Deliverable 2.4.

Report on needs, barriers, and drivers of vulnerable citizens

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Abbreviations

Abbreviation	Full Form
FAO	Food and Agriculture Organization
FS	Food Security
OECD	Organization for Economic Cooperation and Development
UK	United Kingdom
UN CTAD	United Nations Conference on Trade and Development
EC	European Community
CMA	Competition and Markets Authority
ACCC	Australian Competition and Consumer Commission
SERNAC	Consumers National Service in Chile
FBDG	Food-based dietary guidelines
FCA	Financial Conduct Authority
KPIs	Key Performance Indicators
m	mean
SD	Standard deviation
SES	Socioeconomic status
WHO	World Health Organization
WP#	WP followed by a single digit number refers to a specific Work Package

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1 Background

1.1 The DietWise project

The mission of DietWise is to tackle the pressing challenges of unhealthy and unsustainable eating habits by empowering individuals to make informed, healthier, and environmentally conscious food choices. The project seeks to enhance the uptake of beneficial tools and applications, improve food literacy, and promote healthy and sustainable diets. It will also develop policy recommendations and integrity guidelines for the industry. The project focuses on systemic changes, inclusion, and social innovations in food practices. The main goals are to address unhealthy and unsustainable food consumption by developing innovative approaches that streamline existing tools and applications. Key innovations include the Responsible Cooking Alliance, a voluntary reporting system for influencers and food environment actors, and RecipeWatch, an AI-powered app that suggests personalized corrections to online recipes to align with nutrition guidelines.

1.2 Task 2.4: Better understanding the needs, barriers and drivers of vulnerable consumers

1.2.1 Scope and Specific Objectives

In the context of WP 2 and Task 2.4, insights were gathered into the needs, barriers and drivers that influence vulnerable citizens' adherence to healthy and sustainable dietary habits, as well as their use of nutrition-related digital tools. This information will be used to design tools, services and strategies tailor-made for at-risk consumer groups. The specific objectives of Task 2.4 are summarized as follows:

- To conceptualize the definition of vulnerable citizens
- To identify the main needs for vulnerable citizens to adopt healthier and sustainable dietary habits
- To understand the main barriers and facilitators for vulnerable citizens with a special focus on the culinary aspect
- To select the main factors that affect vulnerable citizens' food literacy and uptake of beneficial dietary tools and applications

1.2.2 Linked KPIs

KPIS	Key performance indicators
KPI-5	≥300 VULNERABLE citizens/country
KPI-6	Conceptual definition of vulnerable citizen groups

1.2.3 Participating countries

The participating countries in the research activities of WP 2 were Belgium, Greece, and Lithuania (**Figure 1**).

1.2.4 Overview of Methodology

A mixed-methods approach was implemented, beginning with **desk research** involving a **comprehensive literature review and expert interviews** —at least five per pilot country— designed to define the most vulnerable citizen profiles. Subsequently, **a targeted epidemiological survey** was conducted with vulnerable populations, yielding between 100 and 300 responses per country (. This online survey explored key factors that influence the uptake of beneficial tools and applications, taking into account economic, psychological, social, culinary, and religious aspects.
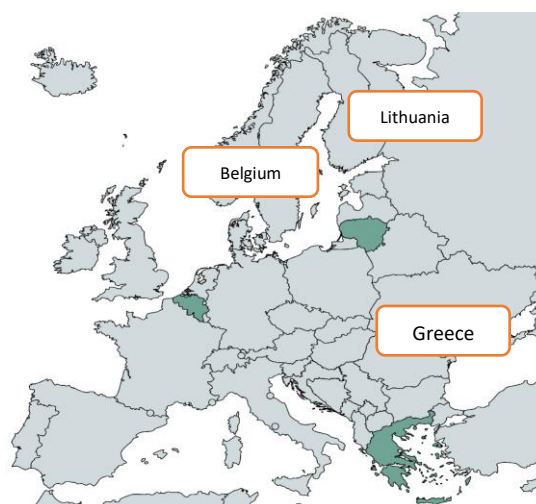
Figure 1 Participating countries in DietWise project

1.2.5 Timeline

	M1	M2	M3	M4	M5	M6	M7	M8	M9
Desk research									
Expert interviews									
Epidemiological Survey									
Analysis & Reporting									

2 Conceptualization of consumer vulnerability

The protection of consumers in moments of heightened vulnerability has long been a fundamental concern for consumer policymakers and regulatory authorities. Consumer vulnerability is increasingly recognized as a complex and multi-dimensional phenomenon, influenced by a combination of personal, social, and market-related factors. At its core, vulnerability refers to a heightened susceptibility to harm, where an individual's ability to make informed, autonomous, and rational choices in the marketplace is compromised[1]. The academic literature does not offer a single, universally accepted definition of consumer vulnerability[2,3]. Instead, vulnerability is most commonly understood as an ex-ante evaluation of the likelihood that a consumer may experience adverse outcomes—a forward-looking assessment of risk, rather than an indication of harm that has already occurred or is guaranteed to occur.

Two overarching categories of vulnerability are typically identified. The first is a **static, class-based approach,** which first relates to inherent **personal characteristics of the consumer** (such as age, health, or cognitive capacity)[4,5]. The second is a **state-based or contextual approach,** which adopts a broader perspective that considers the **situational or transactional contexts in which consumers engage with the market**[2,6]. The latter follows a more dynamic approach. Contemporary definitions increasingly acknowledge that vulnerability is not a fixed or permanent condition. Consumers may enter or exit states of vulnerability over time, and they may be particularly vulnerable in certain types of transactions while remaining relatively resilient in others. Accordingly, vulnerability is more accurately conceptualized as a continuum or spectrum, rather than a binary classification. Nonetheless, in specific policy contexts, it remains important to recognize that certain personal characteristics may place individuals at a consistently higher risk of harm, warranting tailored protective measures.

The **class-based approach** to consumer vulnerability has faced substantial criticism across academic and policy literature. Critics argue that it risks **stigmatizing specific consumer groups** by treating vulnerability as an inherent trait of certain socio-demographic categorie[2,6]. This approach is often seen as overly reductive, lacking the nuance required to capture the diversity and complexity of consumer experiences (Hill & Sharma, 2020). Furthermore, it may overlook **underlying cognitive or psychological drivers of vulnerability**, such as impaired decision-making capacity or low impulse control[2,6]. Another major limitation is its tendency to **ignore contextual and structural factors**, such as exploitative market practices or asymmetries in information and power, which can also significantly contribute to consumer vulnerability[2,6].

In contrast, the **state-based approach** offers a more flexible and comprehensive framework. It acknowledges that **vulnerability is not a fixed condition but a dynamic state**, which can affect any consumer depending on their individual circumstances and environmental context. Advocates of this perspective emphasize that **external market factors—particularly manipulative or aggressive commercial practices—can be as influential, if not more so, than internal personal traits** in shaping vulnerability[2,6]. Empirical findings further support this view, suggesting that commonly assumed vulnerability indicators—such as age or income—do not always correlate with reduced consumer resilience (see Box 1, e.g. on elderly consumers).

This broader interpretation highlights that **vulnerability can be understood from multiple vantage points**.

Vulnerability can be further categorized into several key dimensions, as presented in **Error! Reference source not found.**.

Table 1 The key dimensions of consumer vulnerability

Vulnerability dimensions	Interpretation
Information vulnerability	difficulty accessing or understanding relevant information about products or services
Pressure vulnerability	increased susceptibility to aggressive or manipulative sales tactics

Supply vulnerability	restricted access to affordable and essential goods or services
Redress vulnerability	limited capacity to seek compensation or resolve complaints
Impact vulnerability	greater exposure to negative consequences from poor consumer decisions

2.1 Vulnerability definitions

Under the existing EU legislation, the **Unfair Commercial Practices Directive (UCPD)**, vulnerable consumers are recognized as a distinct group warranting additional protections. They are seen as a deviation from the normative model of the "**average consumer**," who is presumed to be "*reasonably well-informed and reasonably observant and circumspect, taking into account social, cultural and linguistic factors*". In contrast, certain individuals are recognized as needing additional protection due to mental or physical impairments, age-related factors (such as being very young or elderly), or a heightened degree of credulity[7]. Both the "**average consumer**" and "**vulnerable consumer**" constructs have been explicitly and implicitly embedded across various areas of consumer law. However, they have also attracted substantial criticism[7]. The average consumer standard has been challenged for setting the bar unrealistically high, failing to reflect real-world consumer behavior, which is often non-rational and inconsistent. Meanwhile, the definition of the vulnerable consumer has been criticized for being overly narrow, excluding many individuals who may not meet the formal criteria but still face significant disadvantages[8]. Moreover, the binary use of these two categories has been seen as problematic, as it leaves a protection gap for consumers who do not meet the average standard but are also not classified as vulnerable[7].

Although there is no universally accepted definition of consumer vulnerability, the concept that emerges across academic disciplines —such as sociology, marketing, and law— is significantly broader than the one outlined in the **Unfair Commercial Practices Directive (UCPD)**[7]. Scholarly interpretations tend to emphasize a lack of agency in marketplace interactions, a disempowered position relative to other actors, and an elevated risk of experiencing harm or disadvantage as defining characteristics of vulnerability.

Table 2 Conceptualization of vulnerability in national, european and international policies

Source / Year	Approach to Vulnerability	Definition / Key Concepts and Notable Examples
OECD, 2007 (Dispute Resolution & Redress)	Class-based	Defines 'disadvantaged or vulnerable consumers' as those who face challenges accessing redress due to personal traits (e.g. age, disability, education, income, location).
OECD, 2010 Toolkit	Both (class + state-based)	All consumers may be vulnerable depending on context (e.g. grief). Disadvantaged consumers face persistent difficulties due to characteristics like disability or discrimination.
OECD, 2014 Recommendation on Consumer Policy Decision-Making	State-based	Vulnerable consumers are those temporarily at risk due to market, product, or personal circumstances.
UK FCA, 2015	Class-based	Vulnerable consumers are characterized as individuals who, due to their personal circumstances, are at an increased risk of harm—particularly when firms fail to provide an adequate level of care
OECD, 2016 E-commerce Recommendation	Implicit state-based focus on children/providers	No formal definitions but stresses the need for care in marketing to children and consumers with limited understanding.
OECD, 2020 Consumer Product Safety Recommendation	Class-based inclusion of specific groups	Explicitly mentions children, the elderly, and disabled people as vulnerable or disadvantaged.
OECD, 2021 Children in Digital Environment Recommendation	Contextual state-based for children	Recognises children face heightened risks online, especially consumer-related risks.
UNCTAD / UN, 2015 Guidelines	Distinction used, definitions not provided	Acknowledges vulnerable and disadvantaged consumers but lacks formal definitions.

EC, 2016 Vulnerability Study	State-based, dynamic	Defines vulnerability based on socio-demographic, behavioural, situational, and market factors. Emphasises dynamic nature.
CMA, UK 2019	Dual categorisation: personal + market-specific	Identifies personal characteristics and market structure as sources of vulnerability.
ACCC, Australia 2021	Similar to CMA	Emphasises the role of business practices and complex products in creating vulnerability.
Portugal Guidelines	Combined class + state-based	Vulnerability results from both internal (age, condition) and external (education, income, digital literacy) factors.
Chile (SERNAC) 2021	State-based	All consumers are inherently vulnerable due to market power imbalances; conditions may worsen due to specific traits or failures.

Currently, one of the central priorities of the European Commission's **New Consumer Agenda**, adopted in November 2020[9], is to address the specific needs of certain consumer groups, with a particular focus on those considered vulnerable. The strategy sets out targeted measures to protect individuals at risk of financial hardship or social exclusion—such as those facing over-indebtedness, low-income households, older adults, persons with disabilities (particularly those lacking internet access), children and adolescents, and individuals potentially affected by algorithmic bias in digital systems.

2.2   The personal elements of vulnerability

2.2.1   Age groups

Older adults represent a particularly vulnerable demographic concerning dietary habits due to unique physiological changes and complex nutritional requirements that often diverge from those of the general adult population. As individuals age, their energy intake needs decrease, yet there's an increased demand for essential nutrients such as protein (to preserve muscle mass), calcium, zinc, iron, B vitamins, and vitamin D (for bone health and overall functional maintenance)[10]. Research consistently highlights low compliance with these specific dietary recommendations among older adults, often exhibiting significant deficiencies in vital micronutrients like vitamin D and iodine, and sometimes excesses in others[10]. Failing to meet these tailored nutritional requirements can predispose the elderly to a range of serious health issues, including fragility, cardiovascular disease, osteoporosis, malnutrition, and cognitive decline, underscoring the critical importance of understanding and addressing their specific dietary patterns[11].

This vulnerability is further exacerbated by a multitude of interconnected sociodemographic, clinical, and lifestyle factors. Social vulnerabilities such as living in rural areas (due to fewer accessible services), being becoming single (divorced or widowed), or illiteracy can negatively influence nutrient intake [12]. Beyond these, factors directly impacting dietary choices include a lack of knowledge regarding cooking or nutritional needs, heightened by social isolation, which can lead to a loss of interest in food. Physical disabilities, mental disorders, poverty, reduced appetite (often due to dental issues), malabsorption, and even certain medications or excessive alcohol consumption can profoundly hinder the elderly's ability to acquire, prepare, and consume a balanced diet[11]. Therefore, ensuring a comprehensive assessment of dietary intake, alongside these predisposing factors, is crucial for designing targeted and effective health promotion strategies for this growing and often overlooked segment of the population.

Going from the older ages to the younger ones, the dietary habits and lifestyles of **children and adolescents** across Europe have undergone a significant revolution in the past decades, largely attributable to profound changes in the family and broader social environment [13]. Key societal shifts include the increasing participation of women in the workforce, declining birth rates and family sizes, rapid urbanization, and remarkable advancements in food technology and global logistics, which have made a wide array of foods continuously available [14]. A critical concern arising from these changes is the inadequate parental supervision many pre-school and school-aged children receive regarding meals and snacks. Many children are left alone for extended periods, primarily engaging with television or game consoles, with easy access to a refrigerator or cabinet stocked with diverse foods. This often leads to a tendency to choose "portable" snacks like sweets, cakes, and soft drinks, either alone or with friends when consuming meals away from home, such as in school dining halls or cafes[15].

Adolescence is a critical period for establishing healthy behaviors, yet evidence suggests a low propensity among children to read food labels, which is a fundamental aspect of food literacy [16]. While food literacy is a lifelong process, cultivating healthy habits early in life is paramount. Research on the association between food literacy and children's dietary intake presents mixed evidence[17]; however, public health practitioners and policymakers are still advised to prioritize initiatives that increase food literacy in childhood and adolescence. Interventions have evolved from simply teaching 'what to eat' to

empowering children and teenagers with 'how to eat' – focusing on practical skills such as reading labels and proper cooking techniques [18]. Despite these efforts, more research is necessary, especially concerning teenagers, to fully understand the intricate relationship between food literacy and healthy eating behaviors during this transformative period.

Finally, family and socioeconomic contexts play a significant role in shaping adolescent dietary preferences. Teenagers from less deprived family backgrounds often exhibit healthier food preferences, which can be linked to the distinction between conceptual and functional food literacy[19]. Adolescents in more deprived settings might possess knowledge about healthy eating but lack the financial resources to put it into practice due to the higher cost of nutritious foods.

2.2.2 The Gradient of SES and Diet Quality

Socioeconomic status (SES) is a well-established and powerful explanatory variable in dietary studies, consistently demonstrating a significant impact on dietary habits and associated health outcomes across the lifespan [20]. SES is typically characterized by three main variables: occupation, education, and income, each covering distinct yet interconnected aspects of the socioeconomic structure that individually contribute to the relationship between SES and diet [20,21]. A clear socioeconomic gradient exists globally, where individuals and families from higher SES backgrounds consistently exhibit healthier dietary patterns compared to their lower SES counterparts [20]. This is evidenced by higher consumption of water, whole grains, fresh fruits and vegetables, and less sugarsweetened beverages, eggs, and red meats among high SES populations, coupled with lower intakes of fat, saturated fat, and refined sugar, and higher intake of dietary fibers[21,22]. This disparity is particularly evident in the prevalence of overweight and obesity; children from low SES families are significantly more likely to be overweight or obese, with recent WHO studies displaying that adolescents from less affluent families are considerably more prone to being overweight or obese, with a prevalence of 27% versus 18% among their wealthier peers [23]. These socioeconomic disparities in obesity prevalence have regrettably widened over the last decade, underscoring the critical need to address the underlying drivers of these inequalities.

