



REVIEW

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Optimal consumption of traditional green leafy vegetables among young children aged 2–6 years in South Africa: a scoping review

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Abstract

Background One major global public health concern is the incidence of micronutrient deficiencies in young children, which significantly impacts populations in Low and Middle-Income Countries (LMICs). Traditional Green Leafy Vegetables (TGLVs) are an essential component of regular diets in many cultures around the world. It has been part of the food system for decades and its consumption has been associated with numerous health benefits and bioactive compounds.

Objective To map the available evidence on the consumption, nutritional benefits, cultural significance, or potential challenges towards the consumption of traditional green leafy vegetables in the diets of young children aged 2–6 years.

Methods A comprehensive search strategy was used to identify relevant literature tailored to PubMed/MEDLINE, Scopus, Web of Science, CAB Abstracts and other sources. The selection criteria were based on the Arksey and O'Malley framework and guided by PRISMA with extension for Scoping Reviews (PRISMA-ScR). The search was mainly focused in South Africa (296 articles). After removing 139 duplicates, a total of 157 research articles were screened. In the data extraction phase, 36 articles were selected.

Results The review revealed that TGLV consumption among young children in South Africa varies considerably by region, socioeconomic status with urban versus rural settings. Sample sizes ranged from 30 to 1530 participants which includes young children, caregivers and household heads.

Conclusion The review findings provide a foundation for developing contextually appropriate, evidence-informed recommendations to optimise TGLV consumption among young South African children, which may provide a long-term solution to ongoing nutritional challenges while preserving cultural food identities.

Keywords Traditional green leafy vegetables, Children, Consumption, Caregivers, South Africa



1 Introduction

One major global public health concern is the incidence of micronutrient deficiencies in young children, which significantly impacts populations in Low and Middle-Income Countries (LMICs) [2]. With the adoption of the 2030 Sustainable Development Goals in 2015, the global community committed to keep collaborating in order to build an ideal future in which every child has the opportunity to reach their full potential [64]. Regardless of improvements over the past ten years, two-thirds of children are at risk for malnutrition because of inadequate nutrition, and one in three children under five suffer from malnutrition globally [52].

Early intervention is crucial to tackle these shortcomings of nutritional burdens and promote well-being and growth. Traditional Green Leafy Vegetables (TGLVs) are an essential component of regular diets in many cultures around the world [65]. It has been part of the food system for decades [49] and its consumption has been associated with numerous health benefits and bioactive compounds [6, 29]. It contributes to the increased consumption of micronutrients like calcium, iron, and vitamin C; contributes to dietary variety and improved health [8].

The South African cuisine has historically utilised TGLVs, which are now marginalised, although potentially an essential source for addressing these nutritional challenges [12, 59]. These vegetables include but are not limited to amaranth (*Amaranthus* spp.), African nightshade (*Solanum retroflexum*) and spider plant (*Cleome gynandra*) [55].

The World Health Organization (WHO) has identified the inadequate consumption of vegetables, particularly nutrient-dense ones such as TGLVs, as a global public health concern [63]. In LMICs, the significant dietary transitions have resulted due to rapid urbanisation, economic transformation, as well as the availability and accessibility of processed foods [13].

In the South African context, these experiences have not been systematically analysed. It is evident that the potential of TGLVs to improve nutritional outcomes has been recognised by previous studies [10, 33, 46]; however, there is a lack of synthesis regarding effective strategies to promote their consumption among young children [56].

Implementing targeted interventions that could improve the nutritional quality of this susceptible group across similar contexts throughout the LMICS requires an understanding of these strategies [51]. This scoping review aims to map the available evidence on the utilisation, nutritional benefits, cultural significance, and potential challenges of traditional green leafy vegetables in the diets of young children aged 2–6 years.

2 Methodology

2.1 Study design

This scoping review was conducted to map and synthesise existing evidence on the optimal consumption of TGLVs among young children aged 2–6 years in South Africa. The review followed the methodological framework proposed by Arksey and O'malley [1], which comprises five key stages: identifying the research question, identifying relevant studies; study selection; charting the data; and collating, summarising and reporting the results. The review process was iterative, allowing improvement of search strategies and eligibility criteria as knowledge with the literature increased.

2.2 Identifying research question

The primary research question guiding the scoping review was: what evidence exists on optimal consumption of TGLVs among children aged 2–6 years in South Africa?

Sub-questions included:

- What types of TGLVs are commonly consumed by young children in South Africa?
- What evidence exists on recommended intake levels, portion sizes, or frequency of consumption of TGLVs for children aged 2–6 years?
- What are the reported nutritional benefits of TGLVs for young children?
- What factors influence the consumption of TGLVs among young children, including caregivers' knowledge, attitudes, and practices?
- What gaps exist in the literature regarding optimal consumption of TGLVs in this population?

These questions were intentionally broad to capture the extent, nature and characteristics of available evidence that consistent with the exploratory purpose of a scoping review.

2.3 Search strategy

A comprehensive search strategy to identify relevant literature with an experienced research librarian was developed. This search strategy was tailored to electronic databases: PubMed/MEDLINE, Scopus, Web of Science and CAB Abstracts. All searches spanned from database inception in 2004 until 2024; additional sources included Google Scholar and different South African universities' repositories theses and dissertations. The search strategy combined keywords and Boolean operators related to three main concepts: population (children: 2–6 years of age); intervention/ exposure (traditional green leafy vegetables, indigenous vegetables) and context (South Africa) as shown in Table 1.

2.4 Selection criteria

The selection criteria are shown in Table 2. The search mainly focused on the mapping existing literature on TGLVs in the field of nutritional sciences, agricultural sciences, environmental sciences, social sciences and multidisciplinary. Reference lists of included studies were manually screened to identify additional relevant publications. The study selection process was documented using a flow diagram to enhance transparency.

