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Review article

Accessible mobile applications for people with visual impairment: a systematic review of food-focused assistive technologies

Aplicativos móveis acessíveis para pessoas com deficiência visual: uma revisão sistemática de tecnologias assistivas com foco em alimentação

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Abstract: This article presents a systematic literature review of accessible food-related mobile applications for people with visual impairment. The study aimed to map assistive technologies that contribute to food autonomy, including features such as food recognition, label reading, access to nutritional information, and meal preparation. The review identified 14 relevant studies. The applications analyzed include Seeing AI, Google Lookout, Be My Eyes, TapTapSee, and NutriVoice, among others. The results indicate advances in the use of artificial intelligence and computer vision, but also highlight challenges related to accessibility, usability, accuracy in real-world settings, and the lack of testing with blind users. It is concluded that there are significant gaps between technological potential and its practical application in accessible contexts, making it urgent to develop solutions guided by universal design and co-creation with people with visual impairment.
Keywords: visual impairment. assistive technology. mobile applications. food. digital accessibility.

Resumo*:* Este artigo apresenta uma revisão sistemática da literatura sobre aplicativos móveis acessíveis voltados à alimentação para pessoas com deficiência visual. A pesquisa teve como objetivo mapear tecnologias assistivas que contribuem para a autonomia alimentar, incluindo funcionalidades como reconhecimento de alimentos, leitura de rótulos, acesso a informações nutricionais e preparo de refeições. A revisão foi conduzida identificando 14 estudos relevantes. Os aplicativos analisados incluem Seeing AI, Google Lookout, Be My Eyes, TapTapSee, NutriVoice, entre outros. Os resultados indicam avanços no uso de inteligência artificial e visão computacional, mas também destacam desafios relacionados à acessibilidade, usabilidade, precisão em ambientes reais e ausência de testes com usuários cegos. Conclui-se que há lacunas significativas entre o potencial tecnológico e sua aplicação prática em contextos acessíveis, sendo urgente o desenvolvimento de soluções orientadas por design universal e co-criação com pessoas com deficiência visual.
Palavras-chave*:* deficiência visual. tecnologia assistiva. aplicativos móveis. alimentação. acessibilidade digital.

1. Introduction

Eating is one of the most basic and essential activities of human life, serving not only as a means of subsistence but also as a central element in the promotion of health, quality of life, and personal autonomy. For people with visual impairment, however, the eating process can present significant obstacles at every stage — from selecting food in supermarkets to preparing meals and making informed consumption choices based on nutritional information. Although often overlooked, these difficulties directly affect the food security, independence, and social inclusion of these individuals (BRADY et al., 2013; WHO, 2019).

According to the World Health Organization (WHO, 2021), more than 2.2 billion people worldwide live with some degree of visual impairment, and a large proportion of these conditions could have been prevented or treated. In Brazil, according to data from the Brazilian Institute of Geography and Statistics (IBGE, 2022), more than 6.5 million people have some form of visual impairment, including total blindness and low vision. This group faces multiple barriers in daily life, especially in poorly adapted environments with limited accessibility resources. In the food domain, these barriers include difficulty recognizing foods by their visual appearance, reading labels and expiration dates, identifying potentially hazardous ingredients (such as allergens), and preparing food safely (PEREIRA et al., 2021).

Food autonomy, defined as a person's ability to choose, prepare, and consume their own food safely and independently, is a fundamental right that is not yet fully guaranteed to people with visual impairment. In the absence of adequate technological support, these individuals often depend on others to carry out simple everyday food-related tasks, which compromises not only their independence but also their privacy, self-esteem, and dignity (CUNHA; PEREIRA; GIMENES, 2021). It is in this context that the importance of food-focused assistive technologies stands out.

Assistive technology refers to devices, services, and systems intended to promote functionality, independence, and quality of life for people with disabilities or reduced mobility (BRASIL, 2015). With advances in mobile computing, artificial intelligence (AI), and computer vision, new possibilities have emerged for the development of applications that expand digital accessibility. Mobile applications with features such as label reading through OCR (Optical Character Recognition), AI-based image description, food item identification, barcode scanning, and integration with nutritional databases have begun to provide direct support to blind and low-vision people, enabling them to recognize products, assess whether food is fit for consumption, and make safer and more informed choices (ZHOU et al., 2022; MANSOURI et al., 2023). In recent years, several studies have explored the use of AI for food recognition, estimation of nutritional values, and analysis of visual characteristics such as color, texture, and shape — aspects that are fundamental for assessing the quality and state of preservation of food (MIN et al., 2019; XIE et al., 2021). However, most of these solutions are still aimed at the general public, focusing on diet control, calorie counting, or support for athletes. The inclusion of people with visual impairment as a target audience is still incipient, and few studies specifically address the accessibility requirements involved in using these applications (KACORRI et al., 2017).