The observed socioeconomic gradient in diet quality is driven by a complex interplay of specific components of SES and their direct and indirect influences on food choices. Education is considered to impact health outcomes through its influence on lifestyle behaviors (e.g., exercise, diet), problem-solving capacity, and values, such as the importance of preventive health behaviors [24]. It also facilitates the acquisition of positive psychosocial and economic skills, offering protection from adverse influences, and is relatively easy to assess across all age and working circumstances [25]. Occupation can affect diet by creating environmental or social networks that shape behavioral health habits and allows for increased access to medical care, better housing, improved nutrition, safer neighborhoods, and greater opportunities for health-promoting behaviors [26]. Finally, income directly mirrors the availability of economic and material resources, critically influencing dietary quality by determining the affordability and accessibility of healthy food options. A primary mechanism is the affordability of healthy versus unhealthy foods; less nutritious, energy-dense foods are often cheaper sources of calories, making them a more accessible option for lower-income households [27]. Disadvantaged socioeconomic groups consistently exhibit dietary profiles that increase mortality and morbidity rates for chronic diseases due to non-compliance with recommended daily nutrient intakes and dietary guidelines [28]. Specifically, diet quality as measured by intake of micronutrients is significantly better among high SES communities [29]. Studies have found lower intake of essential vitamins among lower SES groups, with a notable deficit in antioxidant vitamin intake being common, largely explained by less frequent consumption of fresh fruit and vegetables[20,21]. While differences in overall nutrient intake levels may sometimes appear small, socioeconomic disparities in food consumption patterns are often more evident[21]. This highlights the importance of analyzing dietary patterns as a comprehensive approach to investigating links between SES, diet, and disease [30]. This approach acknowledges that foods are consumed in complex combinations with interactive and synergistic effects, providing advantages for the development of effective public health nutrition messages[31].

Despite methodological challenges in direct comparison across studies, understanding these patterns offers a holistic view beyond individual nutrients, recognizing the interrelationship of factors within a dynamic system [32]. Beyond traditional SES indicators, a broader concept of social vulnerabilities further illuminates the complex factors influencing dietary habits and health outcomes, particularly in children and ethnic minority populations. These vulnerabilities encompass characteristics or experiences that negatively affect individuals through behavioral, biological, or mental health pathways, including factors like a lack of social network, low support, parental unemployment, minority or migrant background, adverse childhood experiences, and family disharmony[33]. A systems-based framework reveals that diet and physical activity behaviors are shaped by interconnected clusters of factors, including the social and cultural environment, social and material resources, psychosocial factors, and crucially, the migration context for ethnic minorities[34]. While SES can exacerbate or buffer the effects of these social vulnerabilities on lifestyle and stress, the combined impact often leads to unhealthier behaviors, including high energy intakes, contributing to issues like childhood obesity[34]. This intricate interplay necessitates the development of innovative, complex, and culturally sensitive interventions that adopt a holistic, systems-

based approach. Such a paradigm is essential to effectively address the multifaceted drivers of dietary behaviors and achieve meaningful public health improvements for both vulnerable groups and the majority population.

2.2.3 Minorities

Minority populations, broadly defined as groups differing from the majority by customs, language, race, values, or shared history[35], exhibit distinct dietary patterns that often undergo significant changes post-migration. Major ethnic groups in Europe include South Asians in the UK, Africans in France, Turks in Germany, Latin Americans in Spain, and Surinamese in the Netherlands, amongst more[35]. Migration frequently necessitates shifts in the types and quality of consumed foods and preparation methods. While staple foods like chapattis, rice, and noodles tend to remain unchanged for longer periods, accessory foods such as snacks and sweets are readily altered[35]. Studies consistently show a longitudinal shift from traditional diets towards mixed food habits or a more "Westernized" diet, and behavioral interventions are tailored to manage this public health issue[36]. A significant proportion of ethnic minority groups in Europe often belong to lower socioeconomic communities, typically holding low-paid jobs in their host countries[37]. This economic reality can severely restrict food choices, leading to consumption of poorer quality foods, such as cheaper, fattier cuts of meat or very little meat, reduced intake of fruits and vegetables, and a higher consumption of processed foods rich in fat, salt, or sugar. For instance, this trend has been observed in both South Asian and African Caribbean communities in the UK[38]. Furthermore, dietary choices are markedly influenced by generation and age: older immigrant generations tend to maintain traditional dietary habits due to greater segregation from mainstream society, whereas younger generations are more inclined to adopt host country foods, perceiving them as convenient and reflective of independence[35]. The changing dietary habits of ethnic minority populations have resulted in significant health concerns, rendering them particularly vulnerable. An increased risk of diet-dependent degenerative diseases, including obesity, cardiovascular disease, and diabetes, is observed in immigrant populations compared to both host and native country populations[39,40].

2.3 The Contextual Elements of Vulnerability

2.3.1 Vulnerability and new digital era: consideration of digital literacy

The scale and nature of consumer vulnerability are shifting in the digital era. A central emerging insight is that vulnerability can no longer be seen as the condition of a specific group of consumers alone. Instead, it increasingly affects a broader population —potentially all consumers— at varying times and in different contexts, depending heavily on market dynamics. While some groups may still face disproportionate levels of vulnerability, digital environments have introduced conditions under which anyone can be at risk.

This evolving reality has prompted scholars and policy advocates to propose a new understanding of consumer vulnerability in the digital domain. The concept of "universal" or "systemic" digital vulnerability has gained traction, recognizing that all consumers can find themselves in vulnerable situations due to the structure and functioning of digital markets[41,42]. The architectural and relational dimensions of digital vulnerability have been emphasized, including the impact of digital choice architecture, the asymmetry in business-consumer relationships, and the erosion of privacy as key factors reinforcing consumer vulnerability online. Additionally, it has been warned that digitalization may deepen existing inequalities— whether through gaps in digital literacy, cognitive biases, discriminatory practices, or growing imbalances of power between consumers and dominant online platforms[41]. In the 2014 OECD Recommendation on Consumer Policy Decision Making framework, a state-based approach to vulnerability was embedded[43]. That framework recognized both external factors— such as market structure, product features, and the nature of transactions—and internal factors like consumers' personal attributes or life circumstances[43]. These elements remain highly relevant today, particularly in digital markets characterized by limited competition, significant information asymmetries, deliberate obfuscation of terms and conditions, power imbalances between firms and users, barriers to Internet access, the use of manipulative design ("dark patterns") and personalized exploitation tactics[43].

2.3.2 Vulnerability and food cost: consideration of individual and food security levels

According to World Food Conference of 1996, food security (FS) is defined as the condition in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Also, a population is still considered to be "food insecure" if insufficient access to food is recorded periodically, with a risk of worsening its nutritional status, particularly when influenced by environmental, geopolitical, or economic factors. Lower-income households, single-person residences, and individuals with limited educational backgrounds showed significantly lower FS Index scores, reinforcing the role of financial and educational stability in ensuring FS, as key drivers acknowledged in the literature[44]. While food security has traditionally been understood as the ability to access sufficient food, nutritional security introduces a dimension related with the quality of food consumed, ensuring that this will support long-term health. Populations may meet their caloric needs but remain vulnerable to malnutrition due to poor diet diversity [45]. Re-aligning food systems around the world to promote both human

and environmental health is one of the greatest challenges of the 21ˢᵗ century. In this context, the EAT-Lancet committee was established, which in 2020 proposed a single dietary pattern in this direction, with modern improvement of agricultural and livestock practices and reduction of food waste, expecting to ensure nutrition for 10 billion people in 2050[46]. However, the economic analysis of the sustainable dietary pattern in question followed a year later, indicating that a household from a low-income country would have to spend 90% of its income on such a diet pattern[47].

2.3.3 Vulnerability and the era of misinformation and disinformation: consideration of nutrition literacy

Current global health systems have recognized the need to focus on the system instead of the person. To this issue, in today's digital landscape, the widespread nutrition-related information including information on weight management, is often unverified or misleading, and has resulted in significant public health concerns. The fast dissem ination and sharing of misinformation and disinformation on social media platforms and online content has the power to influence dietary habits, choices and perceptions of the general public, even medical decisions. This issue is further aggravated during health crises, such as the COVID-19 pandemic, where inconsistent and unreliable information spreads widely, leading to confusion and harmful health outcomes. Misinformation about nutrition and weight management is widespread, negatively impacting public health and leading to harmful dietary behaviors [48]. Social media, online platforms, and word-of-mouth play a significant role in shaping public perceptions, often spreading misleading or incorrect information [49,50]. Nutrition has become an increasingly important topic over the last few years. Nutritional trends have a significant impact on nutrition-related behaviors by shaping how people eat, shop for food, and perceive health. Consumers have shifted towards organic, whole and natural foods, while the internet is flooded with applications, blogs and information about personalized and nutrition plans. Consumers are trying viral food trends, preparing food based on social media content, and following fitness influencers for nutrition advice. More harmfully, patients often seek nutritional advice or even cures for serious diseases posing significant dangers to their health and even the health of their families, including their children [51]. The increased digitalization of nutrition information ~~poses~~ major health concerns. The widespread dissemination of misinformation about nutrition and weight management can potentially lead to severe health consequences, including diabetes and cardiovascular diseases or an increase in deficiencies and eating disorders[52]. A large part of the population, as research shows, particularly vulnerable groups, lack the necessary critical skills to assess the online information they receive[53]. Nutrition misinformation disproportionally affects vulnerable populations, as this group often has limited access to expert nutrition guidance [52]. Equipping them with the skills to critically assess and share accurate information, the DietWise project creates a ripple effect, reaching wider audiences beyond direct participants. It bridges the gap between nutrition science, media literacy, and digital communication, equipping participants with the tools and knowledge to critically evaluate online content and navigate the complexities of misinformation.

2.4 Vulnerability in consumers: what we need to consider

Consumer vulnerability in relation to nutrition and health is a dynamic, multi-dimensional concept shaped by an intricate web of personal, socioeconomic, cultural, and digital factors. While traditional frameworks often associate vuln erability with fixed attributes—such as age, income, or education—it is increasingly clear that vulnerability is contextual, systemic, and transient, affecting a wide range of populations in diverse and evolving ways.

At the personal level, vulnerability is heavily influenced by life stage. Older adults face physiological and functional challenges that complicate dietary adequacy, while children and adolescents are exposed to rapid socio-environmental shifts that weaken parental oversight and promote unhealthy eating behaviors. Meanwhile, food literacy—both conceptual and practical—is often inadequate across age groups, undermining the ability to make informed choices. SES remains a foundational determinant of diet quality, shaping food access, affordability, and preferences through its core components: education, income, and occupation. The well-documented socioeconomic gradient in nutrition underscores persistent inequalities, with lower SES groups exhibiting poorer dietary patterns, higher obesity rates, and greater susceptibility to chronic diseases. Importantly, these disparities are not solely due to financial limitations but also reflect broader structural vulnerabilities, such as reduced health literacy, limited food access, and weaker social support networks. Ethnic minority groups and migrants represent another dimension of vulnerability, as acculturation often results in a departure from traditional diets toward less nutritious, "Westernized" eating patterns. These shifts are often compounded by socioeconomic hardship and generational divides, amplifying the risk for nutrition-related diseases.

Beyond individual characteristics, contextual vulnerabilities—particularly in the digital era—have broadened the scope of who may be considered vulnerable. Today, digital markets and environments have introduced novel risks for all consumers, with manipulative design strategies, information asymmetries, and data-driven personalization contributing to what is now described as "universal digital vulnerability". The digital divide further entrenches inequalities, particularly for those

lacking digital and nutrition literacy. At the intersection of food security and nutritional quality, economic constraints and systemic inefficiencies continue to limit access to diverse, healthy diets, especially in low-income settings. This dual burden—of food insecurity and poor nutrition—poses urgent challenges for public health, particularly in light of the environmental and economic demands of sustainable dietary transitions. Last, the proliferation of nutrition misinformation and disinformation, especially on digital platforms, introduces a pervasive and insidious form of vulnerability. Lacking the tools to evaluate online content, many—particularly in already disadvantaged groups—are susceptible to misleading dietary claims that can compromise health outcomes.

Conceptualizing consumer vulnerability today requires moving beyond static categorizations. It demands a systems-based, equity-oriented framework that accounts for intersecting personal, structural, and digital influences. Only through such an integrated understanding can effective, inclusive, and sustainable interventions be developed to protect and empower all consumers—especially those who are most at risk.

In summary, the conseptualization of vulnerability includes the following elements, as follows:

Individual-Level Vulnerabilities	▪ Older Adults: Physiological and physical decline, nutrient deficiencies ▪ Children/Adolescents: Family shifts, low food literacy, more susceptible to marketing practices
SES gradient	▪ Education: Affects food choices and problem-solving capacity ▪ Occupation: Shapes lifestyle and social exposure ▪ Income: Limits affordability of healthy food ▪ Socioeconomic Constraints: Restrict food choices and quality ▪ Low Food Literacy: Lack of skills like label reading and cooking
Cultural & Ethnic Minority Factors	▪ Migration & Acculturation: Shift away from traditional diets
Digital Era Vulnerabilities	▪ Systemic Vulnerability: All consumers can be at risk ▪ Misinformation: Manipulative online content ▪ Low Digital Literacy: Increases exposure to misinformation
Food Security vs Nutritional Security	▪ Access vs Quality: People may consume enough calories but lack nutrients ▪ Healthy and Sustainable Diets: Often cost more, especially in low-income contexts ▪ Global Inequities: Disparities in affordability and access to healthy food

3 Qualitative survey: interviews with public health and nutrition experts

3.1 Scope and Specific Objectives

The aim of this qualitative survey was to understand the features of vulnerability that affect adherence to healthy and sustainable dietary habits. This includes exploring the needs, barriers, and drivers influencing dietary choices, as well as the use of nutrition-related digital tools to develop a valid assessment of nutrition-related vulnerability. The interviews were implemented in the three pilot countries of the DietWise project (i.e., Belgium, Greece, Lithuania). The specific objectives are summarized as follows:

- To understand the primary and secondary characteristics of citizens that are considered vulnerable in terms of adopting healthy and sustainable dietary habits.
- To understand the needs, barriers and drivers of vulnerable citizens to adapt health and sustainable dietary habits.
- To understand the level of understanding, preferences, intentions, behavioral aspects and the efficiency of existing nutrition-related tools and apps with regards to vulnerable citizens.

3.2 Profile of experts

The profile of the expects considered in this study included:

- Nutrition experts occupied in the public health field.
- Nutrition experts specialized in the development and testing of digital tools in the field of nutrition education.
- Public health practitioners working in the field with specialization in vulnerable citizens (i.e. adults of low socioeconomic status, food insecure households, minorities etc.).

3.3   Vulnerable citizens

Based on the desk research, in this category, we will include the following individuals:

- Youth (18-21 years)
- Older adults (60+ years)
- Food-insecure households
- Adults with low socioeconomic status
- Minorities

Poor nutrition and digital literacy are also considered elements of vulnerability in terms of adaptation to health and sustainable dietary habits.

3.4   Interview Guide

A common interview guide was shared with all participating partners. The guide is presented in **Annex I**.

3.5   Interview Analysis

3.5.1   Background and General Context

To ensure a diverse and representative perspective on the examined questions, experts were purposefully selected from three countries: Belgium, Greece, and Lithuania. The selection strategy aimed to include experts from various backgrounds, including academia, clinical practice, public health administration, and health communication. This approach enabled a balanced mix of roles, encompassing policy development, education, practical application, and public engagement.

In total, fifteen (15) experts were interviewed: five (5) in each partner country -Belgium, Greece, and Lithuania. To maintain anonymity, interviewees are identified by coded labels. The profile of the participants in each country is presented in detail below:

Belgium

The interviewed experts share a common goal of improving nutrition among vulnerable groups, though their backgrounds and approaches differ. **One expert** from a public health organization focuses on food inequality and supports communities indirectly through collaboration with intermediaries. **Another,** with a background in social work, works at the Flemish Institute of Healthy Living, guiding professionals on health policies and projects like Kleurrijk Gezond. **A third expert,** a dietitian and health promoter at community health centers, provides practical, accessible nutrition advice to individuals from diverse backgrounds. **Another specialist** works to prevent malnutrition in older adults and migrants by supporting local services that integrate healthy eating into daily life. Lastly, **two academic** experts from University College VIVES focus on elderly nutrition and sustainable food initiatives, developing tools and materials that translate scientific knowledge into practice and advocating for better integration of nutrition in health strategies. **Although not all experts help create national nutrition guidelines, they support their implementation through training, educational tools, and tailored projects.** They adapt the guidelines to real-life settings like schools and care homes, using tools such as Nutri-Score and the food triangle. Their combined efforts help make healthy eating more practical, accessible, and evidence-based for diverse populations.

Lithuania

The experts described all play active roles in promoting nutrition guidelines, particularly among children and youth. **One expert** works in public health services, conducts school-based activities on topics ranging from healthy eating to eating disorders, using methods like lectures, discussions, and group work. **Another one** is a nutritionist, focuses on encouraging healthy, balanced eating habits in children through interactive workshops and hands-on activities in kindergartens and schools. **The third expert** combines roles in public health and nutrition, leading educational sessions and projects for preschoolers while, also offering consultations for youth and adults. **Another specialist**, a public health nutrition coordinator, provides online training for parents and school staff, mainly via Microsoft Teams, and also creates video recipes shared on YouTube. **The last one** serves as a coordinator and a dietitian, promoting health literacy through educational activities focused on nutrition for preschoolers, youth, and their parents.