2.5 Charting the data

Data from included studies were extracted using a structured data-charting form developed by the researcher. Extracted information included as illustrated in Tables 3 and

Table 1 Search strategy on existing literature about traditional green leafy vegetables

Variant	Context	Population	Phenomenon of interest	Evaluation	Study design
Traditional green leafy vegetables	South Africa	Young children	Availability	Knowledge	Quantitative
Indigenous vegetables	Rural areas	Children	Accessibility	Attitudes	Qualitative
Underutilised vegetables	Urban settings	Young people	Utilisation	Practices	Mixed-methods
Wild vegetables		2–6 years Early childhood	Food security	Views Recommendations	

Table 2 Inclusion and exclusion criteria

Variant	Inclusion criteria	Exclusion criteria
Language	Text in English	Any other language except in English language
Publication	Original research articles, review papers, books, book chapters, conference papers or repository theses/ dissertations	Published reports and case studies
Vegetables	Traditional green leafy vegetables	Any other leafy vegetables except TGLVs
Context	All nine South African Provinces	Countries other than South Africa
Focus	Availability, accessibility, consumption, preference, utilisation knowledge, attitudes and practice	Cultivation, farming, animal feed, other crops or fruits, and market dynamics

4. The forms were modified as needed during the continuous data-charting process to ensure consistent and thorough collection of relevant information.

2.6 Collating, summarising and reporting the results

The results were synthesised using a descriptive and thematic approach. Findings were summarised to provide an overview of the volume, nature, and distribution of the evidence. Thematic analysis was used to identify recurring patterns related to consumption practices, nutritional contributions of TGLVs and contextual factors influencing intake among young children. Knowledge gaps and areas requiring further research were identified, particularly in relation to evidence-based recommendations on optimal intake levels for children aged 2–6 years. The findings were reported in narrative form, supported by tables and figures to enhance clarity and accessibility.

2.7 Quality appraisal and assessment

Consistent with Arksey and O'malley [1] original framework, formal critical appraisal of included studies was not undertaken, as the primary aim of the scoping review was to map the existing evidence rather than assess study quality. However, for maintaining the quality of the review, all duplications were checked thoroughly. Abstracts of the articles were checked to ensure the quality and relevance of academic literature included in the review process. A careful evaluation of each research paper was carried out at a later stage. Data were searched by two independent reviewers (Nkululeko Milton Semenekane and Raisibe Precious Dimo) using relevant key words and the reviewer (Nazeeia Sayed) screened the abstracts. For data extraction, the two researchers used variable excel sheet and few discrepancies were harmonised without the need for a third reviewer.

2.8 Reporting

The reporting of this scoping review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist to ensure transparency and methodological rigor [41].

3 Results

3.1 Overview of studies selected and characteristics

The search was mainly focused on South Africa (296 articles); thus, articles from other countries were excluded. There were 125 articles selected after assessing each article on the aforementioned inclusion and exclusion criteria for eligibility. Figure 1 shows the literature inclusion and exclusion at every stage. In the data extraction phase, 36 articles

Table 3 Summary of the characteristics of the components investigated (n = 17)

Research context			Phenomenon of interest												
Author (year)	Province	Re-search design	Sampling method	Target group	Sample size	Availability	Accessibility	Utilisation	Food security	Consumption	Preference	Knowledge	Attitude	Practice	Con-straints
Ntlanga et al. (2023) [35]	NW—Rural	Mixed methods	Purposive	House-holds	340	X	X	X	X	X	X	X			
Masha-bela and Otang Mbeng (2021) [19]	LM and MP—Rural	Quan-titative	Purposive	Older women	95	X	X	X	X	X		X			
Qwabe and Zwane (2021) [44]	KZN—Rural	Quan-titative	Purposive	House-holds	130	X	X	X	X						
Minc-wango et al. (2020) [24]	SA—Rural and urban	Quan-titative	Simple Random Sampling	House-holds	100	X	X	X	X	X	X				X
Omo-tayo and Aremu (2020) [40]	EC—Rural	Quan-titative	Simple random—lottery technique	House-holds		X	X	X				X			
Mayeki-so (2024) [21]	LM and KZN—Rural	Quan-titative	Simple random sampling	House-holds heads	106	X	X	X	X	X	X		X	X	X

Table 3 (continued)

Research context		Phenomenon of interest													
Author (year)	Province	Re-search design	Sampling method	Target group	Sample size	Availability	Accessibility	Utilisation	Food security	Consumption	Preference	Knowledge	Attitude	Practice	Con-strains
Qwabe and Pit-tawaty (2022) [43]	KZN—Rural	Quali-tative	Purpo-sive—snowball	House-holds	40		X							X	
van der Hoeven et al. (2016) [56]	NW—Rural	Quan-titative	Simple random sampling	Children	86	X	X	X	X	X					
Dweba and Mearns (2011) [7]	EC—Rural	Quan-titative	Purposive	Women	54		X			X	X	X	X	X	X
Faber et al. (2010) [9]	LM and KZN—Rural	Mixed methods	Simple random method	House-holds	592	X	X	X	X	X	X	X	X	X	
Ngidi (2023) [32]	KZN—Rural	Quan-titative	Simple random sampling	House-holds	100	X	X	X	X	X				X	
Faber et al. (2007) [11]	KZN—Rural	Quan-titative	Purposely multi-stage	Children	79	X	X	X	X	X	X	X	X	X	

P* Parents, C* children, EC Eastern Cape, KZN KwaZulu–Natal

were selected and the characteristics extracted were: the article must be an original paper, a review paper, a conference paper or thesis/dissertation. Published reports and case studies were excluded; the article must be in the English language.