From a technical standpoint, the use of computer vision for real-time food identification, combined with voice interfaces and auditory feedback, represents a promising strategy to overcome the limitations imposed by visual impairment in the food context. Applications such as Seeing AI (Microsoft), Lookout (Google), and Be My Eyes have demonstrated how technology can be successfully applied to describe the environment, identify objects, and read visual information for blind people. Nevertheless, most of these applications still have limitations when it comes to specific food recognition, sensory description (appearance, freshness), or access to personalized nutritional information (CIACCA et al.,

2018; KEBBAILI et al., 2021). From a social perspective, the development of accessible food-related mobile applications for people with visual impairment is not only a matter of technological innovation, but also of social justice and equity. Promoting autonomous and safe access to food is an essential step toward guaranteeing human rights, dignity, and full participation in society. Moreover, such initiatives are directly aligned with the United Nations Sustainable Development Goals (SDG 2 and SDG 10), which seek to end hunger and reduce inequalities, including digital inequality (ONU, 2015). In this scenario, there is an urgent need for studies that systematize the available knowledge on mobile applications focused on food accessibility for people with visual impairment. It is necessary to understand which technologies are being used, which features are being prioritized, how these applications are evaluated by users, and which gaps still need to be addressed for accessibility in this field to advance effectively.

Against this background, the present article aims to conduct a systematic literature review of accessible mobile applications developed for people with visual impairment, focusing on food-related activities such as food identification, meal preparation, and access to nutritional information. By mapping and critically analyzing these assistive technologies, it seeks to provide input for the improvement of existing solutions, encourage the development of new inclusive approaches, and contribute to promoting food autonomy among people with visual impairment.

2. Materials and Methods

This systematic review was conducted with the aim of ensuring transparency, methodological rigor, and reproducibility of results (PAGE et al., 2021). The research focused on identifying, analyzing, and systematizing studies addressing accessible food-related mobile applications for people with visual impairment, including the stages of food identification, meal preparation, and access to nutritional information.

The literature search was carried out in the following electronic databases: PubMed; Scopus; Web of Science; IEEE Xplore; ScienceDirect; SciELO; and LILACS (to cover Latin American scientific output). The inclusion criteria were: studies describing or evaluating accessible food-focused mobile applications for people with visual impairment; empirical articles (quantitative, qualitative, or mixed methods), case studies, and systematic or scoping reviews; applications with features such as food recognition, reading of nutritional information, support for meal preparation, or audio-based sensory description; publications in Portuguese, English, or Spanish; and publications between 2013 and 2025.

The following data were extracted from the included studies: application name; type of technology employed (AI, OCR, TTS, etc.); target population (blind people, people with low vision, etc.); features offered; accessibility and usability assessment; and main results and reported limitations. Data analysis was descriptive and categorical, grouping studies by type of feature (food identification, preparation, nutrition) and type of technological approach (visual recognition, audio, database integration, etc.). When available, data on effectiveness, user satisfaction, number of downloads, and app store ratings were recorded. The methodological quality of the empirical studies was assessed using checklists appropriate to each study type: qualitative studies, Joanna Briggs Institute (JBI) Critical Appraisal Checklist; quantitative studies, STROBE Statement; included systematic reviews, AMSTAR 2.

3. Results and Discussion

After screening 76 studies, 14 were selected according to the inclusion criteria. The applications most frequently cited and analyzed in the reviewed studies include:

Table 1 – Food recognition applications and their description

Be My Eyes / Be My AI	Connects blind users with volunteers via video call or uses AI (GPT-4) to describe environments and objects. The AI version has shown potential to expand visual autonomy in everyday tasks, although it does not yet have specific food-related features (Be My Eyes, 2024; Kacorri et al., 2017).
Seeing AI (Microsoft)	Recognizes objects, people, text, banknotes, and labels using artificial intelligence, with a focus on visual accessibility. Includes barcode reading and identification of packaged foods (Ciocca et al., 2018; Microsoft, 2023).
Google Lookout	Enables identification of text, products, and packaged foods through the smartphone camera, using on-device AI. Its "Food Label" feature recognizes food products by brand and type (Google, 2023).
TapTapSee	App that describes any photographed object by voice. Widely used by blind people to recognize packaging and products, although it does not provide nutritional data (Supersense, 2022).
Supersense and Envision AI	Focused on text reading, scene description, and label scanning, with support for multiple languages and features optimized for screen readers (Cunha, Pereira & Gimenes, 2021).
Portions Master	Application aimed at food recognition, providing nutritional estimates and portion information, including macronutrients and calories. Although designed for dietary control, it has been identified in some studies as promising for people with visual impairment, provided accessibility adjustments are made (Mansouri et al., 2023).
NutriVoice (prototype)	Voice assistant with on-device AI capable of identifying foods, estimating calories, and describing nutritional content with auditory feedback. Designed for blind people, the system was positively evaluated in terms of usability and accessibility (DevPost, 2023).
goFOOD	Nutritional composition estimation system based on 3D photos, which automatically compares results against databases such as the USDA. It showed high accuracy when compared with human dietitians (Rhyner et al., 2016; Eichelberger et al., 2023).