Greece

The first expert is a University Professor who has been actively involved in national nutrition policy in Greece. He was a member of the Scientific Committee that developed the first official Dietary Guidelines for all age groups and currently participates in updating the recommendations for infants, children, and adolescents. He has also served on several Ministry of Health committees and is now part of both the Public Health Experts Committee and the National Nutrition Committee. **The second one** is also a University Professor who works as a co-director at WHO for nutrition and health issues, is a former member and co-director of the National Nutrition Guidelines, and an active member of the current guidelines' writing team. **Another specialist** is a dietitian primarily engaged in research and nutritional data to support food policy. They have contributed to the development of FBDG through work with EFAD on obesity and in collaboration with the

FAO on the consistency of alternative proteins. At the corporate level, they have worked on nutrient profiling. They are well-acquainted with using FBDGs and have published a scoping review focused on FBDGs with the aim of developing a snack product. **The fourth expert** is a Clinical Nutritionist-Dietitian currently working at Sotiria General Hospital for the past two years (public hospital). With over a decade of experience in public health and the promotion of healthy nutrition, they have also contributed as a member of the writing team for the Greek National Dietary Guidelines. **The last expert** is a Public Health Doctor and Occupational Physician. They served as a Senior Official at the Ministry of Environment, Physical Planning and Public Works at the Ministry of Health and for several years as the Head of the General Directorate of Public Health and Quality of Life until her retirement. Due to their position, they have represented Greece in several fora at the WHO and the European Union on issues related to public health including healthy nutrition.

3.5.2   Identification of needs, barriers and facilitators of vulnerable groups in terms of nutritional habits

Identification of vulnerable groups in terms of nutritional habits

In **Belgium**, participants referred to the following vulnerable groups in terms of nutritional habits:
- **People with a migration background** are vulnerable due to unfamiliarity with the local food environment and migration-related stress, rather than lack of cooking skills or nutrition knowledge.
- **Individuals facing food insecurity, especially those with low income,** often struggle with healthy eating habits (e.g. users of social grocers, recipients of increased reimbursements, people with unstable housing).
- **Older adults (65+), particularly those living alone,** in care facilities, or with physical limitations, are considered nutritionally vulnerable.
- **People with low education levels or limited health literacy** are at risk, often overlapping with other vulnerable groups.
- **People with mental or physical disabilities** often face barriers to healthy eating due to limited coping skills or functional impairments.

In **Lithuania**, participants mentioned the following vulnerable groups:
- **Adolescents, especially girls,** are highly vulnerable due to the influence of social media and distorted beauty standards, leading to risks like eating disorders and self-harming behaviors.
- **Children from low-income families, those with special educational needs, and those in food-insecure households** often lack access to diverse, nutritious food and rely on institutional meals.
- **Elderly individuals** face challenges such as reduced mobility, lower income, and social isolation, all of which negatively affect their nutrition.
- **People with low socioeconomic status** often have limited access to healthy, affordable food, resulting in greater consumption of processed, low-nutrient foods.

In **Greece**, participants referred to the following vulnerable groups:
- **Infants** are a key group, as their nutrition depends entirely on parents and healthcare professionals. There are concerns about ready-made baby foods and snacks, as marketing practices often compete with breastfeeding.
- **Pregnant and breastfeeding women** also form a vulnerable group, as the information they receive about nutrition is often conflicting.
- **Young people (15–25 years old)** often adopt poor dietary habits due to a lack of knowledge, the influence of social media, peer pressure, and low autonomy.
- **Older adults (60+ years)** are frequently socially isolated and may have low pensions, mobility or cognitive impairments, chewing difficulties, and limited access to fresh food or digital tools.
- **Households experiencing food insecurity** face challenges regarding both the quantity and quality of food. They often rely on cheap, energy-dense but nutrient-poor options.
- **Low SES adults** tend to lack nutritional knowledge, experience chronic stress, work long hours, and opt for quick, inexpensive food solutions.
- **Minorities and migrants** may struggle with language barriers, limited cultural integration, and are often excluded from prevention or awareness programs.

Similarities and differences among partner countries related to vulnerable groups
Similarities

Older Adults: All three countries identify older adults as nutritionally vulnerable, especially due to factors like social isolation, physical limitations, low income, and limited access to fresh or healthy food.

Low Socioeconomic Status (SES): Vulnerability due to low SES is mentioned in all countries, with challenges such as limited access to healthy food, financial constraints, and a tendency to rely on cheap, low-nutrient options.

Food Insecurity: Households experiencing food insecurity are highlighted in Belgium, Lithuania, and Greece, all facing difficulty accessing both sufficient and nutritious food.

Migrants/Minorities: Belgium and Greece both mention migrants and minorities as vulnerable groups, mainly due to language barriers, cultural differences, and exclusion from nutritional programs.

Adolescents (especially girls): Specifically mentioned in Lithuania as highly vulnerable due to social media pressure and the risk of eating disorders and self-harming behavior. This focus is less pronounced in the other countries.

Infants and Pregnant/Breastfeeding Women: Only Greece highlights infancy and reproductive-age women as vulnerable, particularly due to reliance on external information and marketing pressures competing with breastfeeding.

Children with Special Educational Needs: Mentioned only in Lithuania as vulnerable, particularly in relation to low-income and food-insecure households.

People with Disabilities: Only Belgium emphasizes the vulnerability of individuals with physical or mental disabilities, citing functional limitations that affect healthy eating.

Digital Exclusion: Noted specifically in Greece, where older adults are described as having limited access to digital tools that could support nutrition-related decisions.

3.5.2.1   Needs of vulnerable groups in terms of nutritional habits

Based on Belgian testimonies, one of the most critical needs across all groups—vulnerable or not—is access to affordable, healthy food. Without financial accessibility, even the most well-designed dietary guidelines are unlikely to be effective. In addition, **cultural sensitivity** plays a crucial role in the success of nutritional interventions. Materials and programs should reflect the familiar food habits, languages, and traditions of each group to ensure better engagement and effectiveness. **For vulnerable groups specifically, practical and tailored advice is essential.** These populations respond best to concrete tips, visual aids, and hands-on demonstrations, rather than abstract guidelines on what they should or should not eat.

However, each subgroup has distinct needs. People with a migration background require support in navigating the Flemish food environment and benefit from reassurance that their traditional foods can still be incorporated into a healthy diet. Older adults, who often require high-protein meals and softer food textures, also benefit from social initiatives such as dining events at local service centers to reduce isolation. Individuals living in poverty can be supported through free or low-cost services, access to basic cooking equipment, and skill-building workshops that help them gain autonomy over their food choices. Finally, psychologically vulnerable individuals benefit from low-pressure, positively framed interventions that recognize their mental burden and provide simple, low-threshold dietary advice.

In Lithuania, participants argued that vulnerable groups have several key needs related to dietary habits. **First and foremost is the need for low-cost food and reliable access to nutritious meals**, ensuring basic food security. There is also a strong need for **age-appropriate food literacy education**, along with support from caregivers and teachers, to help individuals make healthier choices from a young age.

Encouraging involvement in meal planning and preparation can further enhance nutritional awareness and autonomy. Since digital literacy is often limited, any **digital tools or resources should be simple, visual, and easy to navigate.** Additionally, **improving both food literacy and digital literacy is essential**, as they are closely linked to informed decision-making and long-term healthy eating habits.

Participants in Greece stated that different vulnerable groups require specific forms of support to improve their dietary habits:

- **Young people** need practical nutrition education (e.g., how to make simple and healthy snacks) and help developing critical thinking around diet trends. Reaching them through familiar digital platforms like TikTok and Instagram is key to effective engagement.
- **Older adults** would benefit from government support for obtaining and preparing meals, as well as simple, accessible dietary guidelines. Improving digital literacy, such as how to shop for food online, is also important.
- **Households experiencing food insecurity** require access to affordable, nutritious food options. This can be supported through financial aid, food vouchers, or special offers. Educational programs on how to choose and store food with limited resources are also needed.
- **People of low socioeconomic status** need a combination of time-flexible solutions, financial assistance, practical dietary advice, and nutrition education. Community or workplace-based programs can be effective in building knowledge and skills.
- **Minority groups** need multilingual resources and culturally appropriate dietary recommendations. Interventions led by individuals from within their own communities can increase trust and participation.

Cultural attitudes and economic conditions shape eating habits across these groups. For example, red meat is often associated with social status, while sugary drinks and juices are widely consumed across age groups.

Similarities and differences among partner countries related to the needs of vulnerable groups
Similarities

Affordability of Healthy Food: All three countries highlight the importance of access to nutritious, low-cost food as a basic and urgent need across vulnerable groups.

Food Literacy and Practical Education: There is a shared emphasis on the need for education tailored to each group's needs—particularly practical, age-appropriate, and culturally relevant nutrition advice rather than abstract guidelines.

Cultural Sensitivity: All three countries recognize that dietary interventions must respect cultural habits. Belgium and Greece, in particular, mention minority and migrant groups, and the need for culturally adapted support.

Support for Low Socioeconomic Status (SES) Groups: All three countries point to financial difficulties and limited autonomy in food choices for low-SES individuals and stress the need for financial aid, skill-building programs, and community support.

Digital Literacy: Both Lithuania and Greece stress the need for simple, visual digital tools due to limited digital skills. Belgium also refers to the importance of hands-on and visual support, aligning with this point.

Support for Older Adults: In Belgium and Greece, older adults are considered vulnerable due to social isolation, physical limitations, and low digital skills, and benefit from accessible guidelines and social eating initiatives.

Differences

The three countries demonstrate distinct approaches in addressing the dietary needs of vulnerable groups. In Belgium, particular emphasis is placed on supporting people with a migration background by helping them navigate the local food environment while reassuring them that their traditional foods can still be part of a healthy diet. Additionally, Belgium stands out in addressing the psychological dimension of vulnerability, advocating for low-pressure, positively framed dietary interventions for individuals dealing with mental health burdens. The country also highlights the role of social initiatives, such as communal dining for older adults, to combat social isolation. **In contrast, Lithuania** focuses strongly on ensuring basic food security, particularly among children and youth. The country emphasizes early, age-appropriate food literacy education and encourages participation in meal planning and preparation to foster autonomy. It also identifies a strong connection between food and digital literacy, stressing the need for simple, visual digital tools. **Meanwhile, Greece** provides a more segmented and detailed approach, tailoring interventions for specific groups such as youth, the elderly, low-income households, and minorities. It highlights the use of social media platforms like TikTok and Instagram to engage younger audiences and emphasizes culturally specific dietary habits—such as the symbolic value of red meat or the preference for homemade sweets. Greek participants also note that fast food delivery is not widely prevalent and is culturally perceived differently than in other contexts.

3.5.2.2 Barriers of vulnerable groups in terms of nutritional habits and mitigation strategies

In Belgium, participants stressed that several barriers prevent vulnerable groups from adopting healthier dietary habits. **Financial constraints** limit both food purchasing and access to essential services like dietitians. **Distrust in institutions—driven by fear of judgment or misunderstanding from healthcare professionals—**also hinders engagement. **Furthermore, language barriers and low literacy levels** can prevent individuals from understanding nutritional information and guidance. **Psychological stress, including lack of time, mental energy, or capacity,** is another widespread obstacle to focusing on healthy eating. **Lastly, digital exclusion, especially among older adults and socio-economically disadvantaged individuals**, was highlighted by most experts as a major barrier to accessing nutritional resources and support.

To address the identified barriers, several practical strategies have been proposed. **Building trust** by engaging peers or familiar local figures and providing non-judgmental support is a key approach to increasing acceptance and participation. Additionally, **the use of accessible communication formats**—such as simple visuals, translated materials, videos, and printed guides—can significantly improve understanding and engagement. Another important strategy involves **offering low-threshold, free or low-cost services in familiar and frequented locations** such as local service centers, pharmacies, or family doctors, making access easier for vulnerable populations.

In Lithuania, several key barriers **affect children's and families' access to healthy relationships, accurate information, and supportive environments.** These include a lack of reliable information, weak family or peer relationships, and feelings of isolation. Many parents face time constraints, limiting meaningful interaction with their children. **Additionally, digital inequality and low digital or food literacy among caregivers create further challenges. Teachers are also often overwhelmed,** making it difficult to implement extra initiatives. **Finally, the overload of online content**—often misleading—makes it hard for families to find trustworthy guidance.

To address these issues, targeted strategies are needed. **Clear, accessible communication** through trusted channels (schools, community groups) can improve awareness. **Programs that build strong family and peer connections**, such as mentoring and family workshops, help reduce social isolation. **Providing access to digital tools, the internet,** and basic training for caregivers, can reduce inequalities. **For teachers, ready-to-use, time-efficient materials** can ease implementation. Finally, **media literacy education**, reliable online content can help families navigate digital spaces safely and effectively.

In Greece, several challenges limit the effective use of digital tools and access to support among vulnerable populations. These include **digital illiteracy,** which prevents individuals from navigating online resources; **a lack of trust in digital tools or technology,** often due to unfamiliarity or negative past experiences; **and linguistic and cultural barriers,** which make generic tools inaccessible or irrelevant to certain communities. Additionally, **financial constraints** pose a significant barrier, particularly when tools or services require payment or when users lack basic resources like internet access or devices.

To address these issues, targeted and inclusive solutions have been proposed. **Digital illiteracy** can be tackled through education provided by social services or peer-to-peer support, promoting confidence and basic skills. **Building trust in**

technology requires credible endorsement by health institutions and professionals. Linguistic and cultural barriers can be reduced by **co-designing tools with members of the target groups** to ensure relevance and accessibility. Finally, financial barriers should be addressed by **offering free tools and connecting users to food assistance programs and other support services**.

Similarities and differences among partner countries
Similarities

All three countries—**Belgium, Lithuania, and Greece**—identify vulnerable populations as facing **multiple, overlapping barriers** to adopting healthier habits and accessing support services. A **lack of trust** in institutions or tools is a recurring issue, whether it's due to fear of judgment by healthcare professionals (Belgium) or skepticism toward digital platforms (Greece). **Digital exclusion and low digital literacy** are also consistent concerns, particularly among socio-economically disadvantaged groups and older adults. **Financial constraints** appear in all three countries, limiting access to nutritious food, services, or digital tools. Additionally, there is a strong emphasis on **accessible communication**, such as using visuals, translations, or simple formats, and on **building trust** through peers, local actors, or credible institutions. Each country also proposes **low-threshold, community-based interventions** as essential for increasing engagement.

Differences

Despite these similarities, each country highlights **context-specific challenges**. In **Belgium**, psychological barriers such as stress, time scarcity, and emotional overload are emphasized more than in the other countries. There is also a stronger focus on **institutional distrust in the healthcare system**, and on **language and literacy issues** as direct barriers to understanding nutritional advice. In **Lithuania**, the emphasis shifts toward **family dynamics** and **parent-child relationships**, with time constraints for parents and teachers playing a central role. Lithuania also highlights the **overload of online information** as a unique barrier. In **Greece**, the challenges are more **technology-focused**, including digital illiteracy, mistrust in tools, and cultural/linguistic mismatches between services and users. The Greek context puts more weight on **co-designing solutions** with the target population and involving **health institutions** to build digital credibility.

3.5.2.3   Facilitators in terms of nutritional habits

In Belgium, building on trusted relationships with familiar figures—such as general practitioners, pharmacists, or local volunteers—was identified as a key enabler for promoting healthier dietary habits among vulnerable groups. **Group-based activities**, including cooking sessions and workshops, were also seen as valuable for strengthening motivation, reducing isolation, and improving practical skills and product knowledge.Experts emphasized the use of **positive messaging and encouragement**—rather than fear-based approaches—as a more effective strategy to inspire lasting behavioral change. However, there was a notable divergence in views regarding the role of **digital tools**. While some experts advocated for digital resources (e.g. multilingual videos or goal-oriented apps), others stressed the importance of **offline approaches**, particularly for groups with low digital literacy or privacy concerns.

In Lithuania, supporting children in adopting healthy habits requires a **holistic and multi-level approach**. Key factors include **parental support and knowledge**, as well as **active involvement from the school community**. Continuous access to **motivating and reliable information**, alongside promoting **body acceptance, critical thinking, self-esteem, and resilience**, are essential components. Encouraging **quality leisure time**, participation in **after-school activities**, and fostering **student engagement** can further enhance overall well-being. Effective strategies involve the use of **visual and gamified educational content**, **culturally appropriate and age-specific materials**, and **hands-on learning experiences** such as gardening or cooking. A **supportive school environment**—combined with the involvement of caregivers and educators—can reinforce positive messages. **User-friendly tools** and **educational activities**, including training for parents and staff and **cooking workshops for children**, also play a key role in making learning practical, enjoyable, and impactful.

In Greece, participants stated that effective interventions for vulnerable populations require **free, easy-to-use tools and applications** with **tailored content** that respects users' **language, cultural context, and financial limitations**. Features like **personalized goal-setting, reminders**, and **positive reinforcement**, as well as **integration with healthcare and social support services**, enhance engagement. Despite the existence of various programs, **limited awareness—even among professionals—remains a major barrier**. Many initiatives are launched but not sustained. There is a need for a **coordinated network** to disseminate guidelines via ministries, professional associations, and workplaces. Primary care settings offer a more accessible entry point, while private pediatricians remain harder to reach. A **dual campaign**—targeting both professionals and the general public—could help bridge these gaps, with **universities** contributing through relevant academic departments. Experts emphasize that **practical, hands-on methods** are more effective than abstract motivational strategies, especially for vulnerable groups. Interventions must **accept current eating habits** and work at a **substitution level**, offering realistic, cost-conscious alternatives. Digital tools may be perceived as distant or inaccessible, particularly when affordability is a major barrier. Instead, the focus should shift toward **skill-building activities**, such as simple cooking ideas tailored to participants' real-life constraints. The concept of **stigma-free, low-effort participation** is

essential, and success lies in providing **concrete, relatable examples** that meet people where they are—without judgment or unrealistic expectations.