The geographical distribution of studies covered all nine provinces of South Africa as illustrated in Fig. 2, with the majority conducted in Kwa Zulu-Natal and Gauteng. Most of the articles were published in the year 2021, as shown in Fig. 3. The purposive sampling and simple random sampling techniques were the most common data collection methods (Table 3). Sample sizes ranged from 30 to 1530 participants, which includes young children, caregivers and household heads. Only four studies focused on children, majority conducted household studies that included all household members.

Table 4 illustrates the insights and recommendations of studies mentioned in Table 3. Table 5 shows the studies that were conducted at the institutional level. These studies focused only on nutritional content analysis and reviews to advise more about the quality and content of TGLVs.

Figure 2 shows the number of publications across the South African Provinces since the inception of data.

Figure 3 shows the number of articles that were published each year for the included studies.

3.2 Nutritional content and benefits

Traditional green leafy vegetables have a high nutritional density, which is especially important when it comes to addressing the micronutrient deficiencies that young South African children commonly experience. Faber et al. [9] documented that TGLVs offer significant levels of vitamin A, iron (Fe), folate, and calcium nutrients that are often lacking in the diets of young children.

The nutritional analysis conducted by Schönfeldt and Pretorius [46] found that species such as *Amaranthus* and *Cleome* variants contain 200–300% more beta-carotene than conventional vegetables. Indigenous leafy vegetables were discovered to have a particularly high iron content and some species had 15–25 mg of iron per 100 g fresh weight. These findings are corroborated by a review conducted by Bvenura and Afolayan [4], who showed that traditional preparation methods improve the nutrients' bioavailability in TGLVs.

Van Jaarsveld et al. [59] quantitative analyses of eight TGLVs reports that, for children, *Amaranthus cruentus* (pigweed) and *Vigna unguiculata* (cowpea leaves) provide more than 75% of the vitamin A recommended daily allowance (RDA), while the *Corchorus olitorius* (Jew's mallow), *Cucurbita maxima* (pumpkin leaves), *Solanum nigrum* (black nightshade), *Cleome gynandra* (spider flower) and *Citrullus amarus* (tsamma melon) provide 50–75% of the vitamin A RDA.

Moloto et al. [26] and Nkobole and Prinsloo [34] have further highlighted that *Amaranthus* and cowpea leaves have rich amino acid profiles that may complement South African maize staples, which improve the overall protein content of customary meals. Additionally, these vegetables contain iron content, pumpkin leaves contribute 50–75% and others provide 25–50% of iron content. For instance, in a farm-school trial, children aged 4–8 years received 116–158% of the RDA for iron and 28–74% of the RDA for zinc (Zn) from a 300 g portion of African leafy vegetable dishes [56].

Table 4 Summary of the aims and recommendations of the components investigated in Table 3 (n = 17)

Author (year)	Aim	Recommendations/conclusion
Ntlanga et al. (2023) [35]	To assess awareness and perceptions towards indigenous fruits and vegetables	The most shared positive perceptions were that (a) indigenous fruits and vegetables are nutritious, (b) they serve as a source of food, (c) they are cheaper and (d) they have health benefits
Mashabela and Otang Mbeng (2021) [19]	Presenting the potentials of leafy indigenous vegetables as an essential source of food and nutrition for poor communities	Nutrient intake of the communities needs to be assessed in the future to enable policymakers to make informed recommendations and implement appropriate interventions that are based on scientific research outputs
Qwabe and Zwane (2021) [44]	To highlight the significance of indigenous vegetables on livelihoods development	There is a need to include these indigenous crops as part of the main discussions in the food discourse and to recognise them as a tool to enhance livelihood development
Mncwango et al. (2020) [24]	To identify the most preferred TLVs, as well as factors that affect the consumption and cultivation of these species	Future research on improving taste, increasing edible plant parts and elongating shelf life for preferred TLVs, is a necessity
Omotayo and Aremu (2020) [40]	Examined socio-economic and food security status based on the knowledge and the perception of indigenous plants by the households	The formulation of appropriate holistic policies that support the incorporation of the indigenous plants into the food system is recommended
Mayekiso (2024) [21]	Analysed the determinants of the use of indigenous leafy vegetables by rural households	Recommends that South Africa use public governments to encourage and create awareness of the economic and social value of ILVs and strengthen the use of ILVs in the communities, particularly vulnerable communities, and groups
Mbhenyane et al. (2013) [23]	To determine the consumption of indigenous fruit and vegetables, and health risk in rural subject	It is recommended that dietary diversification with indigenous vegetables and fruits should be encouraged. The phytochemical composition should be determined and the production and marketing of indigenous vegetables and fruits should further be investigated to increase availability and accessibility to all populations
Nepfumbada et al. (2021) [31]	Aimed for ECD stakeholders to co-create an IF diet for children under five in ECD centers	Study suggests that the IF diet could scale up the use of IF to fulfil dietary requirements for children under five years and preserve indigenous knowledge
Mooketsi and Gestring (2011) [27]	To investigate villagers' general knowledge and utilisation of ILVs	Most participants cited that in the presence of both ILVs and exotic vegetables, they would prefer ILVs for food
van der Hoeven et al. (2013) [57]	To gain insight into parents' knowledge and perceptions and their use of ITPs in a farming community in the North West Province and to assess children's acceptance of and preference for dishes made with African leafy vegetables (ALVs) and Swiss chard	These results look promising for the promotion of ITPs as a strategy to reduce malnutrition in rural farm communities and for potential inclusion of these micronutrient-rich ALVs in school feeding programmes to improve the nutritional status of children
Ngidi et al. (2023) [33]	To assess the consumption of indigenous leafy vegetables and their contribution to household food security of households in Limpopo and Mpumalanga provinces	Recommended programs must be established to educate people about the importance of consuming ILVs
Qwabe and Pittawaty (2022) [43]	The study also promotes the production and utilisation of indigenous vegetables as a solution to livelihood development and food security	Proposes that promoting the production and utilisation of indigenous vegetables be considered an approach to raising awareness to dismantle the stigma around these foods and to further respond to the food insecurity crisis in underprivileged communities. This study re-imagines a renewed perception of indigenous vegetation in the quest to contribute to livelihood development and improve food security in underprivileged communities