FoodTracker (YOLOv4):	Uses convolutional neural networks to recognize foods and estimate nutritional information. Evaluations show satisfactory performance in controlled environments (Zhou et al., 2022; Min et al., 2019).

Source: the authors (2025).

Regarding the features analyzed, Table 2 presents the main specificities.

Table 2 – Features of the applications

Application/System	Food recognition	Label reading	Nutritional information	Auditory feedback	On-device AI
Be My Eyes / AI	Volunteer/general AI	Yes	Partial	Yes	GPT-4 (cloud)
Seeing AI	Objects/packaging	Yes	No	Yes	On-device AI
Google Lookout	Packaged products	Yes	No	Yes	On-device AI
TapTapSee	Various objects	No	No	Yes	On-device AI
Portions Master	Dishes and ingredients	Yes	Yes	Yes	On-device AI
NutriVoice (prototype)	Computer vision	Yes	Yes	Yes	On-device AI
goFOOD	Multiple foods	No	(volume + macros)	Partial	On-device AI/cloud
FoodTracker	Multiple foods	No	Estimate	No	On-device AI

Source: the authors (2025).

Studies such as those by Kacorri et al. (2017) and Cunha, Pereira and Gimenes (2021) show that applications with simple interfaces, voice reading, and screen reader support are the most highly rated by blind and low-vision people. Apps such as NutriVoice and Portions Master were cited for providing direct support for food autonomy, with voice description, ingredient reading, and suggestions of safe portion sizes. On the other hand, many applications still face challenges related to setup, language, and visual recognition accuracy in real-world settings.

The solutions found vary widely in their ability to meet the food-related needs of people with visual impairment. Applications such as Seeing AI and Lookout are widely used for text reading and object recognition, but do not provide specific nutritional information (Microsoft, 2023; Google, 2023). In contrast, apps such as Portions Master and NutriVoice are food-oriented and show potential for assistive use, although they still lack validation with real users (Mansouri et al., 2023; DevPost, 2023).

Food autonomy depends on the combination of multiple features: accurate visual identification of foods, label reading, reliable estimates of nutritional composition, and real-time auditory feedback. Only a small number of apps manage to bring these elements together in an accessible way.

Most experimental AI models, such as goFOOD and FoodTracker, achieve high accuracy in food recognition (above 85%), but have not yet been integrated into accessible applications focused on blind users (Eichelberger et al., 2023; Min et al., 2019). Furthermore, the algorithms still have limitations in identifying foods in real-world settings with variable lighting, overlapping objects, or prepared dishes.

Other technological barriers include lack of connectivity for cloud-based apps (such as Be My AI), high battery consumption, and lack of customization for different visual impairment profiles (Kacorri et al., 2017).

As identified by Cunha, Pereira and Gimenes (2021), users with visual impairment often face barriers when using mobile applications, such as unintuitive visual interfaces, unlabeled buttons, and incompatibility with screen readers. Many food-related applications are originally designed for the general public and do not follow the accessibility guidelines established by the WCAG (Web Content Accessibility Guidelines).

In addition, there is a scarcity of empirical evaluations with real users in the food context. Studies on assistive apps focus more on technical performance than on user experience, overlooking issues such as usability, acceptance, reliability, and emotional impact.

The review reveals an important gap between the development of cutting-edge food recognition technologies and their practical application in the field of accessibility. Most existing AI systems neither take into account the experience of blind users nor implement adapted interfaces.

Investment is recommended in applied research that integrates:

- Visual recognition + nutritional database (e.g., TACO, USDA);
- Voice-based interfaces and interactive auditory feedback;
- Testing protocols with users with visual impairment, including longitudinal impact assessment;
- Development guided by universal design and co-creation with people with visual impairment.

4. Conclusion

Based on this review, it can be seen that, although there have been significant advances in the development of mobile applications based on artificial intelligence and computer vision, there is still a marked gap between technological potential and its effective application in food accessibility contexts for people with visual impairment. The solutions identified demonstrate the capacity to expand food autonomy, mainly through label reading, object recognition, and the provision of nutritional information, but they lack greater integration of features as well as validation with real users. It was also found that most available applications prioritize technical aspects over user experience, resulting in usability barriers, lack of customization, and limitations in the auditory reading and interpretation of information.

Therefore, strengthening universal design practices, co-creation with people with visual impairment, and empirical testing of assistive technologies are fundamental strategies for promoting the development of more effective and inclusive solutions. Furthermore, the expansion of public policies and incentives for applied research is essential to ensure equitable access to assistive technology, contributing to the autonomy, dignity, and social inclusion of people with visual impairment.

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