Similarities and differences among partner countries
Similarities

All three countries highlight the importance of **practical, community-based approaches** and **trust-building** when working with vulnerable populations. In **Belgium** and **Greece**, establishing **trusted relationships**—whether with healthcare professionals, volunteers, or social service providers—is seen as essential. **Hands-on learning**, such as cooking sessions or workshops, is promoted in all three settings as a way to **build skills**, **motivate participants**, and **reduce social isolation**.

Another common theme is the recognition that **digital tools** can be helpful, but must be **accessible, user-friendly, and culturally adapted**. Across all countries, there is **caution about over-relying on digital approaches**, especially given concerns around **digital literacy, privacy, and affordability**. Additionally, all countries stress the importance of **positive messaging** and **encouragement** over fear-based strategies to support behavior change.

Differences

In **Belgium**, the focus is on **trusted local actors** and **group-based activities** to address dietary habits, with some disagreement among experts on the role of digital tools. Belgium emphasizes **community trust** and **flexible access**, especially for (older) adults.

In **Lithuania**, the emphasis is more **child- and school-centered**. Strategies are built around **parental involvement**, **school support**, and **developing emotional and cognitive skills** (e.g., self-esteem, critical thinking). The Lithuanian approach is broader in scope, addressing both **health literacy and emotional well-being** within a **structured educational environment**.

In **Greece**, there's a strong focus on **structural barriers**, such as a **lack of continuity of programs**, **limited awareness among professionals**, and **the need for institutional coordination**. Practicality and **cost-sensitive substitution strategies** are emphasized more than in the other countries. There is also a notable critique of **digital tools as potentially alienating**, and a push toward **very simple, stigma-free, real-world approaches** tailored to everyday challenges.

3.5.3   Existing promotion systems for vulnerable target groups

Roles of key stakeholders

Interviews in Belgium revealed a strong consensus on the importance of **multi-actor collaboration** for successful project implementation, though the **level of involvement varies** among stakeholders:
- **Government and Local Authorities:** Play a central role by providing **policy support**, **infrastructure**, and **funding** (e.g., subsidies for community-based initiatives).
- **NGOs:** Serve as key actors in **community outreach**, **trust-building**, and **culturally sensitive implementation**. They are often on the front lines of delivering effective, grassroots interventions.
- **Private Sector:** Has a more limited role, typically supporting **logistical aspects** such as distributing healthy products (e.g., recipe boxes via supermarkets). However, experts noted that the private sector is **not yet systematically engaged** in long-term or strategic health promotion efforts.

Lithuania

Interviews in Lithuania revealed the important role of government and public health sector:
- **Government and Local Authorities:** The government plays a central role by **announcing legal acts** and **developing national nutrition guidelines**. Ministries such as the **Ministry of Health** and **Ministry of Education** are responsible for **creating public health campaigns**, **supporting educational programs**, and **implementing policies** aimed at improving nutrition standards, particularly for children. A significant initiative is **School Feeding Programs**, such as the **EU School Fruit, Vegetables, and Milk Scheme**, which provides free nutritious food to students.
- **NGOs:** Such as **Public Health Bureaus**, play an important role in **monitoring health indicators**, **carrying out educational activities**, and **implementing projects**. They cooperate with **polyclinics**, **organize public events**, and offer **consultations** for organizations, educational institutions, and participants involved in various health-related initiatives.
- **Private Sector:** The private sector contributes through **consultations**, **information dissemination**, and the **preparation of individualized meal plans**. It also participates in initiatives like **School Feeding Programs**, providing logistical support. However, its role is more limited compared to the government and NGOs.

In **Greece**, the roles of **government, private sector**, and **NGOs** are all essential in promoting healthy nutrition, each complementing the others:

- **Government** plays the most significant role, particularly by developing **national guidelines** that carry authority and are widely accepted. These guidelines are crucial for ensuring **consistency** and **credibility**. As the official body, the government must clarify any conflicts between different recommendations, such as those from **scientific societies**, to ensure national standards take precedence. It is also essential that the government ensures **broad and frequent dissemination** of these guidelines. The government should **promote**, **evaluate**, and integrate the initiative into **permanent structures** that are accessible to vulnerable populations, ensuring the long-term sustainability of efforts.
- **NGOs** have a key role in **accessing vulnerable groups**, thanks to their proximity and daily interactions. They are often involved in **research**, **community outreach**, and **culturally sensitive dissemination**. Their **on-the-ground presence** allows them to provide personalized support, such as translating materials into different languages. However, their capacity to represent and engage vulnerable groups effectively depends on their internal structure and resources.
- **Private Sector** plays a **supportive role** but faces challenges. While the private sector is primarily driven by **profit motives**—particularly in the food industry—there are opportunities for **corporate responsibility** efforts. **Food companies** could contribute by supporting dissemination, helping with networking, or through initiatives focused on **social responsibility**. However, they are less likely to actively participate in academic or evidence-based interventions. The **food industry**, especially, is considered less **useful** for promoting healthy habits due to potential conflicts of interest.

Similarities and differences among partner countries

While the general roles of government, NGOs, and the private sector are similar across the three countries, there are significant differences in the focus and depth of involvement of each stakeholder. The government plays a stronger, more defined role in Greece and Lithuania by developing national nutrition guidelines and implementing School Feeding Programs, whereas in Belgium, the focus is more on local policy support and community-based initiatives was also added. **The private sector's role is similarly limited** but varies in its nature across countries, while **NGOs are consistently crucial for community engagement and culturally sensitive delivery,** but the scope of their involvement depends on the local context and resources available.

3.5.3.1 Current strategies for promoting compliance and their effectiveness

In Belgium, several strategies were identified as key to promoting healthier dietary habits among vulnerable groups across the interviews. A common theme was the importance of **local and low-threshold interventions**, which seamlessly integrate into individuals' daily routines and environments. Examples include:

- **Community-based initiatives**, such as "Ratatouille" sessions for families, the Kleurrijk Gezond group programs, and **budget cooking workshops** organized by welfare centers like OCMW.
- **Meal-related interventions**, including **soup cafés** with pay-what-you-can models, the distribution of **healthy recipe boxes** (e.g., "In 1,2,3 euro aan tafel"), and cooking workshops by organizations like **Velt** and **SAAMO**.
- Municipalities also work on developing programs, often under frameworks like **Gezonde Gemeente** (Healthy Municipality), or those facilitated by local service centers.
- **Digital approaches** like **Nutri-Score promotion** and online food guidance were mentioned, but with a note of caution regarding their reach, especially due to low digital literacy in some groups.

The effectiveness of these strategies was evaluated based on their ability to foster **social connection**, **dignity**, and **practicality**, rather than simply offering top-down informational campaigns. The most effective interventions were those that promoted **community involvement** and allowed for social interactions. Key examples include:

- **Shared meals**, **taste-testing sessions**, and **community gardening**, which helped improve social cohesion and motivated individuals to adopt healthier habits.
- Programs like **"Lekkers op school"** showed positive outcomes, not just in **dietary behavior** but also in **school performance**.
- Interventions held in trusted environments, such as **mosques**, **schools**, or **local service centers**, were considered more **sustainable** and better received, creating a higher likelihood of lasting impact.

However, concerns were raised about the **scalability** and **sustainability** of these programs. Many local initiatives depend on **short-term funding**, which limits their long-term impact and potential for broader implementation.

In Lithuania, strategies to promote healthier dietary habits include l**ectures, debates, quizzes, and national programs** like free school meals, school fruit schemes, and milk programs. Additionally, NGOs and municipal projects run **educational activities, cooking workshops, and games.**
These strategies have led to positive outcomes, such as 80% of primary school **children eating fruits and vegetables daily** and 76% consuming dairy. Nearly 47% choose **fruits or vegetables as snacks. Children also retain and share**

healthy eating knowledge with their parents, and projects where they grow and cook vegetables have improved both knowledge and acceptance of healthy foods.

In Greece, the key programs and actions by various sectors are the following, based on participants arguments:
- **Government Actions**: The government supports initiatives like the **"Household Basket"** (economic strategy for access), **EFET's nutritional guidelines**, and **NSRF-funded programs** for school and vulnerable group feeding.
- **National Action Against Childhood Obesity**: This national program targets children and families, promoting healthy eating and physical activity. It strongly emphasizes primary prevention in schools and communities, as well as secondary and tertiary prevention of childhood obesity.
- **NGO Actions**: **PROLEPSIS** and **Boroume** are key examples of successful NGO-led programs. Boroume focuses on food-waste. The DIATROFI program by Prolepsis focuses on providing food assistance to vulnerable groups while also promoting nutritional education. It plays a key role in improving food security for vulnerable populations and integrating health education to ensure long-term positive dietary changes.
- **Church and Community Involvement**: In many communities, the church plays a role in outreach and education, contributing to the spread of nutrition-focused interventions.

The most successful interventions in Greece are those with the following characteristics:
- **Central Coordination by the State:** The involvement of government bodies in coordinating interventions ensures consistency and wide acceptance. Experts and professionals from diverse fields (e.g., nutritionists, health communication professionals) are crucial to the program's success.
- **Clear, Simple Recommendations:** Success depends on formulating dietary guidelines in a way that is easily understandable for the general population, particularly vulnerable groups.
- **Media Involvement:** Engaging the media in disseminating interventions ensures wider reach, especially for promoting healthy eating behaviors in a relatable manner.
- **Health Education:** Educational initiatives aimed at children, students, and their families help in creating lasting behavior changes, while experiential activities like cooking workshops further support these efforts.

3.5.3.2 Implemented behavioral interventions and "success stories"
In Belgium, behavioral interventions combine **structural support, nudging, and education:**
- **Subsidized or free meals** (e.g., school meal programs)
- **Public campaigns** (e.g., Week of the Pulse)
- **Health promotion in schools and daycare centers**
- **Cooking and gardening workshops with active participation**
- **Visual tools and food labeling** (e.g., Nutri-Score, educational placemats)

The following factors together promoted **lasting behavior change and broader participation, especially in vulnerable groups:**
- **Community-based approaches:** Increased relatability, reduced stigma
- **Empowerment over restriction:** Motivated behavior change without pressure
- **Cultural sensitivity:** Respect for food traditions enhanced engagement, especially in migrant populations
- **Trusted settings and individuals:** Familiar environments (e.g., schools, local centers) and known figures (e.g., teachers, health workers) increased trust and acceptance

In Lithuania, the focus has been primarily on school settings:
- **Food tastings** to expose children to new, healthy options
- **Increasing nutrition literacy** through programs, including the use of the "keyhole" symbol for healthy food choices
- **Cooking classes and practical activities** that engage children in learning about healthy foods
- **Visual food diaries and reward systems** to encourage children to try new foods
- **Educational training for parents and school staff** on meal organization and healthy eating
- **Digital tools like video recipes shared on platforms** (e.g., YouTube) to make nutrition education more engaging
- **School feeding programs that promote healthy snacks and balanced meals**, encouraging children to choose fruits, vegetables, and dairy products

The most effective interventions are those **that promote emotional connection and relevance to the students' everyday lives:**
- **Discussions, group activities, and creative contests** were particularly successful in engaging students
- **Cooking and tasting activities** foster engagement and encourage children to try new foods
- **Support from peers and adults in the school environment** was a crucial factor in ensuring the interventions' success

In Greece, the following **behavioral interventions were mentioned by the participants:**

- **Cooking educational workshops:** These workshops teach practical cooking skills to help individuals prepare healthier meals with accessible ingredients.
- **Distribution of vouchers:** Vouchers are provided to encourage healthy food choices by making nutritious options more affordable.
- **Empowerment through group activities**: Initiatives like community gardens engage people and empower them to take control of their food choices in a collaborative, hands-on way.
- **DIATROFI by PROLEPSIS:** A program focused on improving nutrition in vulnerable populations by providing structured, practical support and resources.

The key success factors were mentioned as follows:

- **Community-based approach:** Success is often driven by the approach rooted in the community, ensuring accessibility, trust, and engagement. People are more likely to participate when interventions feel familiar and relevant to their everyday lives.
- **Involvement in design:** Involving the target groups in the design of the interventions enhances their sense of ownership and ensures the actions are tailored to their specific needs.
- **Consistency and monitoring:** Ongoing support and tracking progress are essential for maintaining engagement and ensuring long-term success.
- **Practical skills and action:** Interventions that focus on practical skills (e.g., how to cook healthy meals, use vouchers, or grow food in community gardens) are more engaging and effective. It's crucial that these interventions feel real and actionable, without adding a burden or stigma to the participants.
- **Avoiding stigma:** Programs that bypass the stigma often associated with health interventions are more successful. If people do not feel judged or forced into health discussions, they are more likely to engage in behavior changes when they feel ready.

Similarities and differences among partner countries
While the three countries share a strong foundation in community-based, participatory interventions, each has adapted its approach to meet the specific needs of its population. Belgium focuses on broader public campaigns and school health promotion, Lithuania prioritizes school-based initiatives and nutrition literacy, and Greece combines practical skills development with targeted support for vulnerable groups, including the use of vouchers and community gardens. **The key to success across all interventions lies in their ability to be relatable, culturally sensitive, and aligned with participants' everyday realities.**

3.5.3.3   Addressing cultural and societal barriers
In Belgium, participants argued on the following cultural and societal barriers of vulnerable populations:

- **Mistrust in institutions:** Vulnerable groups often do not trust institutional efforts.
- **Language barriers:** Individuals without proficiency in the local language struggle to participate.
- **Fear of stigmatization:** People in poverty or with health issues fear being stigmatized.

They mentioned the following strategies for overcoming barriers:

- **Culturally sensitive communication:** Using appropriate messages that respect cultural traditions.
- **Community involvement in design:** Engaging participants in the design of programs.
- **Offering choices:** Providing different options to respect participants' autonomy.

Lithuanian participants mentioned the following strategies that foster trust, participation, and long-term impact:

- **Encouraging open dialogue and critical thinking:** Engaging individuals in discussions that promote self-reflection and understanding, helping them question unrealistic norms.
- **Promoting media literacy:** Educating students on how to critically analyse media and societal expectations, reducing the influence of unrealistic beauty standards.
- **Building self-esteem:** Supporting students in developing confidence helps lessen the impact of negative social influences.
- **Involving families:** Adapting educational content to local food cultures and engaging families in the process creates a supportive environment for behavior change.
- **Using non-judgmental language:** Communication should be inclusive and respectful, avoiding stigmatization and allowing individuals to feel comfortable in their journey.
- **Flexibility and inclusivity:** Approaches should be adaptable and inclusive, respecting diverse cultural backgrounds and ensuring relevance to all participants.

In Greece, to effectively implement interventions among vulnerable groups, the following strategies were mentioned:

- **Co-creation with target groups:** Involving communities in designing content ensures relevance and builds ownership.
- **Cultural adaptation:** Recipes and materials should reflect traditional dietary habits to increase acceptance.

- **Use of community health mediators:** Engaging mediators from the same background improves trust, communication, and cultural sensitivity.
- **Multilingual and visual materials:** Providing content in native languages and using simple visuals ensures accessibility, regardless of education level.
- **Acknowledge real-life contexts:** Focus on achievable changes and everyday situations rather than ideal outcomes to keep interventions realistic and motivating.

Similarities and differences among partner countries
Similarities
Cultural sensitivity & adaptation: All three countries emphasized the need to respect cultural traditions through adapted recipes, inclusive language, and tailored messaging.

Community involvement: Co-designing programs with the target groups was highlighted as a key to building trust and ensuring relevance.

Non-judgmental communication: Avoiding stigma and promoting dignity were common themes, especially important for engaging vulnerable populations.

Accessibility: Use of multilingual materials, simple visuals, and trusted intermediaries helped overcome language and literacy barriers.

Differences
Belgium: Emphasized autonomy and providing multiple choices and focused on culturally respectful communication.
Lithuania: Highlighted media literacy, emotional resilience (self-esteem), and family engagement.

3.5.4 Tools and applications for nutrition (digital tools) for vulnerable target groups

Existing digital tools for nutrition promotion and "successful ones"
In Belgium participants mentioned the following tools:
- **"Zeker Gezond" app and "Gezond Leven" website:** Widely used and appreciated for being accessible and promoting healthy eating.
- **Other tools:** Examples like a Dutch protein screening tool exist but these are not tailored to vulnerable groups. Supermarkets (e.g., Albert Heijn) use digital nudges and printed materials, though this lacks specific targeting.

For Belgian participants, simple, friendly, and supported tools work best, especially when paired with human guidance:
- **Simplicity:** Tools that clearly present nutrition information (e.g., Nutri-Score) are more effective.
- **Tone:** A non-judgmental, encouraging tone increases engagement.
- **Gradual change:** Tools promoting small, manageable steps are better received.
- **Trusted guidance:** Personal introduction by a trusted individual improves uptake and sustained use, especially among low-literacy or older populations.