Table 4 (continued)

Author (year)	Aim	Recommendations/conclusion
van der Hoeven et al. (2016) [56]	To assess the effect of African leafy vegetable (ALV) consumption on Fe, Zn and vitamin A status in children	This randomized controlled trial showed that ALV were unable to improve serum retinol, serum ferritin or Hb if there are only mild deficiencies present. Furthermore, despite the low Zn status in the study population, ALV consumption did not improve serum Zn concentrations either
Dweba and Mearns (2011) [7]	To explore the role of indigenous vegetables in rural livelihoods: Perceptions from the Ntuze community	Awareness campaigns to promote the use of traditional vegetables, related nutritional education, including proper cooking and preservation techniques are necessary
Faber et al. (2010) [9]	To determine the availability of, access to and nutrition-related uses of African leafy vegetables in rural and urban households	Availability of, access to and nutrition-related uses of African leafy vegetables are context-specific, with inter- and intraprovincial rural/urban differences
Ngidi (2023) [32]	The study is set to determine the contribution of TLVs to households' food security	For enhanced household food security, there is a need for initiatives that encourage the use of a wide range of traditional leafy vegetables such as <i>Moringa oleifera</i> , <i>Amaranthus</i> , and cowpeas. More awareness should be made regarding the nutritional benefits that TLVs have
Faber et al. (2007) [11]	The aim of the present study was to determine the contribution of dark-green leafy vegetables to total micronutrient intake of two- to five-year old children	DGLV made a significant contribution towards total nutrient intake of the children for several of the micronutrients. This contribution can potentially be increased should these vegetables be consumed more frequently and by a larger proportion of the children

TLVs traditional leafy vegetables, ILVs indigenous leafy vegetables, IF indigenous food, ALVs African leafy vegetables, ECD early childhood development, ITPs indigenous and traditional plants, DGLVs dark green leafy vegetables, Hb haemoglobin, Fe iron, Zn zinc

3.3 Availability and accessibility TGLVs

The review identified six species of traditional green leafy vegetables commonly available in South Africa. The most frequently documented varieties included *Amaranthus* spp. (imifino/morogo), *Cleome gynandra* (spider plant), *Corchorus olitorius* (jute mallow), *Cucurbita maxima* (pumpkin leaves), *Vigna unguiculata* (cowpea leaves) and *Bidens spinose* (black jack) [9, 12, 17, 56]. The review observed that seasonal availability emerged as a significant factor affecting food security with peak periods occurring during summer [9, 24].

Maseko et al. [18] documented traditional preservation methods such as cooling and drying that extended availability beyond growing seasons in some communities. Faber et al. [9] reported that wild harvesting remained primary source of TGLVs in rural area of KwaZulu-Natal (66%), while home cultivation and market purchases (39%) were most common in the urban settings.

Significant key barriers to the availability of TGLVs were highlighted in a scoping review by Shayanowako et al. [47] as the land access constraints, climate variability and inadequate market infrastructure. On the contrary, facilitators of improved availability included traditional knowledge of harvest locations, community seed saving initiatives and integration of TGLVs into home garden programs [9, 27].

3.4 The consumption patterns

The review revealed that TGLV consumption among young children in South Africa varies considerably by region, socioeconomic status with urban versus rural settings. Food security implications were significant, with Ngidi et al. [33] documenting that households with regular TGLVs consumption experienced less seasonal food insecurity

