collaboration and exchange. Within the field of diet, they undertake several actions related to food preparation, new electrical appliances (kitchen robots, air fryers, etc.), food storage techniques, etc.

- Campaigns: cooking campaigns aimed at adolescents and young adults, in order to promote independent food preparation.
- Workshops: monographic workshops that provide training on diet and cooking are conducted on a frequent basis.
- Informative talks: some of them are on the importance of nutrition and food habits.

4.1.5 ClubONCE

ClubONCE is a web portal for ONCE members containing a section titled "For lovers of cooking" where they can share tips, useful tools, anecdotes as well as recipes, which can also be uploaded as sound files.

This channel also periodically publishes an updated list of mobile apps that provide cooking and shopping assistance for accessible mobile phones.

4.1.6 NaviLens App

NaviLens is an application developed by a company from Murcia in collaboration with the University of Alicante, which provides colour codes similar to a QR code, so that persons with complete or partial vision loss may move independently in unknown environments. This technology has been implemented in the public transport networks in the cities of Murcia, Barcelona, Madrid and New York, and they are increasingly present in public buildings.

NaviLens enables smartphones to read codes from a distance of up to 3 metres and it has great potential to improve accessibility in different areas. In the area of food, NaviLens has been implemented in foods from the Kellogg's brand; shoppers can select what is read aloud from the information on ingredients, allergens and recycling.

4.2 Initiatives proposed by the Royal National Institute for the Blind (RNIB)

4.2.1 Information on food preparation and cooking

On its website, the RNIB offers useful information for persons with visual disabilities on how to safely prepare and cook foods (RNIB, 2021).

4.2.2 Food Shop: a shopping service with support for persons with vision loss

This initiative was implemented during the coronavirus epidemic in collaboration with a food distributor in the United Kingdom. It provides a telephone hotline that connects the person with disability to a member of the customer care service, who guides them through the process of placing their order, making the payment and arranging the delivery, which is made by people who are trained in the specific steps of delivering to this collective.

4.2.3 Design for all

The RNIB has recently launched a campaign called "Design for all" in order to illustrate the impact that inaccessible packaging continues to have on people with vision loss. The activities conducted include the opening of a store (WhatsIn Store) in London, with products in blank packaging with illegible information, in order to bring people with vision closer to the experience of persons with visual disabilities when faced with inaccessible packaging.

4.3 Initiatives proposed by the American Foundation for the Blind (AFB)

Since 1921, the AFB has been at the forefront of efforts to create a more inclusive world for persons with complete vision loss or low vision. The AFB has a website with a significant amount of information on projects and initiatives aimed at improving the quality of life for people with visual disabilities (AFB, 2021).

4.3.1 COVID-19 initiatives

Its goal was to understand how blind or partially sighted individuals were affected since the beginning of the pandemic and to establish recommendations and provide aid to reduce inaccessibility to food and another essential goods. The study was conducted on 1921 participants. They found that 51 % of the participants answered that they were worried about accessing these resources. They also identified the main channels of provisioning, which consisted of: shopping with assistance, placing orders online with large supermarkets that provide home delivery, and using the home delivery services of local establishments. To facilitate the latter two options, recommendations were drafted for supermarkets, pharmacies and other essential goods stores, to provide better attention to persons with visual disabilities.

4.3.2 General initiatives related to diet and the nutritional status of persons with visual disabilities

The website lists other recommendations and initiatives that take into account the diversity of age as well as health status, in addition to socio-economic conditioning factors within the collective of persons with visual disabilities. Generally, each section of recommendations has a printed document and an audio version, and in some of them, apps by which to put into practice some of these recommendations. Below are a few examples:

- Recommendations for people with diabetes:
  - Healthy Eating: The Basics (print document).
  - Audio: https://static.afb.org/legacy/media/ss_audio/diabetes/living_with_diabetes_vi/05_diabetes_vi_healthy_eating.mp3?_ga=2.145356340.1819593493.1627546075-1077147803.1627546075
- Recommendations for weight control:
  - The Accessibility of the Weight Watchers Website and iOS and watchOS Apps (print document).
  - My Fitness Pal: A Guide to an Accessible Fitness Tool (App). Provides links to the calorie content of foods and dishes served in different restaurant chains.
  - The Hunger Pains: A Review of the DoorDash, Grubhub, Postmates, and Uber Eats Food Delivery Apps (App). Advice on how to prepare quick and healthy meals at home.

4.4 Other initiatives

4.4.1 Model of attention to food habits based on strategies of emotional intelligence, aimed at children with visual disabilities at early ages, in Ecuador

Researchers at the Salesian Polytechnic University in Cuenca, Ecuador, have proposed this model with the goal of helping parents to train children with visual disabilities to adopt correct food habits (Bernal et al., 2011). This model emphasises the objects that are part of the daily eating ritual. These objects are presented with textures, smells, sounds, contrasting colours which help children with visual disabilities to associate foods, tastes and smells with other sensory stimuli. Finally, it presents techniques to teach them how to use kitchenware.

Conclusions of the Scientific Committee

In short, there is still very little scientific literature on visual disability, nutritional status and dietary behaviours, and those studies that have been conducted, possess the following characteristics:

1. The reviewed studies have been conducted on highly varied sample sizes, although they are generally small and limited to specific geographical areas or very specific population groups, and therefore none have been representative of the population under study. Very different approaches have been used, mainly employing transversal quantitative designs, qualitative designs and, more recently, case-control studies.
2. No homogenous definition of visual disability has been used across the studies, therefore the results may not be applicable to the different degrees of visual disability.
3. There is no objective evidence of the role of physical activity as a mediator in the association between visual disability and obesity.
4. There is less scientific proof for the Spanish population than there is for populations in other nations, without any comparative study based on age or geographical areas.

The reviewed scientific evidence suggests that:

1. The habitual diet reported by persons with visual disabilities does not fit the parameters generally considered healthy, as stated in current food guides.
2. People with visual disabilities display a greater risk of obesity and/or malnutrition than people without visual disabilities.
3. People with visual disabilities have significant difficulties in performing the activities required to follow a suitable diet. In an attempt to mitigate this problem, non-governmental organisations that aid persons with severe visual disability or vision loss such as Spanish National Organisation for the Blind (ONCE), have developed support programmes that cover all aspects related to diet: rehabilitation programmes to provide training in culinary techniques, adapting household appliances and kitchen utensils, teaching activities, as well as promoting the formation of member groups in order to share solutions.

The Scientific Committee proposes the following activities:

1. To promote, in collaboration with organisations that represent people with visual disabilities,

studies that conduct a detailed exploration of the nutritional status of persons with slight and severe visual disability, and loss of vision, by means of nutritional surveys specially tailored to this collective, and the assessment of the diagnostic criteria of malnutrition. This information will enable the detection and correct assessment of possible nutritional deficiencies, not only for each level of visual disability, but also for every age, gender and health condition.

2. To support scientific research on the identification of obstacles faced by people with visual disabilities in Spain that prevent them from leading a healthy lifestyle. This information will enable public policy-making that promotes the best possible health status of this population.
3. To promote the development of digital tools that provide information on the nutritional content of foods, intended for use by people with visual disabilities. This initiative is line with the European Commission's "From farm to fork" proposal (EC, 2020).
4. To support measures for rehabilitation, training, innovation and other actions introduced by non-governmental associations, such as the ONCE, which have been shown to improve the ability of persons with visual disabilities to consume a healthy diet. Some of these measures may also benefit the collective of persons with moderate vision loss, who do not have access to ONCE programmes.

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