Existing digital tools for nutrition promotion in Lithuania:
- **Apps & online platforms:** *MyFitnessPal*, *Kilo Health*, *Persikas.com*, *Mitybos Dienoraštis*, *Insane Coaching*
- **Interactive tools:**
  - **Simple mobile games for food literacy**
  - **Online educational videos and digital recipe books**
  - **Some schools use interactive nutrition platforms**

Digital tools are most effective when they are age-appropriate, engaging, and address actual knowledge/behavior gaps, especially when paired with personal relevance or support. More specifically:
- **Children:** Tools are effective when they target specific gaps in knowledge or behavior and games and interactive platforms engage children and support behavior change.
- **Adults:** Apps and platforms can be useful when tailored and relevant to users' needs. Success is higher when combined with clear guidance and real-life applicability.

In Greece, interviewees unanimously reported that **they are not aware of digital tools** designed explicitly for vulnerable groups to promote healthy eating. **However,** they argued that these tools might be **potentially effective**, but only **if integrated** with existing support systems (e.g., healthcare or social services). Thedy also mentioned that for true effectiveness, tools should be:
- **Simple and user-driven**
- **Include** push notifications**, food substitutions, and** gamified elements
- Deliver short, practical messages **directly (e.g., to a mobile phone)**

▪ **Designed with** usability in mind **for the general public, not just professionals**

Similarities and differences among partner countries

Despite differences in availability and use, **all three countries recognize the value of digital tools when they are simple, tailored, and combined with personal support. In Belgium and Lithuania, several apps and digital platforms are used to promote healthy eating,** with success linked to clear presentation of information, encouraging tone, and trusted guidance. In Lithuania, tools are often interactive and age-specific, addressing both knowledge and behavior gaps—particularly effective among children. **In Greece, no digital tools specifically targeting vulnerable groups were identified, but experts agreed they could be effective** if integrated into existing support systems (e.g., healthcare or social services). Key success factors include simplicity, user-driven design, practical content delivery (e.g., via mobile), and thoughtful usability for the general public.

3.5.5 Gaps and areas for improvement

In Belgium, digital tools remain underused among vulnerable populations, particularly older adults and individuals with low digital or health literacy. Professionals often rely more on hybrid or offline approaches for these groups. Despite the availability of some tools, interviews across countries highlighted consistent limitations. Many digital tools are not user-friendly for those with limited literacy, due to complex language and unclear navigation. Technical barriers and a lack of cultural adaptation often exclude key user groups. Experts agreed that digital tools should complement—not replace—real-life strategies. Offline methods like brochures, meal cards, or group sessions are still essential and often more effective in engaging vulnerable populations.

In Lithuania, key gaps in the use of digital tools for nutrition promotion include significant differences in digital literacy levels across populations. Parental attitudes toward technology and limited interest among adolescents can reduce engagement, while some families lack access to devices or reliable internet. There is often resistance to screen-based tools for children, especially among those who prefer traditional approaches. Additional barriers include language limitations, strong attachment to traditional food habits, and skepticism toward new technologies or health advice. Addressing these challenges requires culturally sensitive, accessible, and low-threshold solutions that build trust and meet users where they are.

In Greece, interviewees pointed out the lack of digital tools specifically tailored to vulnerable groups. The main limitations include the absence of such tools, the lack of adaptation for users with limited digital or health literacy, such as the use of complex language and poor readability. Additionally, many tools do not connect users to real assistance, like access to food or vouchers, reducing their usefulness. The limited dissemination of dietary guidelines and the lack of awareness even among professionals are also significant barriers. Suggestions for improvement include the creation of tools with simple, practical language, incorporating graphics and symbols for better accessibility, and linking tools to real support systems, such as vouchers for healthy food. It is also recommended to include notifications, personal messages, and features like gamification to encourage user engagement. Health professionals suggest integrating the tools into existing support systems and creating tools that are more accessible and user-friendly, especially for those with lower digital literacy.

Similarities and differences among partner countries

Similarities

▪ All three countries face challenges with the underuse of digital tools among vulnerable populations, especially those with low digital or health literacy.
▪ There is a consistent need for digital tools to be user-friendly, culturally adapted, and easy to navigate.
▪ Professionals in all three countries prefer offline or hybrid approaches, such as group sessions, brochures, or meal cards, due to their higher effectiveness with vulnerable populations.
▪ All experts agree that digital tools should complement real-life strategies, not replace them.

Differences

▪ Belgium emphasizes the need for tools to support vulnerable groups in real-life settings. Still, it is less focused on overcoming access to technology issues, while Lithuania highlights significant barriers like limited access to devices and resistance to screen-based tools.
▪ Greece's main concern is the lack of digital tools entirely tailored for vulnerable groups, with suggestions focusing on integrating simple language, food vouchers, and notifications to increase user engagement, which is less emphasized in Belgium or Lithuania.

3.5.6 Recommendations and Insights

In Belgium, across all interviews, there was a strong consensus that nutrition tools for vulnerable groups must be simplified and specifically tailored to their needs. Visual design and cultural sensitivity were highlighted as critical elements to ensure that the tools are easily understandable. Experts suggested that using more image-based information could enhance accessibility for diverse groups. Incorporating features like multiple language options and alignment with specific dietary needs would further contribute to inclusivity. However, mistrust of digital applications and concerns about data collection were common among certain groups, which led to the suggestion of avoiding login procedures to increase trust and participation.

To better integrate nutrition guidelines into everyday life, experts recommended making them more natural, accessible, and trustworthy by embedding them into daily environments, such as doctor's offices, supermarkets, and community health centers. This would allow people to encounter the guidelines more frequently, fostering a sense of familiarity. Involving intermediaries in this process—such as health professionals—could enhance the effectiveness of the interventions by providing opportunities for people to ask questions and seek additional support. The key focus should also be on motivating individuals and increasing their self-efficacy, empowering them to take control of their health and eating habits.

In Lithuania, the experts argued that, to improve the uptake and effectiveness of nutrition tools and applications, it is essential that they are visually appealing, emotionally engaging, and tailored to the specific needs of the target audience. This includes addressing not just nutrition but broader issues like self-esteem, body image, and media influence. Involving young people in the creation or testing of these tools can enhance their relevance, ensuring they are both engaging and motivational. Additionally, integrating these tools into school activities and working closely with families can help increase their reach and effectiveness. Combining digital tools with hands-on, in-person learning experiences, such as games, storytelling, and food-based crafts, can make the process more engaging and interactive. To ensure inclusivity, these tools must be multilingual, simple to use, and free to access, while regular promotion through educational campaigns and family-focused activities will help maintain long-term engagement.

For better integration of nutrition guidelines into everyday life, it's crucial to make them accessible and natural by embedding them into platforms that people already interact with, such as social media, school communication tools, and popular apps. Presenting the guidelines in an interactive and relatable format, with consistent reinforcement through schools and families, will enhance their visibility and impact. Tools like simple app-based challenges, illustrated booklets, or games can align with guidelines to promote understanding and behavior change. Collaboration between health authorities and app developers ensures the guidelines are accurate and available across widely-used platforms, such as fitness apps and food delivery services. In addition, ensuring these tools are user-friendly and seamlessly integrated into daily routines will be more effective in promoting long-term healthier habits.

In Greece, in order to improve the uptake of tools and applications promoting healthier eating habits for vulnerable target groups, several key interventions should be implemented. First, co-developing these tools with users from the target groups ensures that the solutions are relevant and effective. Incentives like vouchers, rewards, and gamification can make engagement more appealing, especially for younger generations who are more digitally literate. Additionally, in-person training sessions during the initial introduction of the tools can help users understand their functions and value. To ensure broader accessibility, national dietary guidelines should be integrated into existing, widely-used platforms like Google Fit, Viber bots, and Apple Health, allowing seamless access to nutrition advice through familiar tools.

National nutrition guidelines can be better integrated into everyday tools and platforms by using practical, simple, and culturally sensitive methods. For example, communication apps like Viber or SMS can be used to send basic dietary tips, and shopping apps or product labels can incorporate the guidelines to make them more accessible. Visual guides, such as traffic light colors or easy-to-understand food signals, can aid in quick decision-making, and ready-made low-cost meal plans can encourage healthier food choices. Adapting the content for low literacy levels and different languages is essential, as is linking recommendations to daily routines with reminders. Additionally, collaboration with health and social care services, using trained professionals to integrate the guidelines into existing systems, will increase their practical application and relevance for vulnerable populations. Gamification and challenges, like setting fruit and vegetable intake goals with rewards, can further motivate people to adopt healthier eating habits.

3.5.7 Summary

The findings in **Section: identification of needs, barriers and facilitators of vulnerable groups in terms of nutritional habits** highlight the diverse needs and challenges faced by vulnerable groups in terms of nutrition across Belgium, Lithuania, and Greece. While there are common themes—such as the need for affordable, healthy food, cultural sensitivity,

and practical education—each country faces unique barriers and has developed tailored strategies to address them. Effective interventions emphasize trust-building, accessible resources, and community involvement.

Section existing promotion systems for vulnerable target groups examined the current systems and stakeholders involved in promoting healthy nutrition among vulnerable populations in Belgium, Lithuania, and Greece. In all three countries, governments, NGOs, and the private sector play roles of varying intensity and focus. The government has the strongest role in Greece and Lithuania, providing national guidelines and implementing large-scale initiatives like school feeding programs. In Belgium, efforts are more localized, focusing on municipal programs and community-based support. NGOs are central to outreach and cultural adaptation across all countries, while the private sector has a more limited role, mostly offering logistical or consultative support, with limited strategic engagement in public health efforts.

Effective strategies include low-threshold, community-based interventions that are embedded in trusted, everyday settings such as schools, health centers, and religious institutions. In Belgium, successful programs like cooking workshops and healthy recipe boxes emphasize dignity, empowerment, and social connection. Lithuania focuses strongly on school-based interventions and parent-child engagement, which have led to measurable improvements in children's eating habits. Greece employs a mix of structured support (e.g., DIATROFI food aid and education) and hands-on approaches like vouchers and community gardens. Common across all countries are factors such as community involvement in design, cultural sensitivity, practical skills-building, and non-stigmatizing communication. Key barriers like mistrust, language gaps, and stigma are addressed through inclusive strategies such as multilingual materials, visual aids, and the use of trusted mediators. While the approaches differ in scope and emphasis, the success of these interventions lies in making nutrition support accessible, relatable, and empowering.

Concerning **Section: tools and applications for nutrition for vulnerable target groups**, despite differences in the use and availability of tools, all three countries emphasize the importance of digital tools being simple, tailored, and combined with personal support. In Belgium and Lithuania, digital tools like apps and platforms are used to promote healthy eating, with success linked to clear information presentation, an encouraging tone, and trusted guidance. In Lithuania, tools are often more interactive and age-specific, targeting both knowledge and behavior gaps, particularly effective for children. In Greece, the lack of digital tools tailored for vulnerable groups is a significant concern, but experts agree that if integrated with existing systems, these tools could be effective. The focus across all countries is on simplicity, user-driven design, practical delivery, and usability for the general public.

In terms of recommendations, the findings from Belgium, Lithuania, and Greece emphasize the importance of designing nutrition tools that are simple, user-friendly, and tailored to the specific needs of vulnerable populations. Experts in all three countries agree that visual design, cultural sensitivity, and inclusivity are critical for ensuring accessibility. Tools should use clear, image-based information and be available in multiple languages to reach a broader audience. In addition, mistrust towards digital applications and data privacy concerns should be addressed by avoiding login procedures. Furthermore, integrating nutrition guidelines into daily environments like doctor's offices, supermarkets, and community health centers, alongside the involvement of trusted intermediaries, can make these tools more familiar and impactful. Motivation and empowerment are also key elements to encourage individuals to take control of their health.

Concerning the improvement of the uptake and effectiveness of nutrition tools, experts in Lithuania stressed the need for engaging, emotionally appealing tools that address not only nutrition but also broader issues such as self-esteem and body image. Involvement of young people in the development and testing of these tools, along with integration into school activities and family-based strategies, could increase engagement. In Greece, experts highlighted the lack of tools tailored to vulnerable groups and suggested incorporating incentives like vouchers and gamification to boost participation. They also recommended embedding national dietary guidelines into widely used platforms like Google Fit and Viber, and adapting the content to lower literacy levels. Collaboration with health and social services would also improve the practical application and relevance of these tools for vulnerable populations.

3.5.8   Key findings related with the conceptualization of vulnerable citizens

Across Belgium, Lithuania, and Greece, the conceptualization of **"vulnerable citizens"** in the context of nutrition reflects a **multidimensional understanding** that moves beyond mere economic status to include **social, cultural, psychological, and functional factors**. The following key themes emerged:

Vulnerability Is Multifactorial

Participants from all three countries emphasized that vulnerability is **not defined by a single criterion** (e.g. income), but rather a **confluence of factors**, including:

- **Socioeconomic disadvantage** (e.g. low income, food insecurity)

- **Social isolation** (particularly among older adults)

- **Cultural marginalization** (notably migrants and minorities)

- **Limited knowledge or skills** (low health or food literacy, digital exclusion)

- **Life stage or physical/mental conditions** (infancy, adolescence, disability, pregnancy, aging, mental health issues)

Vulnerability Is Context-Dependent

Vulnerability is seen as **shaped by local systems**, including food environments, welfare support, education access, and cultural norms:

- In **Belgium**, vulnerability is linked to **navigating unfamiliar systems** (for migrants), **mental health**, and **institutional barriers**.

- In **Lithuania**, emphasis is placed on **early-age vulnerabilities**, the influence of **digital media on adolescents**, and **limited food autonomy** among children.

- In **Greece**, there is a detailed, **life-course approach**, highlighting how different stages (infancy, youth, aging) intersect with broader social and cultural dynamics.

Vulnerable Citizens Are Often Overlooked in Policy and Practice

Several groups—such as **people with disabilities** (Belgium), **adolescents** (Lithuania), or **pregnant and breastfeeding women** (Greece)—were described as **under-recognized or underserved** in current public health strategies. This points to a need for **more inclusive definitions** and **tailored interventions**.

Vulnerability Often Overlaps

Multiple forms of vulnerability often **intersect**, creating **compounded disadvantage**. For example:

- A low-income single mother from a migrant background may face financial, cultural, and informational barriers simultaneously.

- An older adult with mobility issues and digital illiteracy may struggle both to access food and understand dietary advice.

Emphasis on Functional and Relational Aspects

Especially in Belgium and Greece, vulnerability is also defined by **capacity** and **support networks**:

- Functional limitations (e.g. chewing, cooking, shopping) can lead to vulnerability, even in the absence of poverty.

- Lack of **social or institutional support** (e.g. for meal preparation, accessing services) was highlighted as a key vulnerability factor.

3.5.8.1 Key findings related to the uptake of beneficial tools and apps

- All three countries face challenges with the underuse of digital tools among vulnerable populations, especially those with low digital or health literacy.
- There is a consistent need for digital tools to be user-friendly, culturally adapted, and easy to navigate.
- Professionals across all countries rely on offline approaches, such as group sessions, brochures, or meal cards, due to their higher effectiveness with vulnerable populations.
- All experts agree that digital tools should complement, not replace, real-life strategies.
- Belgium focuses on the need for tools to support vulnerable groups in real-life settings, while Lithuania highlights barriers like limited device access and resistance to screen-based tools.
- Greece's primary concern is the lack of digital tools tailored for vulnerable groups, with suggestions focused on integrating simple language, food vouchers, and notifications to increase user engagement.

4 Quantitative survey: an EU multi-country epidemiological study with vulnerable citizens

4.1 Methodology

4.1.1 Research hypothesis

A large-scale, EU survey was implemented to provide initial insights into the needs, barriers, and drivers affecting vulnerable citizens across the pilot countries. In particular, the survey explores aspects such as understanding, preferences, intentions, behaviors, as well as the effectiveness of existing tools

4.1.2 Sample and Setting

In May 2025, a multi-center survey was conducted across three European Union countries—Belgium, Greece, and Lithuania—focusing primarily on vulnerable adult populations. Vulnerability was defined based on the presence of at least one of the following sociodemographic characteristics:

- Low SES (*more details on the definition of SES are provided in **Section 4.1.4***)
- Age (either youth (18-21 years) or individuals aged 60 and above)
- Belonging to an ethnic minority group

To be eligible for participation in the study, adults were required to meet at least one of these criteria. A non-probability, purposive sampling approach was applied, with deliberate efforts to ensure adequate representation of all vulnerability subgroups, even if statistical representativeness could not be guaranteed. The focus is on diversity and inclusion rather than generalizability.

4.1.3 Bioethics

The study was accepted by the Bioethics Committee of Prolepsis Institute (26/2025). The study was carried out in accordance with the Declaration of Helsinki (1989) of the World Medical Association. All participants were informed about the study aims and procedures and provided written informed consent.

4.1.4 Survey tool

An anonymous, self-administered online survey available in the four national languages of the participating countries (Dutch, French, Greek, Lithuanian) was designed to map the demographic, social, and cultural characteristics of the target population. SES was determined using a custom classification algorithm that combines responses to two core variables: the highest level of education attained and the current or most recent occupation. Based on this combination, respondents were categorized into three levels:

- High SES (e.g., professionals, highly educated retirees, and executives),
- Moderate SES (e.g., clerical workers, skilled laborers, average educational attainment), and
- Low SES (e.g., manual laborers, unemployed individuals, students, low educational attainment).