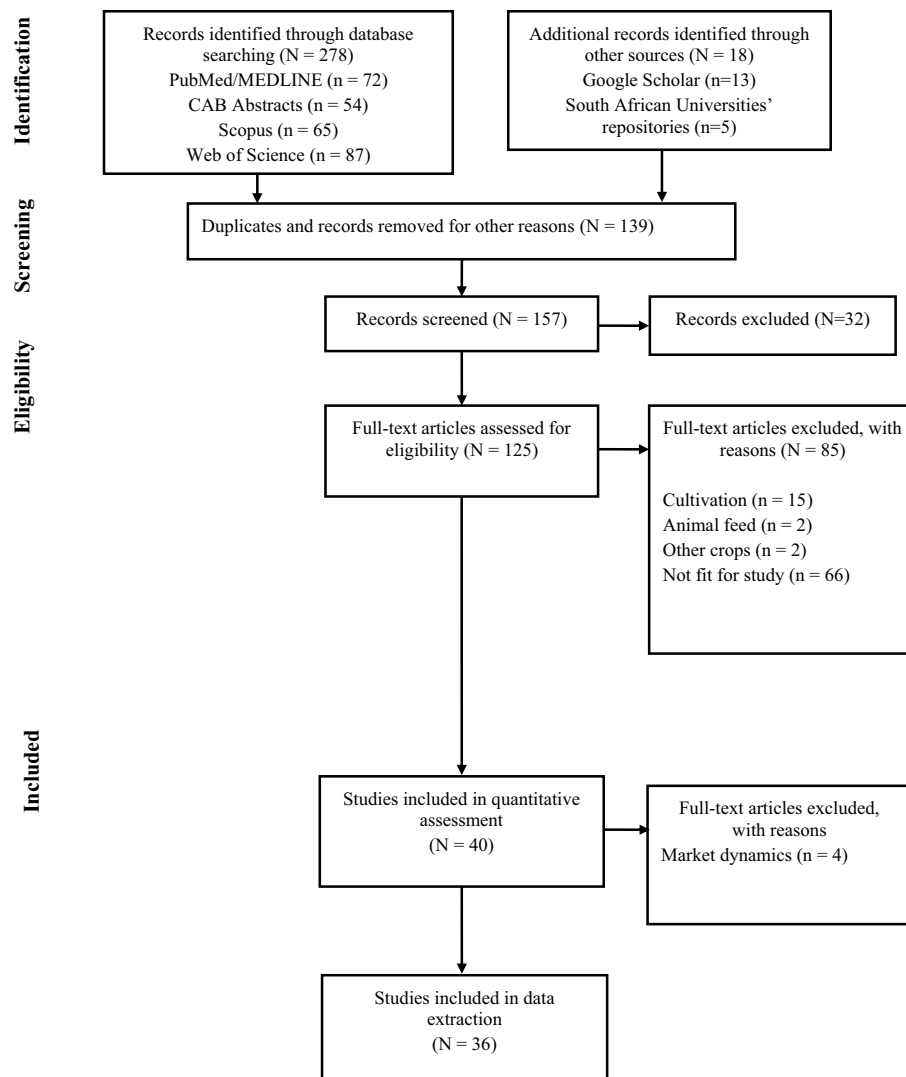


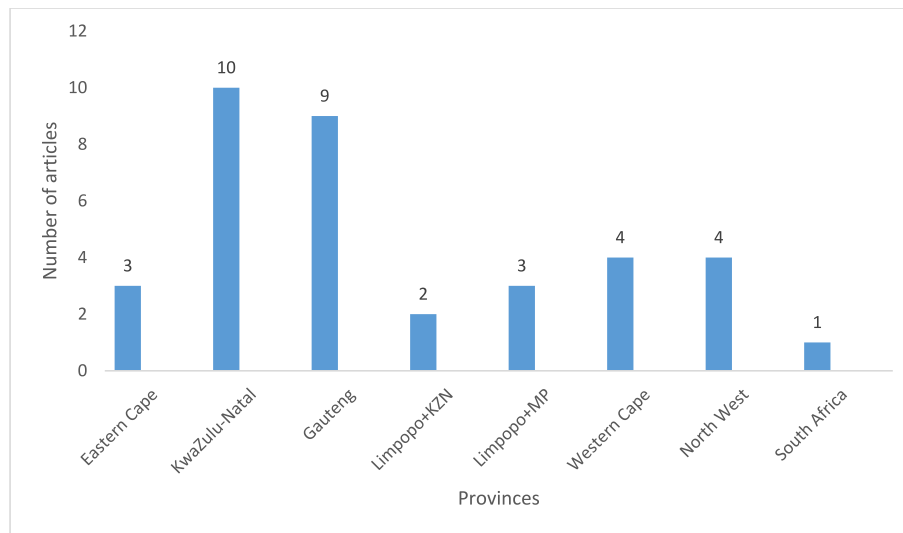
Fig. 1 PRISMA–ScR flow diagram of the study selection process followed during the literature search

compared to non-consuming households. The survey conducted by Ngidi [32] at the rural KwaZulu-Natal showed the consumption pattern of high intake of pumpkin leaves (97%) and blackjack (81%).

Nutritional analyses of repeated studies that were conducted by Faber et al. [12] consistently highlighted the exceptional micronutrient profiles of TGLVs. The average portion size consumed was approximately $\frac{1}{2}$ cup (38 g for *Amaranthus* spp). *Amaranthus* spp. demonstrated particularly high levels of vitamin A (42–68%), iron (19–39%), calcium (21–39%), and riboflavin (9–22%) from two-time point (May survey and February survey, respectively).

3.5 Cultural perception and knowledge factors

The cultural perceptions of TGLVs significantly influenced their inclusion in children's diets. In the context where TGLVs were highly valued for cultural significance, consumption rates were higher in the older generation [23, 43]. This demonstrated comprehensive knowledge of TGLV identification and preparation, compared to younger



KZN: KwaZulu-Natal; MP: Mpumalanga

Fig. 2 Number of publications across the South African Provinces (n = 36). KZN KwaZulu-Natal, MP Mpumalanga

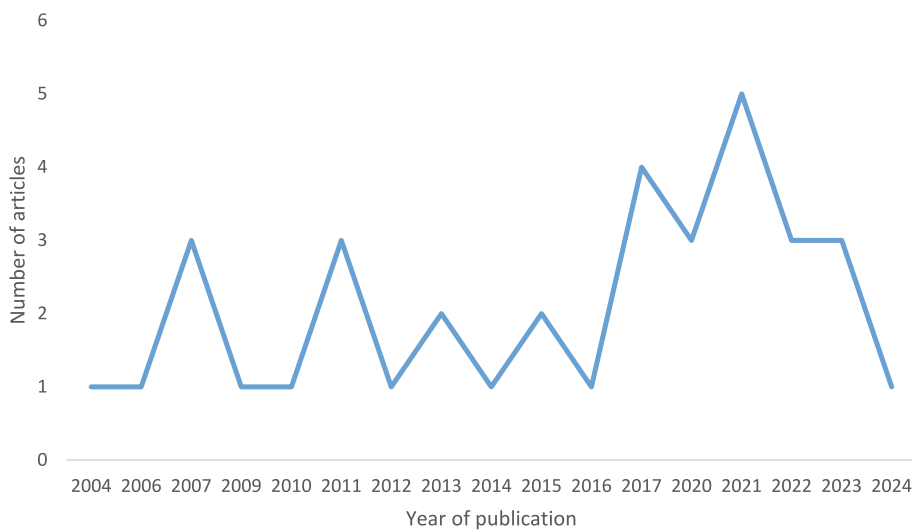


Fig. 3 Number of articles published per year (n = 36)

caregivers. The study further adds that the youth participants associated the TGLVs with low socio-economic status and hunger. Vorster [62] identified TGLVs as culturally ingrained in rural diets and indigenous knowledge systems that have been passed down through generations of women cooks.