This multidimensional approach allowed for a more nuanced understanding of socioeconomic vulnerability, beyond income alone. More details on the methodology followed is provided in **Annex II**. Food security status was assessed to capture both adult and household food insecurity using the Food Insecurity Experience Scale[54].

The core part of the exploratory survey included sections on **nutrition literacy**, assessing knowledge of healthy eating and understanding of dietary guidelines[55], as well as **digital literacy**[56], which examines access to and confidence in using digital technologies. **Attitudes toward food and food choices were also examined using questions from existing surveys**. These focused on decision-making and **food skills**, such as meal planning, preparation, and label reading, which support nutritious and budget-friendly meals in daily life[57,58]. **Food preferences** focused on consumer concerns and priorities such as price, food waste, and more[59]. The questionnaire further explored **attitudes toward food waste** and **ambivalence related to cooking**, revealing emotional and practical barriers. Cultural and regional influences on nutrition were considered in the **cultural and regional aspects of eating**, alongside **consumer ethnocentrism**, which reflects preferences for local versus foreign food products. Additionally, the survey examined **seasonal food orientation**, identifying the importance of eating foods in season, and concluded with measures of **intention to use cooking or nutrition-related apps**, indicating the potential for digital engagement.

The full questionnaire is provided in **Annex III**.

4.1.5 Statistical Analysis

Categorical variables are presented as absolute (n) and relative frequencies (%). Continuous variables are presented as mean values ± standard deviation. The average of the respondents' statements regarding their level of knowledge, attitudes and skills was assessed. Since the Likert scales of the statements were different, the average was rescaled to a scale from 1 (*the lowest*) to 10 (*the highest*) to ensure comparability across sections Associations between normally distributed variables and vulnerability-related categories (i.e., age, SES, nutrition literacy, digital literacy) were assessed using ANOVA test. In case of non-normally distributed variables, the Kruskal-Wallis test was used. SPSS software, version 29 (IBM SPSS STATISTICS) was used for all statistical analyses. Two sided level of significance was set at *p<0.05*.

4.2 Results

4.2.1 Demographic characteristics

The basic demographic characteristics of the study sample are summarized in Error! Reference source not found..

Table 3 Basic demographic characteristics of the study sample

Demographics	Greece n=159		Belgium n=173		Lithuania n=150		Total n=482	
Age, years								
17-24	51	(32.1)	61	(35.3)	62	(41.3)	174	(36.1)
35-34	18	(11.3)	12	(6.9)	27	(18.0)	57	(11.8)
35-44	15	(9.4)	17	(9.8)	16	(10.7)	48	(10.0)
45-54	21	(13.2)	34	(19.7)	11	(7.3)	66	(13.7)
55-64	5	(3.1)	7	(4.0)	1	(0.7)	13	(2.7)
Above 65	49	(30.8)	42	(24.3)	33	(22.0)	124	(25.7)
No of Children								
0	91	(57.2)	76	(43.9)	94	(62.7)	261	(54.1)
1	38	(23.9)	26	(15.0)	33	(22.0)	97	(20.1)
2	23	(14.5)	34	(19.7)	12	(8.1)	69	(14.3)
3	5	(3.1)	18	(10.4)	7	(4.7)	30	(6.2)
4	2	(1.3)	15	(8.7)	1	(0.7)	18	(3.7)
5 or more	-	-	4	(2.3)	3	(2.0)	7	(1.5)
Place of residence								
Village	11	(6.9)	24	(13.9)	35	(23.3)	70	(14.5)
Town	26	(16.4)	61	(35.3)	42	(28.0)	129	(26.8)
Medium-sized city	33	(20.8)	61	(35.3)	38	(25.3)	132	(27.4)
Large city	89	(56.0)	27	(15.6)	35	(23.3)	151	(31.3)
Marital status								
With a partner	97	(61.0)	96	(55.5)	86	(57.3)	279	(57.9)
Single	62	(39.0)	77	(44.5)	64	(42.7)	203	(42.1)

Results are presented as absolute and relative frequency [n (%)].

4.2.2 Health-related self-awareness

In this section, we present respondents' perception of health-related self-awareness. Overall, the results show a consistent pattern of health-related self-awareness (**Figure 2**). A high level of health-related self-awareness among participants was observed. The highest mean score was observed for the statement "I reflect about my health a lot" (m = 5.2, SD = ±1.7, range: 1-7), suggesting that many participants often think about their health. This was also verified by the fact that 31.7% of the respondents chose the highest possible rating (7) for this item. The statements "I'm very self-conscious about my health" and "I'm generally attentive to my inner feelings about my health" yielded slightly lower but comparable mean values (m = 4.9, SD = ±1.7 and m = 4.9, SD = ±1.6, respectively, range: 1-7). This suggests that participants are also somewhat self-conscious about their health and inner feelings.
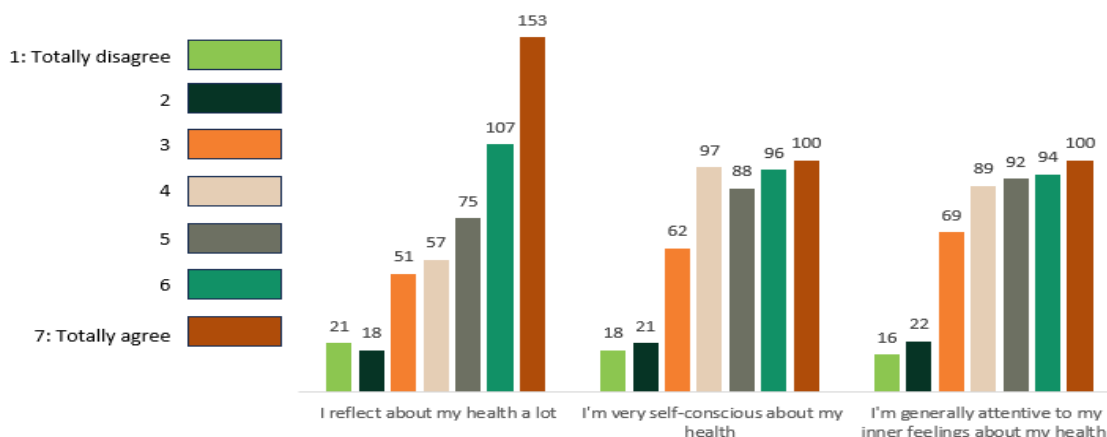
Figure 2 Distribution (m) of the health related self-awareness statements (1: Totally disagree – 7: Totally agree)

4.2.3 Food security status

Food insecurity, a condition characterized by limited or uncertain access to adequate, safe, and nutritious food necessary for a healthy life was examined. The indicators used explore a range of food-related difficulties, including concerns about food availability, the inability to afford nutritious meals, and instances of skipping meals or eating less than needed, reflecting underlying economic and social challenges.

As presented in **Error! Reference source not found.** a notable proportion of participants experienced some level of food insecurity. Reducing the amount of food consumed as well as reducing the variety of foods and skipping meals were experiences mentioned by more than three out of ten respondents. . In particular, 36.9% "you ate less than you thought you should", 36.6% reported "eating only a few kinds of foods" and 30.3% reported "skipping meals".

Table 4 Statements of Individual Food Security Status (%) (n=482).

	Yes	No	I don't know	Prefer not to say
You ate less than you thought you should?	36.9	53.3	7.5	2.3
You ate only a few kinds of foods?	36.6	50.0	11.4	2.3
You were hungry but did not eat?	32.8	58.7	6.8	1.7
You had to skip a meal?	30.3	60.8	6.0	2.9
You were unable to eat healthy and nutritious food?	27.6	57.7	13.3	1.5
You were worried you would not have enough food to eat?	27.0	60.4	8.9	3.7
Your household ran out of food?	20.5	70.5	7.1	1.9

Sub analysis focusing on the respondents with children/adolescents in their household was implemented and results are summarized in **Error! Reference source not found.** and **Error! Reference source not found.**. More than half (56.5%) of the respondents reported often or sometimes "relying on only a few kinds of low-cost food to feed their children". Furthermore, nearly half (48.0%) indicated they were unable to "feed their children a balanced meal" and 38.0% reported that their children "were not eating enough because they could not afford sufficient food" (**Error! Reference source not found.**).

Table 5 Statements of Household Food Security Status (%) in respondents with children/adolescents (n=221)

Was there a time when, because of lack of money or other resources	Often	Sometimes	Never
You relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food	21.7	34.8	43.4
The children were not eating enough because we just couldn't afford enough food.	19.9	18.1	62.0
You couldn't feed our children a balanced meal, because we couldn't afford that.	18.1	29.9	52.0

The results also reveal that a small but notable portion of respondents reported severe food insecurity experiences. Specifically, 7.9% indicated they had to "cut the size of their children's meals" or "that their children were hungry but they couldn't afford more food". Additionally, 6.8% reported that their children "had to skip meals", and 6.2% stated that their children went "an entire day without eating due to a lack of money", reflecting serious conditions with potentially harmful consequences for child health and development (**Error! Reference source not found.**).

Table 6 Statements of Household Food Security Status (%) in respondents with children/adolescents (cont.) (n=221)

Was there a time when, because of lack of money or other resources	Yes	No	I don't know	Prefer not to say
Did you ever cut the size of any of the children's meals because there wasn't enough money for food?	17.2	70.6	9.5	2.7
There the children ever hungry but you just couldn't afford more food?	17.3	73.3	6.8	2.7
In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food?	14.9	74.7	7.2	3.2
Did any of the children ever not eat for a whole day because there wasn't enough money for food?	13.6	75.1	7.2	4.1

4.2.4   Attitudes towards food and health that could shape food choices

It is notable that most people mentioned that they "prefer to buy fresh meat and vegetables rather than pre-packed options" (m = 3.8, SD = 1.1, range: 1-5), while they reported a tendency to "avoid food products with additives" (m = 3.4, SD = 1.1, range: 1-5). On the other hand, there was a trend of disagreement, as expected, with the statements: "I have more confidence in food products that I have seen advertised than in unadvertised products" (m = 2.7, SD = 1.1, range: 1-5), "I frequently use ready-to-eat foods in our household" (m = 2.8, SD = 1.3), and "I frequently use mixes, for instance, baking mixes and powder soups" (m = 2.5, SD = 1.3, range: 1-5). The distribution and the trends are presented in Error! Reference source not found. and **Figure 3.**

Table 7 Distribution of Attitudes towards Food and Food Choices statements (%) (1: never, 5: always) (n=482)

	1	2	3	4	5
I prefer to buy meat and vegetables fresh rather than pre-packed	4,6	8,1	24,3	26,3	36,7
I try to avoid food products with additives	6,6	15,4	32,2	27,2	18,7
I make a point of using natural or ecological products	9,5	15,1	27,6	29,9	17,8
I compare labels to select the most nutritious food	9,5	15,4	33,0	25,7	16,4
I frequently use ready-to-eat foods in our household	20,1	23,9	25,5	18,9	11,6
I frequently use mixes, for instance, baking mixes and powder soups	30,3	23,2	23,7	14,3	8,5
I have more confidence in food products that I have seen advertised than in unadvertised products	17,8	27,2	32,0	16,2	6,8

Items are arranged in descending order based on the frequency of the response "5: Always."
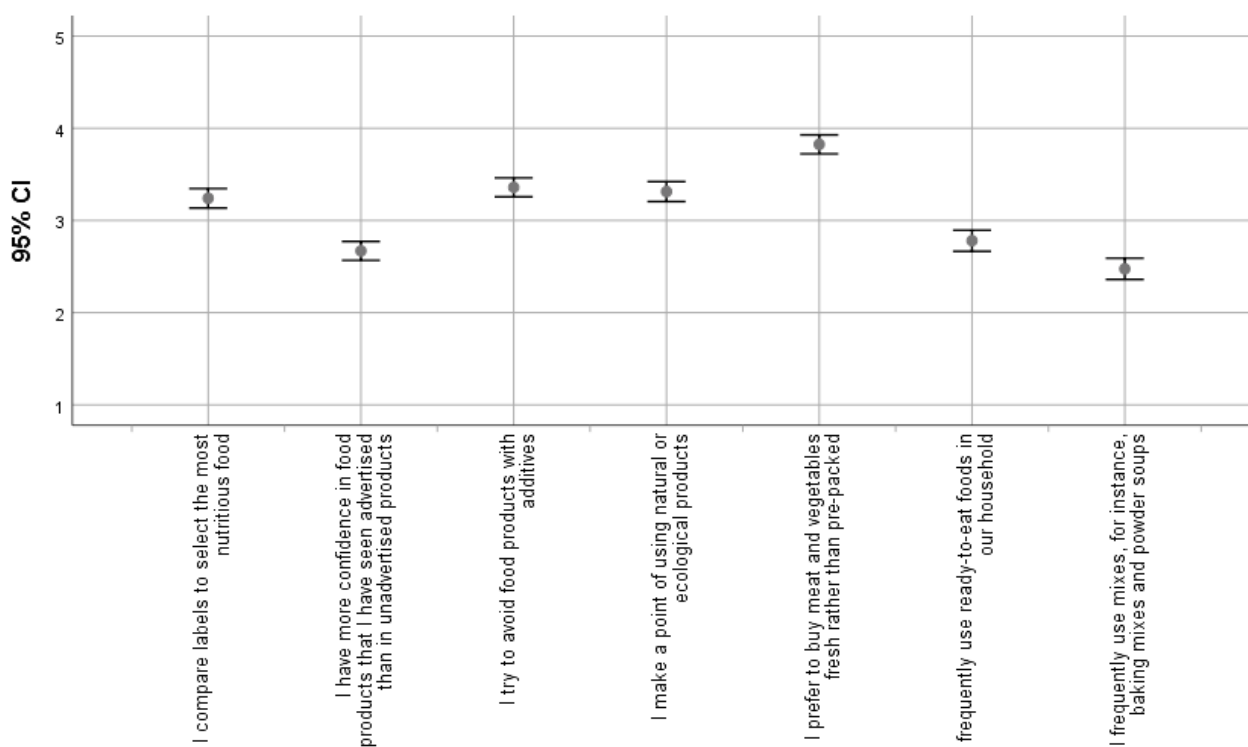
Figure 3 Mean scores and corresponding 95% confidence intervals for respondents' attitude to food and health statements.

4.2.5 Attitudes towards food waste that could shape food choices

Herein the participants' level of concern and awareness about the broader consequences of wasting food, including the misuse of resources, environmental damage, financial loss, unnecessary packaging, and the ethical implications of food waste in a world where hunger persists is examined (Error! Reference source not found.).

Table 8 Distribution of statements (%) regarding food waste concept (1: not at all concerned to 5: extremely concerned) (n=482)

	1	2	3	4	5	
People go hungry every day	4.1	7.3	23.4	28.2	36.9	
Wasted money from throwing out food	4.6	7.3	25.3	25.9	36.9	
Waste of healthy/nutritious ingredients	4.4	9.3	24.3	28.4	33.6	
Unnecessary packaging waste	4.8	6.2	27.6	28.6	32.8	
Impact on biodiversity by using fertilizers and pesticides	5.8	11.6	27.2	26.6	28.8	
Waste of time and effort by farmers/ food producers	5.0	9.5	17.0	32.2	26.3	
Contribution to Climate Change - growing, processing, disposal of food	6.4	14.1	25.5	28.4	25.5	
Resources that went into food are wasted	8.7	11.8	32.8	27.4	19.9	

Items are arranged in descending order based on the frequency of the response "5: extremely concerned"

The highest levels of concern were expressed for "people going hungry every day" (m = 3.9, s=1.11, range: 1-5) and "wasted money from throwing out food" (m = 3.8, s=1.1, range: 1-5), followed closely by "unnecessary packaging waste" and "waste of healthy/nutritious ingredients" (both m = 3.8, s=1.1, range: 1-5). In contrast, the lowest concern was reported for "resources that went into food being wasted" (m = 3.4, s=1.2), and "contribution to climate change from food production and disposal" (m = 3.5, s=1.2). Overall, participants appeared to be most concerned with all the aspects of the food disposal ( ).
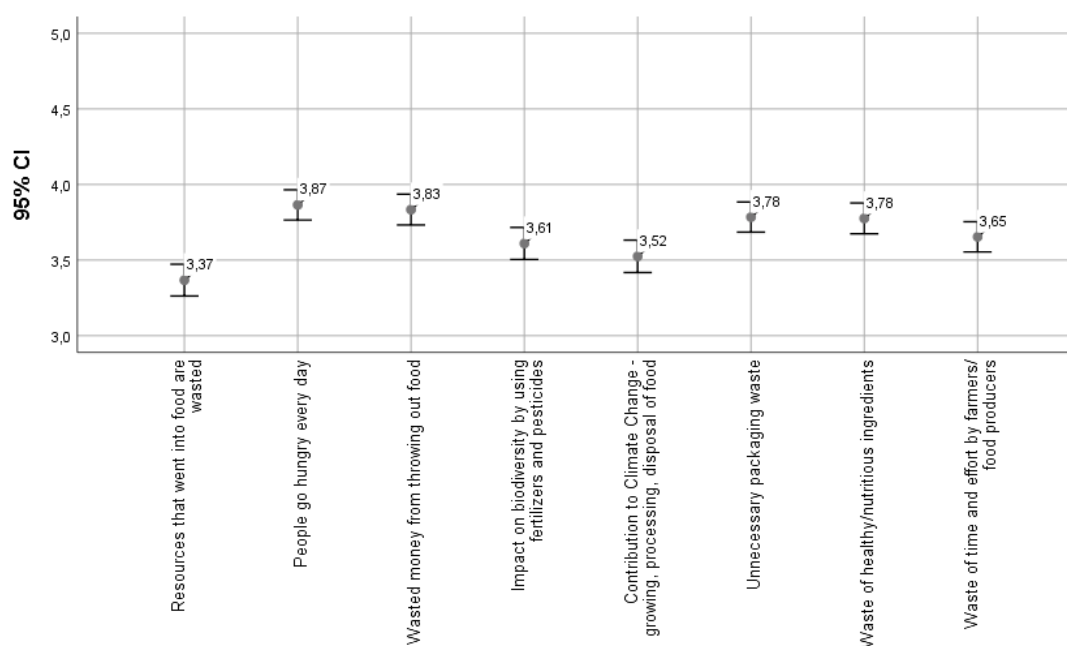
Figure 4 Mean scores and corresponding 95% confidence intervals for food waste attitude statements.

As it is summarized in Error! Reference source not found. and **Figure 5**, generally positive attitudes were noted towards reducing food waste, particularly in relation to financial and environmental consequences. The majority of respondents (46.5%) strongly agreed that "throwing away uneaten food is like throwing money away", while 35.3% strongly agreed that "food waste is a serious environmental issue". Similarly, a combined 59.1% agreed or strongly agreed that "minimizing food waste is a top priority" (m=3.9, s=1.2, range: 1-5). Conversely, uncertainty about how to reduce waste was notable, with 17.6% strongly agreeing with the statement "I would like to reduce my food waste but I don't know how"—the lowest mean score (m=3.03, s=1.3, range: 1-5) indicating a potential gap in knowledge or practical guidance. Overall, the findings reveal strong motivation to act, particularly for financial reasons, but highlight the need for more food waste literacy.

Table 9 Distribution of statements (%) regarding food waste prevention practices (1: totally disagree to 5: totally agree) (n=482)

	1	2	3	4	5	
Throwing away uneaten food is the same as throwing money in the bin	2.7	3.7	22.6	24.5	46.5	
Food waste is a serious environmental issue like climate change	6.4	8.5	22.4	27.4	35.3	
I want to save money by reducing the amount of food I waste	4.6	10.2	22.0	29.9	33.4	
I believe it will make a real difference if I reduce the amount of food that I waste	4.8	8.9	24.7	29.7	32.0	
I am concerned about the cost of the food that goes to waste in my home	7.7	13.7	25.5	23.7	29.5	
Minimizing my food waste is one of my top priorities	4.4	9.8	28.8	30.1	27.0	
I would like to reduce my food waste but I don't know how	17.0	16.8	29.9	18.7	17.6	

Items are arranged in descending order based on the frequency of the response "5: totally agree"
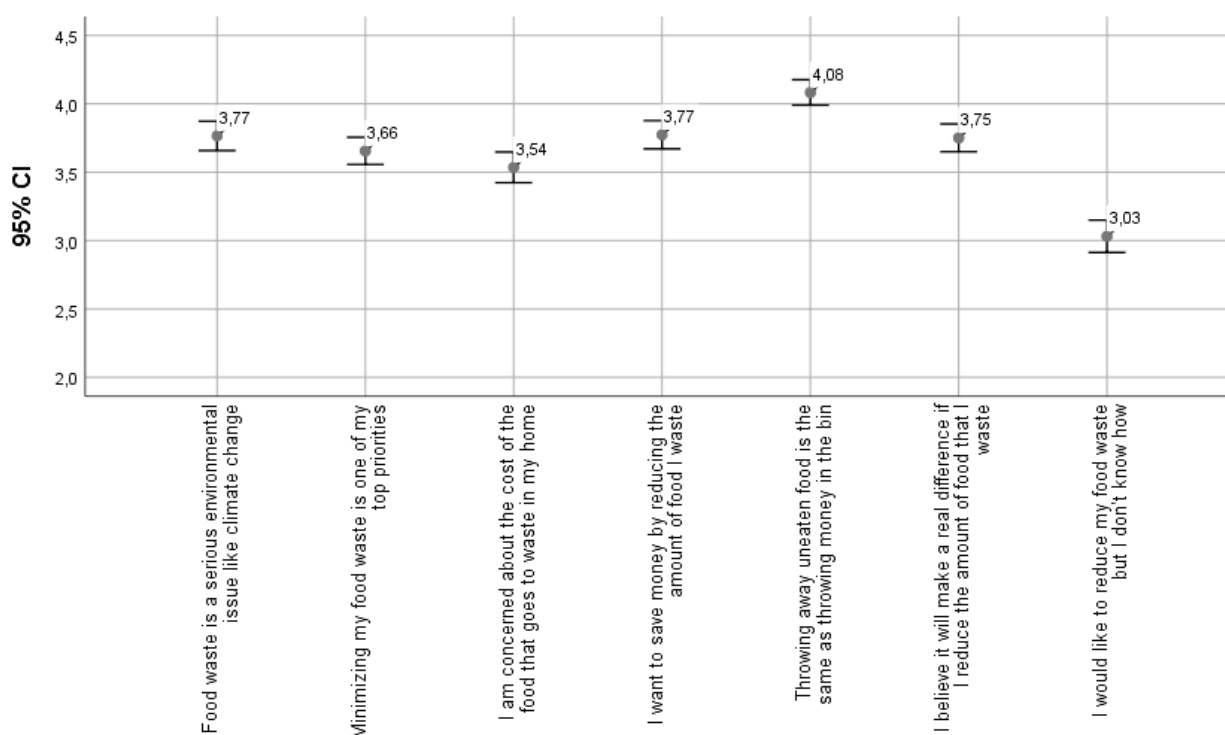
Figure 5 Mean scores and corresponding 95% confidence intervals for food waste attitude statements and environmental health.

4.2.6 Main criteria that shape food choices

Regarding the food issues concerning the participants the survey focused on peculiar aspects that formulate their preference as shown in Error! Reference source not found..

The most important food-related concern among participants is the price of food, with 68.7% indicating it as a top preference, followed by food waste (30.3%) and how long fresh food lasts (27.8%), suggesting that affordability, value,

and minimizing waste are key priorities. Other concerns like food ingredients (22.8%) and food safety (20.5%) also received notable attention, while factors such as nutritional content (8.5%), animal welfare (8.3%), and food miles (7.7%) were of less concern to most participants. Overall, the results reveal a strong emphasis on cost and practicality over ethical or environmental considerations.

Table 10 Factors that affect food choices (n=482)

	N	%
The price of food	331	68,70%
Food waste	146	30,30%
How long fresh food lasts for	134	27,80%
Food ingredients (e.g. salt, fat, sugar, additives)	110	22,80%
Food safety (e.g. Salmonella, E. coli)	99	20,50%
Food labelling (e.g. 'use by' date, storage instructions)	72	14,90%
The way that food products are packaged	69	14,30%
Genetically Modified (GM) foods	63	13,10%
Seasonality of food	56	11,60%
Nutritional content of food	41	8,50%
The welfare of animals	40	8,30%
Food miles (the distance that food travels)	37	7,70%
Shortages in food supply	23	4,80%

4.2.7 Food skills

Food skills, refer to the practical abilities and habits that support planning, preparing, shopping for, and managing food effectively—such as meal planning, using leftovers, budgeting, following recipes, reading food labels, and making nutritious, cost-effective choices under time or ingredient constraints. These parameters have been evaluated for the participants based on an agreement Likert scale (1: totally disagree to 7: totally agree) of the statements presented in **Error! Reference source not found.**.

The most commonly practiced food skills include "reading the best-before date on food" (m = 5.5, SD = 1.72, range: 1-7), "keeping basic items in cupboard for putting meals together such as herbs/spices, and dried/tinned goods" (m = 5.2, SD = 1.76, range: 1-7), and "reading the storage and use-by information on food packaging" (m = 5.0, SD = 1.74, range: 1-7) reflecting a focus on food safety and household preparedness. In contrast, the least agreed-upon food skills involve "preparing meals in advance, such as packed lunches or partially prepped meals" (m = 3.7, SD = 1.78), "planning meals ahead for the day or week" (m = 3.8, SD = 1.74, range: 1-7), and "buying cheaper cuts of meat to save money" (m = 4.0, SD = 1.88, range: 1-7) suggesting that while participants are attentive to food safety and basic stocking habits, they may be less consistent in forward-planning and cost-saving strategies related to meal preparation and budgeting (**Figure 6**).

Table 11 Distribution of food skills (%) (1: totally disagree, 7: totally agree) (n=482)

	1	2	3	4	5	6	7
Reading the best-before date on food	3.1	3.9	9.3	10.6	13.3	18.7	41.1
Keeping basic items in your cupboard for putting meals together? e.g., herbs/spices, dried/tinned goods	3.5	4.8	10.2	14.1	14.7	21.0	31.7
Comparing prices before you buy food	2.7	5.2	12.2	15.8	15.8	17.6	30.7
Knowing what budget you have to spend on food	3.5	5.0	13.3	15.6	20.1	15.6	27.0
Shopping with a grocery list	6.6	9.1	17.6	17.2	15.1	13.9	20.3
Reading the storage and use-by information on food packets	5.4	7.1	14.3	21.4	18.0	15.4	18.5
Reading the nutrition information on food labels	5.4	7.1	14.3	21.4	18.0	15.4	18.5
Buying food in season to save money	4.8	8.1	17.0	17.2	17.8	17.0	18.0
Planning how much food to buy	5.2	6.0	14.9	19.5	17.4	20.1	16.8
Shopping with specific meals in mind	4.8	5.6	17.8	18.7	21.2	16.4	15.6
Preparing or cooking a healthy meal with only few ingredients on hand	6.4	7.1	15.4	20.3	19.9	15.4	15.6
Using leftovers to create another meal	8.5	9.5	15.1	17.6	18.5	17.0	13.7
Preparing or cooking a meal with limited time	6.6	9.5	12.1	23.0	18.5	15.6	13.7
Balancing meals based on nutrition advice on what is healthy	6.6	8.3	15.6	21.4	17.4	17.0	13.7
Buying cheaper cuts of meat to save money	12.4	12.7	16.4	16.8	18.7	10.4	12.7
Cooking more or double recipes which can be used for another meal	10.0	11.6	18.7	16.8	18.9	11.8	12.2
Planning meals ahead (e.g., for the day/week ahead)	10.6	12.0	24.3	21.2	13.9	7.5	10.6
Following recipes when cooking	9.5	12.2	21.6	20.7	16.4	10.0	9.5
Preparing meals in advance e.g., packed lunch, partly preparing a meal in advance	13.3	15.1	20.7	19.5	14.9	7.1	9.3

Items are arranged in descending order based on the frequency of the response "7: Totally agree"
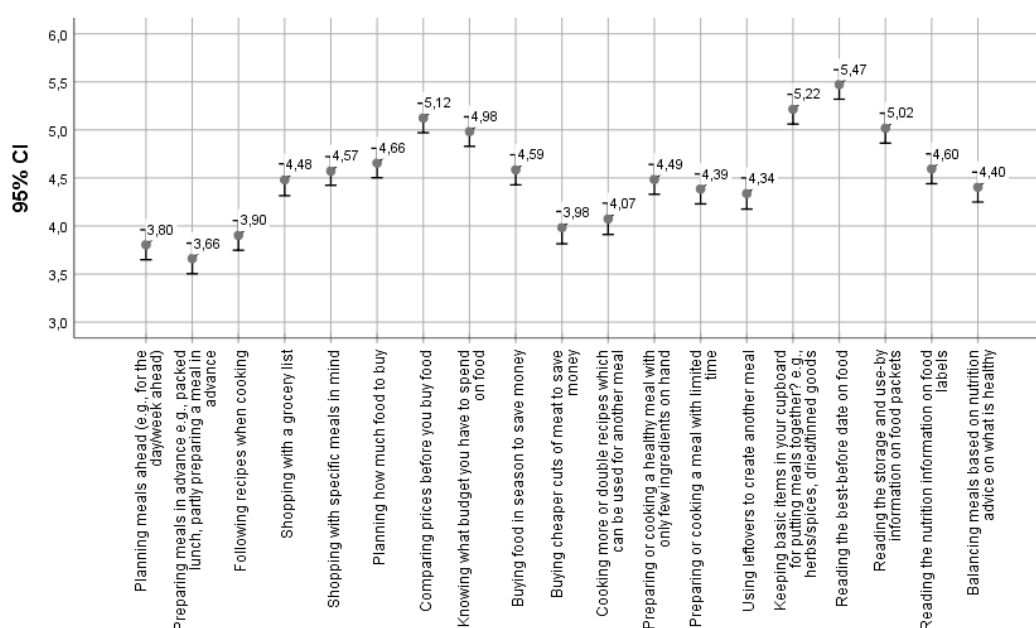

Figure 6 Mean scores and corresponding 95% confidence intervals for respondents' food skills.

4.2.8 Food shopping attitudes

The most frequently practiced behaviors, as presented in Error! Reference source not found. and **Figure 7** during main food shopping include "checking labels for use-by or best-before dates" (56.8% often; m = 1.7, s=1.0), "sticking to a shopping list" (43.8% often; m = 1.9, s=1.0) and "purchasing larger packs because they are cheaper" (38.4% often; m = 1.9, s=0.9) indicating a focus on food safety and planning. "Buying unplanned items requested by family" (28.8% often; m = 2.0, s=0.9) was less common.

Table 12 Distribution of statements (%) of Food waste attitudes (1: not at all concerned to 5: extremely concerned) (n=482)

	Often	Sometimes	Rarely	Never	
Check labels for use by / best before dates	56.8	26.1	11.0	6.0	
Stick to a shopping list	43.8	28.6	20.5	7.1	
Buy bigger pack because cheaper	38.4	38.2	17.0	6.4	
Buy an item with reduced price - near its expiry date	29.7	36.5	23.9	10.0	
Buy unplanned item family wanted	28.8	43.8	22.0	5.4	
Choose a smaller trolley or shopping basket	28.0	39.0	21.2	11.8	
Buy bigger than needed - smaller unavailable	20.1	47.5	25.3	7.1	

Items are arranged in descending order based on the frequency of the response "Often"

Conversely, "buying larger items because smaller sizes were unavailable" was less frequent overall, with nearly half of participants (47.5%) saying this applied to them "sometimes." Thus, while many consumers tend to shop intentionally and cost-effectively, they often adapt their behaviors based on family preferences and product availability.
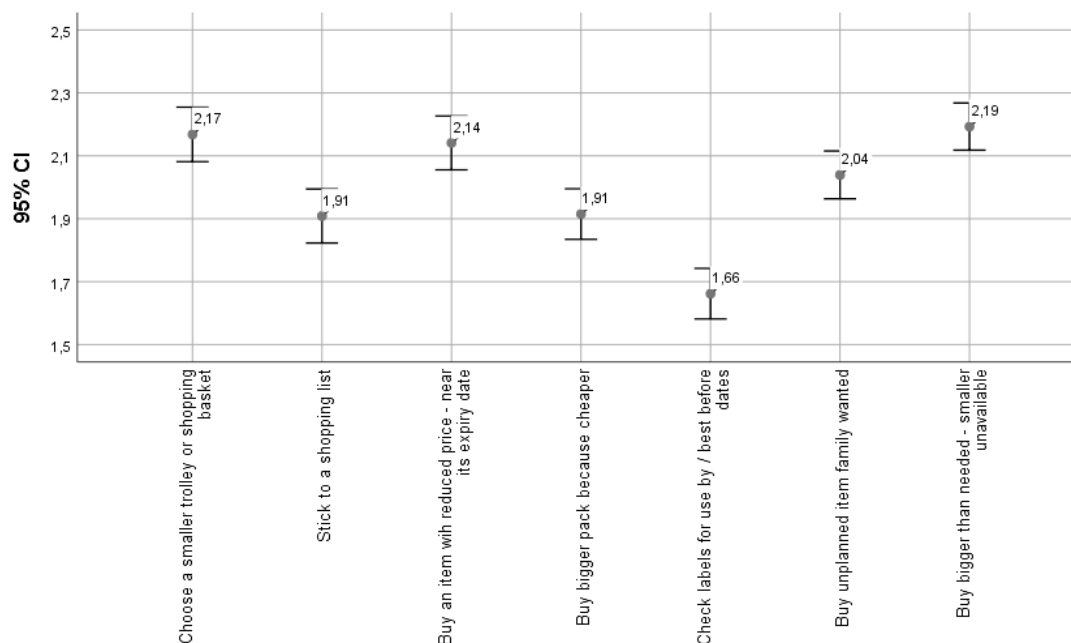
Figure 7 Mean scores and corresponding 95% confidence intervals for food shopping attitude statements.