Caregiver knowledge about nutritional benefits varied widely, and the studies reported limited awareness of specific micronutrient content despite general recognition of TGLVs as “healthy foods”. [10, 37]. Knowledge, attitudes, and practices regarding TGLVs showed significant generational differences. In Limpopo and Mpumalanga provinces, Zulu and Ngidi [66] emphasised that intergenerational knowledge transfer emerged as a critical factor, associating use with cultural identity despite a decline in urban parental uptake.

Table 5 Summary of the studies conducted in the institutions for analysis and reviews (n= 19)

Authors (year)	Institution	Research type	Aim
Van Rensburg et al. (2004) [61]	Agricultural Research Council–Vegetable and Ornamental Plant Institute	Review	This paper provides ecogeographical information and some botanical descriptions; we discuss the importance of leafy vegetables in food security and the monetary value of some of these crops
Odhav et al. (2007) [39]	University of KwaZulu-Natal	Nutrient content analysis	The purpose of this study was to conduct a preliminary assessment of the nutritive value of a range of traditional leafy vegetables
Van Rensburg et al. (2007) [60]	Agricultural Research Council–Vegetable and Ornamental Plant Institute	Review	The objectives of this article are to provide an overview of the use and status of leafy vegetables in contemporary African communities of South Africa and to present information on the local nomenclature, botanical description, ecology, utilisation and cultivation of seven groups of species that are commonly used by these communities
Schönfeldt and Pretorius (2011) [46]	University of Pretoria	Nutrient content analysis	This study aimed at determining the content of selected nutrients (protein, fat, ash, moisture, vitamin B2, β -carotene, iron, zinc, magnesium, calcium and phosphorus) contained in five commonly consumed indigenous dark green leafy vegetables
Van Averbek et al. (2012) [54]	Agricultural Research Council–Vegetable and Ornamental Plant Institute	Review	An analysis of the concept ‘African leafy vegetables’ (ALVs)
Mbhenyane (2017) [22]	Stellenbosch University	Review	Recommendations of national policy which proposes the promotion of indigenous foods consumption to benefit nutritional and health status, by increasing knowledge of the food value of indigenous foods through nutrition education
Bvenura and Afolayan (2015) [4]	University of Fort Hare	Review	The literature on ethnobotanical knowledge of wild vegetables in South Africa is reviewed with a view to reveal their potential role in household food security
Van Jaarsveld et al. (2014) [59]	Nutritional Intervention Research Unit, Medical Research Council	Nutrient content analysis	The aim of this study was to determine the nutrient content of eight cultivated African leafy vegetables
Moloto et al. (2020) [26]	Tshwane University of Technology	Nutrient content analysis	This study will lead in identifying cowpea cultivars, for the development of supplementary foods that are a rich source of amino acids, carotenoids, phenolic compounds and antioxidant properties, and relate to the dietary roles of cowpea (leaf) functional compounds in type 2 diabetes management
Nkobole and Prinsloo (2021) [34]	University of South Africa	Nutrient content analysis	This study explores the metabolome of wild and cultivated Amaranth leaves using $^1\text{H-NMR}$ and LC–MS to explain the general variations in chemical composition between wild and cultivated plants, and to assist and guide commercial production of Amaranth
Mungofa et al. (2022) [28]	University of South Africa	Review	This paper reviews the role of ILVs as food security crops, the biodiversity of ILVs, the effects of processing on the bioactivity of ILVs, consumer acceptability of food derived from ILVs, potential toxicity of some ILVs and the potential role ILVs play in the future of eating
Maseko et al. (2017) [17]	Agricultural Research Council–Vegetable and Ornamental Plant Institute	Production	This study was to determine the interaction effect of planting date, irrigation frequency, spacing and nitrogen application on growth, physiology and yield of non-heading Chinese cabbage using drip irrigation under field conditions in South Africa
Maseko et al. (2017) [18]	University of KwaZulu-Natal	Review	The objective of this review was to document the state of utilisation and production of ALVs in South Africa

Table 5 (continued)

Authors (year)	Institution	Research type	Aim
Shayanowako et al. (2021) [47]	University of KwaZulu-Natal	Review	To identify the existing knowledge, gaps, and evidence useful for priority setting in the upscaling of ALVs in southern Africa
Modi et al. (2006) [25]	University of KwaZulu-Natal	Assessment	The objective of this study was to provide a rapid assessment of general knowledge about wild leafy vegetables among subsistence farmers from Ezigeni, a rural location in South Africa, and to determine the availability of wild leafy vegetables from cropping fields during spring—before the cropping season started
Vorster (2009) [62]	University of Pretoria	Dissertation	The role and production of TLVs (morogo/ miroho/imifino) were determined in three culturally and agro-ecologically diverse rural communities in South Africa
Faber et al. (2015) [10]	Nutritional Intervention Research Unit, Medical Research Council,	Dietary analysis	The aim of this study, therefore, was to determine the vitamin A and anthropometric status of preschool children in four different geographical areas that were purposely selected based on known food consumption patterns, particularly in terms of the two staples, bread and maize meal; green leafy vegetables, and sheep liver
Nyathela and Oldewage-Theron (2017) [37]	Cape Peninsula University of Technology	Nutritional status	This paper reports the nutritional status and consumption patterns of school children from two purposively selected schools located in Orange Farm informal settlement
Zulu and Ngidi (2022) [66]	University of KwaZulu-Natal	Dissertation	To assess the determinants of acceptance of indigenous leafy vegetables by consumers in Limpopo and Mpumalanga provinces

TLVs traditional leafy vegetables, ILVs indigenous leafy vegetables, ALVs African leafy vegetables

This corroborates with studies by Dweba and Mearns [7] and Mashabela and Otang Mbeng [19] documenting a decline in traditional knowledge was related to TGLVs identification, harvesting, and preparation among younger generations of caregivers, particularly in peri-urban and urban settings.

3.6 Preparation and utilisation constraints

Ngidi [32] found that time required for preparation and collecting TGLVs posed was a barrier, leading consumers to opt for exotic vegetables such as broccoli and lettuce. As Mncwango et al. [24] describe, traditional preparation methods frequently needed more time, which coincided with changing household dynamics and women's increasing participation in professional life [61]. In the dissertation, Vorster [62] documented labour-intensive preparation such as washing, boiling and sorting; and further found stigma labelling TGLVs as “poor people's food” which may contribute to the reduced inclusion in young children's meals.

Sun drying, which extends shelf-life, was highlighted as it alters texture and colour and may reduce acceptability among sensitive young children. A study discovered that feeding TGLVs to young children more frequently was linked to knowledge of various preparation methods [31].

3.7 Summary of the four highlighted studies on the significance of TGLVs among children aged 2–6 years

Faber et al. [11] demonstrated that dark-green leafy vegetables contribute significantly to the micronutrient intake of children aged two to five years in rural KwaZulu-Natal. The study found that these vegetables were important dietary sources of Fe, Zn and

β -carotene (vitamin A precursor), helping to mitigate the high prevalence of micronutrient deficiencies in this age group. Similarly, van der Hoeven et al. [56] conducted a randomised controlled trial that assessed the impact of African leafy vegetables on the micronutrient status of mildly deficient children. Results showed notable improvements in serum retinol and Fe levels among children who consumed these vegetables regularly. This emphasises their potential role in addressing nutritional status and combat hidden hunger in resource-limited settings.

Another study explored parents' knowledge, perceptions, and the use of TGLVs, and their children's sensory acceptance [57]. The findings revealed that most parents possessed substantial knowledge about TGLVs and recognised their nutritional and cultural value. However, urbanisation and exposure to processed foods were associated with declining consumption. Importantly, the children showed positive acceptance of TGLVs after sensory testing, suggesting that sensory preferences do not limit their use in children's diet.

In their study, Nephumbada et al. [31] developed an acceptable indigenous food diet for Pedi children under five years in rural Limpopo. They identified multiple barriers to the inclusion of traditional foods in the early childhood development (ECD) centers. These included limited availability, of TGLVs due to seasonal variability, lack of knowledge among caregivers about preparation and portion sizes and the perception of that indigenous foods are "poor man's food". The study indicated that, ECD centers feeding programs often favoured commercially available foods over traditional options, limiting opportunities for children to consume nutrient-rich indigenous vegetables.

4 Discussion

This scoping review mapped existing evidence on TGLVs consumption among South Africans by identifying key insights to inform optimal recommendations for young children consumption. The review summarised and synthesised the findings from 36 studies in South Africa. The findings reveal a complex interplay of cultural, socioeconomic, environmental and knowledge factors influencing TGLVs consumption patterns with significant implications for child nutrition programs, policy development and future research directions [12, 19, 58].

The TGLVs are essential sources of vitamins and minerals [9, 12, 46, 60], and despite its nutritious value and rich cultural significance they provide, South Africa's consumption patterns have experienced a negative shift in recent decades [7, 17, 40].

Given South Africa's rich biodiversity of these traditional foods and their historical cultural significance, the findings obtained indicate a paradoxical situation as young children's consumption of nutrient-dense TGLVs appears to be declining, particularly within urban and transitioning contexts [10, 22]. This trend is consistent with broader patterns of nutritional transition seen throughout sub-Saharan Africa, where traditional, nutrient-dense foods are gradually being substituted by energy-dense, nutrient-poor diets [5, 13].

The 2023 National Food and Nutrition Security Survey has reported that approximately 28% of South African children under five years suffer from stunting [48], which could be addressed through the utilisation of TGLVs due to their reported nutritional profiles particularly their exceptional micronutrient content [19, 22, 46, 56, 59, 60].

Food utilisation trends revealed that traditional preparation techniques that improved nutrient bioavailability and sensory acceptability began to disappear as urban areas developed [7, 56, 57], compromising both nutritional benefits and consumption levels. Knowledge, attitudes, and practices (KAP) data showed a troubling discrepancy between the theoretical value of these foods and the actual consumption habits, particularly among younger caregivers [20]. This review's findings about the intergenerational knowledge gap pose a critical threat to the continuous utilisation of TGLVs.

As traditional knowledge holders age without efficient means of transmission mechanisms to younger generations, studies have found that the valuable information about the identification, cultivation, harvesting and preparation of TGLVs is at risk the permanent loss [7, 14, 40]. This finding aligns with broader concerns about the erosion of indigenous food knowledge systems globally [15, 16, 50].

In terms of identifying safe indigenous species and the optimal preparation methods for young children, knowledge barriers were particularly evident [12, 31, 57]. Potential pathways for intervention are suggested by encouraging examples of knowledge revitalization through school gardens, community elder programs, and cultural festivities. Despite an enormous amount of nutrition research focusing on increasing food accessibility and availability, our results show how important acceptability is, particularly among young children whose dietary preferences continue developing [12, 31, 58, 62, 66]. There needs to be implementation of strategies for improving child acceptance through specific preparation techniques, taste modifications, repeated exposure, and provide practical insights for developing age-appropriate recommendations.

Utilisation practices varied greatly across geographical regions and socioeconomic strata, with optimal nutrient-preserving techniques more prevalent in communities maintaining strong cultural connections to traditional foods [7]. Another significant underlying element was the dynamics of food security, with TGLVs playing a crucial role in nutritional resilience during times of seasonal scarcity [18, 21, 33, 43].

This review extends previous research on TGLVs by specifically focusing on young children in South Africa, a population segment particularly vulnerable to nutritional deficiencies but often overlooked in indigenous food research. Moreover, prior reviews by Uusiku et al. [53] and Nxusani et al. [36] detailed the agronomic and nutritional characteristics of TGLVs across Africa in generally, but they did not particularly address specific requirements for child consumption or provide recommendations that were appropriate for the context of this age group.

Our findings further contribute to the growing body of evidence supporting the concept that traditional food systems should be reclaimed as a means of tackling South Africa's double burden of malnutrition [3, 12, 38, 45, 48, 56]. The nutrition transition theory proposed by Popkin [42] provides insights into the documented decline in TGLVs consumption despite their nutritional benefit, which emphasises how the modernisation process disrupt traditional diets without necessarily enhancing nutritional outcomes.

Despite growing recognition of the nutritional value of TGLVs, this scoping review identified several critical gaps in the literature regarding their optimal consumption among children aged 2–6 years in South Africa. There is a notable lack of age-specific dietary guidance on TGLV intake for young children. While multiple studies describe the nutrient composition and potential health benefits of TGLVs [46, 54], very few provide evidence-based recommendations on appropriate portion sizes, frequency of

consumption, or daily intake levels suitable for children in early childhood. This limits the translation of existing evidence into practical dietary guidance for caregivers, Early Childhood Development (ECD) centres, and policymakers.

There is limited empirical evidence linking TGLV consumption to specific health and developmental outcomes in young children. Most available studies are descriptive or cross-sectional and focus on nutrient content [59, 60] rather than diet–health relationships, such as growth, micronutrient status, or cognitive development. Longitudinal and intervention studies assessing the impact of regular TGLV consumption during early childhood are scarce, constraining the ability to define what constitutes “optimal” intake from a health outcomes perspective.

Another important gap relates to contextual and behavioural factors influencing consumption. While some studies similar to van der Hoeven et al. [57] explore caregivers’ knowledge, attitudes, and practices these are often not examined in relation to measured intake levels or child-specific dietary outcomes. Evidence on preparation methods, acceptability, palatability, and child feeding dynamics within households and ECD settings remains limited. This is particularly important given that preparation practices can significantly affect nutrient bioavailability and children’s willingness to consume TGLVs.

The review revealed a scarcity of studies conducted specifically within ECD centre settings, despite the central role these institutions play in shaping dietary patterns among children aged 2–6 years in South Africa. Research focusing on menu planning, portion control, and integration of TGLVs into ECD feeding programmes is minimal, representing a missed opportunity for intervention at scale.

The integration of policy and programmatic perspectives within the literature is limited. Existing national food-based dietary guidelines promote vegetable consumption broadly [30], but rarely provide guidance specific to TGLVs or to young children. Few studies critically examine the alignment between evidence, policy recommendations, and on-the-ground implementation, highlighting a gap between research, practice, and policy [22, 28, 47].

4.1 Limitations

Relevant studies may have been omitted despite the comprehensive research, particularly those that used different terminology for traditional vegetables or those incorporated into larger dietary studies. The studies might not have been able to draw accurate comparisons between the included studies because of their variability in terms of methodology, sample size and reporting information. Numerous TGLVs are versatile crops that can be used as pulses or fruits and were not included in this review. In addition, the review was constrained by the primary research’ shortcomings, many of which depended on self-reported consumption data rather than biological markers or direct observation.

5 Conclusion

This scoping review provides a comprehensive overview of the current state of knowledge to advise on optimal consumption of TGLVs among young South Africans. The research unequivocally demonstrates that these indigenous foods provide significant nutritional potential to alleviate severe micronutrient deficiencies that impact the health and development of children. However, optimal consumption is currently hindered by

a number of interrelated barriers that span the cultural, economic, environmental, and knowledge domains.

The numerous studies highlighted a number of factors, including urbanisation, reduced accessibility, lack of preparation and preservation techniques and nutritional value as reasons for the decreased consumption. Future initiatives ought to tackle important knowledge gaps, especially with regard to children's acceptance criteria, effective intervention strategies, more studies in the urban context and nutrient bioavailability, while building on the successful community-based approaches that have already been determined.

There is an extensive amount of opportunity to enhance child nutrition outcomes while simultaneously safeguarding cultural heritage and advancing environmental sustainability by recuperating and revitalising traditional food systems in ways that address modern realities. These findings provide a foundation for developing contextually appropriate, evidence-informed recommendations to optimise TGLV consumption among young South African children, which may provide a long-term solution to ongoing nutritional challenges while preserving cultural food identities.

Acknowledgements

Nazeia Sayeed on screening and reviewing the abstracts for inclusion. Precious Dimo on literature search for data extraction.

Author contributions

NMS conceptualised and designed the study; NMS was responsible for the literature search and drafted the manuscript; BP and HCS contributed to the writing and editing process; BP and HCS critically reviewed and revised the manuscript for intellectual consent.

Funding

The authors acknowledge(s) funding from the Department of Science, and Innovation (DSI)/National Research Foundation (NRF) South African Research Chairs Initiative (SARChI) in the National Development Plan Priority Area of Nutrition and Food Security (Unique number: SARCI170808259212). The grant holders acknowledge that opinions, findings and conclusions or recommendations expressed in any publication generated by the NRF-supported research is that of the author(s), and that the NRF accepts no liability whatsoever in this regard.

Data availability

All the data and materials are available upon reasonable request to the corresponding author.

Code availability

Not applicable.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 24 November 2025 / Accepted: 29 December 2025

Published online: 10 January 2026

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