4.2.9 Cooking related ambivalence

To investigate the feelings of the participants toward changing their cooking habits to become healthier and more sustainable, we evaluated how conflicted, mixed, or undecided they were on a scale from 0 (don't harbor this feeling), 1

(slightly) to 5 (extremely). Results are summarized in **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 13 Distribution (%) of participants' feelings towards changing their cooking habits to become healthier (0: don't harbor this feeling, 1: slightly to 5: extremely)

Cooking healthier	0	1	2	3	4	5
Conflicted	26.1	12.4	14.7	28.6	11.0	7.1
Mixed	16.0	9.8	21.2	32.0	14.1	7.1
Indecision	18.9	12.0	18.	29.7	12.9	7.9

Table 14 Distribution (%) of participants' feelings towards changing their cooking habits to become more sustainable (0: don't harbor this feeling, 1: slightly to 5: extremely)

Cooking healthier	0	1	2	3	4	5
Conflicted	24.5	13.9	16.8	25.5	13.1	6.2
Mixed	16.6	12.2	17.6	30.1	15.6	7.9
Indecision	18.7	11.8	18.0	27.6	16.8	7.1

Overall, participants expressed moderate emotional responses—conflicted, mixed, or undecided—toward changing their cooking habits to become healthier and more sustainable. The distribution data show that the highest concentration of responses across all three emotional states falls at the mid-point of the scale. These trends are reflected in the corresponding **Figure 8** and **Figure 9**, which presents average scores for conflicted feelings, mixed feelings, and indecision, (excluding the participants who did not harbor the corresponding feeling), with a lower average of conflicted feelings (m=2.7, range: 1-5) towards turning to more sustainable habits. This suggests that while strong emotions are rare, many participants may experience a noticeable but moderate degree of internal tension or uncertainty regarding adopting healthier cooking practices.
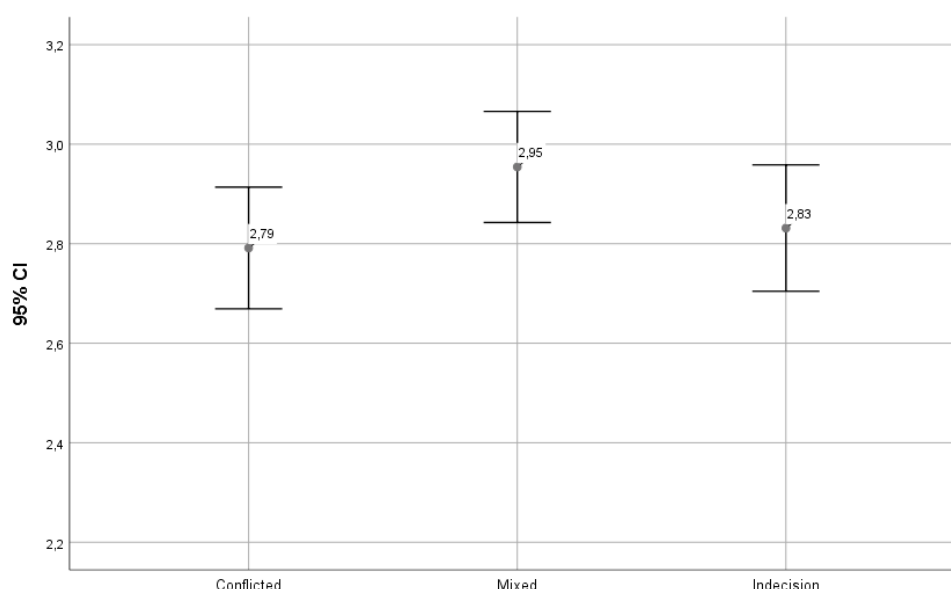
Figure 8 Mean scores and corresponding 95% confidence intervals of the average feelings towards changing cooking habits to healthier (1: slightly harbor the feeling to 5: extremely harbor the feeling).
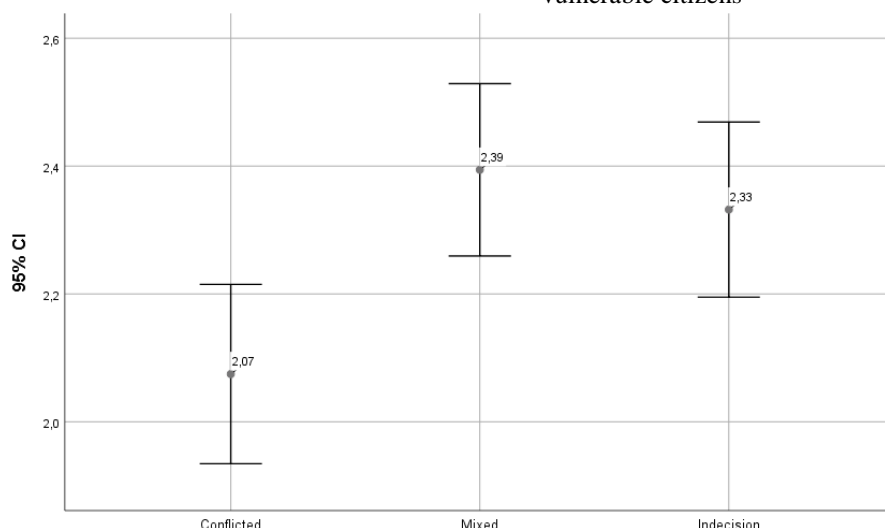
Figure 9 Mean scores and corresponding 95% confidence intervals of the average feelings towards changing cooking habits to more sustainable (1: slightly harbor the feeling to 5: extremely harbor the feeling).

4.2.10 Cultural and Regional aspects of nutrition

The cultural aspects of nutrition hold significant importance for participants. The highest agreement was found in the statement "I enjoy learning about and trying dishes from other cultures," with almost 1 in 4 "Totally agree" (m=4.8, s=1.8, range: 1-7). Similarly, strong agreement was observed for "Food is a central part of my family's traditions and celebrations" (m = 4.8, s=1.8, range: 1-7). On the other hand, the lowest level of agreement appeared in the statement "My culinary practices have been influenced by the foods of other regions" with a mean score of 4.1, despite 18.3% still expressing strong agreement (Error! Reference source not found. and **Figure 10**).

Table 15 Distribution (%) of Respondents' cultural aspects towards nutrition (1: totally disagree to 7: totally agree) (n=482)

	1	2	3	4	5	6	7	
I enjoy learning about and trying dishes from other cultures	5.6	7.7	12.4	16.4	18.0	15.6	24.3	
Food is a central part of my family's traditions and celebrations	7.1	7.3	14.3	19.1	16.6	13.7	22.0	
I am knowledgeable about the food-related customs of my culture.	5.6	8.3	15.8	15.8	17.6	17.6	19.3	
I tend to participate in preparing traditional dishes for special occasions	7.1	11.6	15.4	17.8	17.0	12.9	18.3	
I see food as a way to bridge cultural differences and foster understanding	8.5	10.0	14.9	25.3	13.1	13.9	14.3	
My culinary practices have been influenced by the foods of other regions	8.9	11.4	18.0	18.7	17.0	15.4	10.6	

Items are arranged in descending order based on the frequency of the response "7: Totally agree"
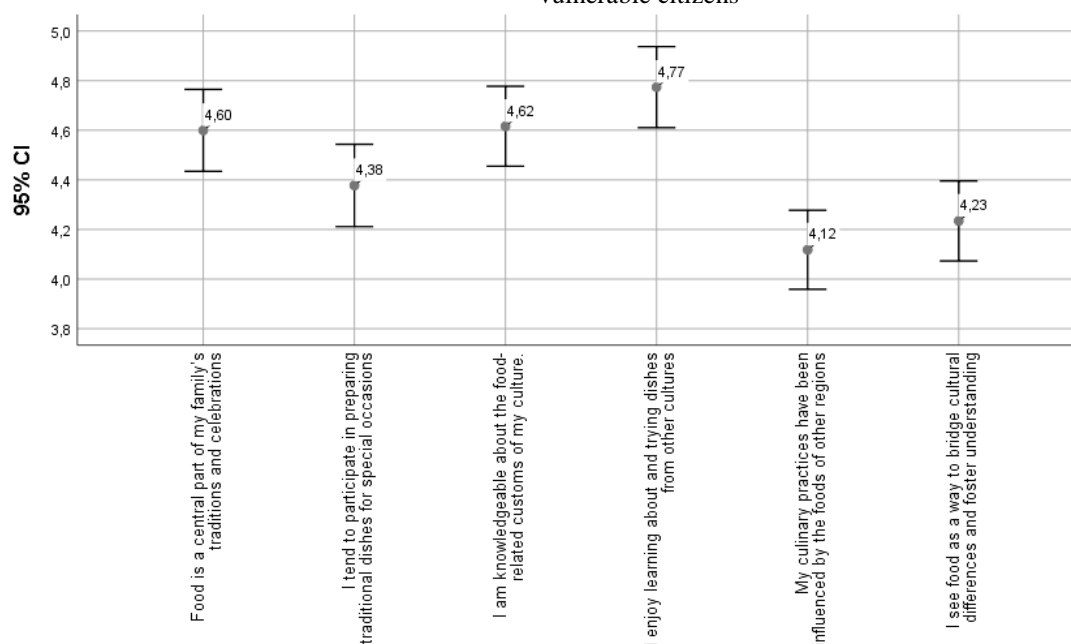
Figure 10 Mean scores and corresponding 95% confidence intervals of the average cultural aspects towards nutrition (1: totally disagree to 7: totally agree)

Overall, participants clearly favor local foods by generally expressing positive views about locally produced food. Most participants agreed that "local food has a lower environmental impact", (m=4.8, s=1.8, range: 1-7). Many also felt that "local food tastes better" (m=4.6, s=1.8, range: 1-7) and is "more nutritious" than food from elsewhere (m=4.4, s=1.8, range: 1-7). On the other hand, fewer people agreed that there's no taste difference between local and shipped food (m=3.5, s=1.7, range: 1-7). Overall, the findings suggest that taste, nutrition and environmental impact are important reasons why participants prefer local food. All results are presented in Error! Reference source not found. and **Figure 11**.

Table 16 Distribution (%) of Respondents' aspects towards local food regional aspects of nutrition (1: totally disagree to 7: totally agree)

(n=482)

	1	2	3	4	5	6	7	
Locally produced food has lower environmental impact	6.2	5.8	12.0	18.0	18.3	16.6	23.0	
Locally produced foods just taste better	7.1	6.0	15.8	20.3	15.6	14.5	20.7	
Locally produced foods are more nutritious than foods that have been shipped from somewhere else.	8.9	7.1	13.7	23.4	15.8	13.3	17.8	
All else equal, there is no taste difference between a locally produced food and one that was shipped from somewhere else.	15.4	15.6	21.4	22.2	13.3	6.0	6.2	

Items are arranged in descending order based on the frequency of the response "7: Totally agree"
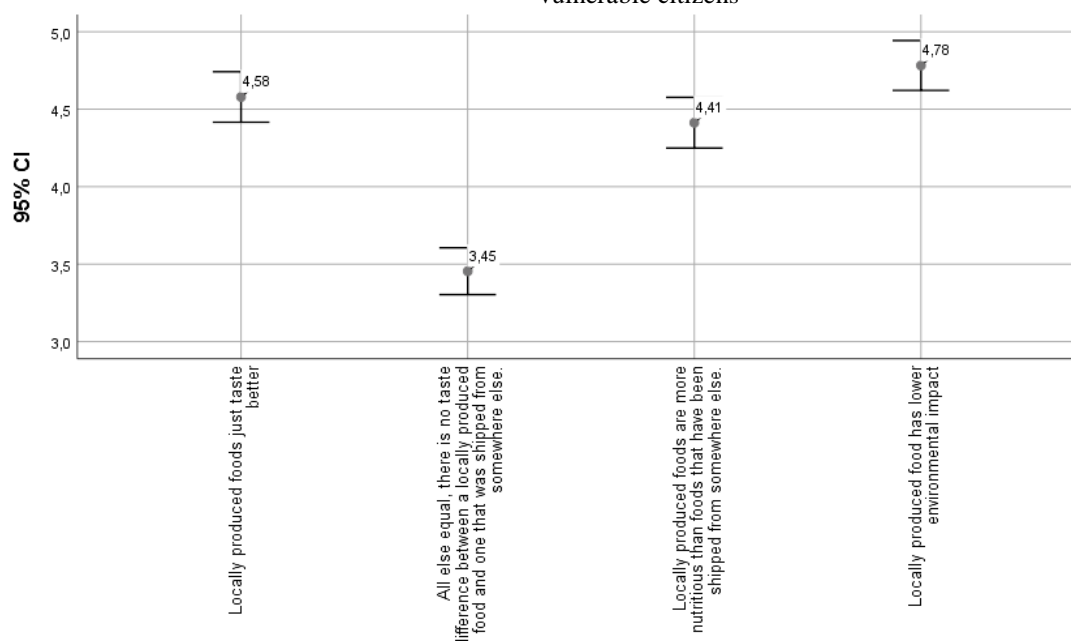
Figure 11 Mean scores and corresponding 95% confidence intervals of the average aspects towards local food (1: totally disagree to 7: totally agree)

4.2.11 Consumer ethnocentrism

To explore consumer ethnocentrism, participants were asked to indicate their level of agreement with statements expressing preferences for domestic over imported food. These questions aimed to assess the extent to which national loyalty and concern for local economies influence food purchasing choices. Results are summarized in Error! Reference source not found. and **Figure 12**.

Many participants have a preference for local food over imported products. The highest agreement was with the statement "I always prefer local food over imported products", (m=4.4, s=1.8, range: 1-7). The idea that "people should only buy domestic food" also received moderate agreement (m= 4.1, s=1.8, range: 1-7). Statements about not buying imported food because it hurts local farmers or causes job loss had slightly lower average scores, but still show that some participants share these concerns (Error! Reference source not found. and **Figure 12**). Overall, there is a tendency toward supporting local products, especially based on preference rather than strong opposition to imports.

Table 17 Distribution (%) of Respondents' consumer ethnocentrism (1: totally disagree to 7: totally agree) (n=482)

	1	2	3	4	5	6	7	
I always prefer local food over imported products.	8.3	8.3	14.1	20.3	16.4	15.6	17.0	
One should not buy imported food because it hurts local farmers	9.8	12.4	19.3	21.0	14.9	9.5	13.1	
One should only buy domestic food	9.3	10.8	16.2	23.4	17.0	10.6	12.7	
It is not right to purchase imported food because it causes the loss of jobs in [adapt country].	9.5	13.1	21.8	20.3	15.1	8.1	12.0	

Items are arranged in descending order based on the frequency of the response "7: Totally agree"
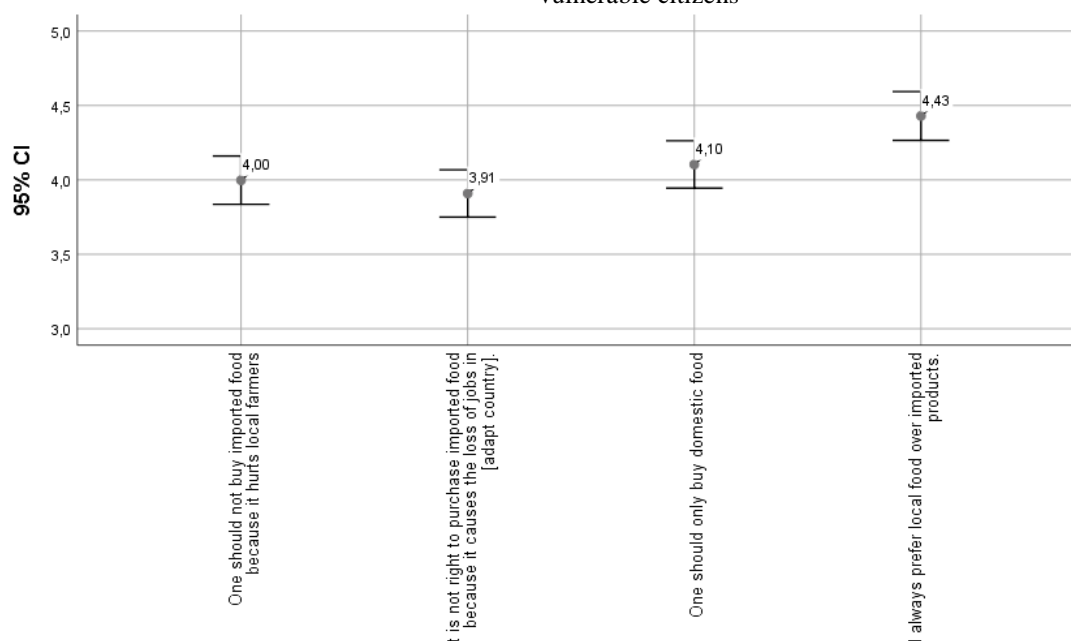
Figure 12 Mean scores and corresponding 95% confidence intervals of the average of consumers ethnocentrism statements (1: totally disagree to 7: totally agree)

4.2.12 Seasonal food orientation

As shown in Error! Reference source not found., participants generally have positive attitudes toward seasonal food. The highest agreement was with the statement "I prefer to eat foods that are naturally available during their peak season" (m=5.2, s=1.7, range: 1-7). Overall, the results suggest that taste, freshness, and availability are key reasons consumers value seasonal eating.

Table 18 Distribution (%) of Respondents' attitudes towards seasonal food products (1: totally disagree to 7: totally agree) (n=482)

	1	2	3	4	5	6	7
Seasonal vegetables taste better than out-of-season produce	5.2	6.6	11.0	13.1	13.7	16.8	33.6
I prefer to eat foods that are naturally available during their peak season	4.1	4.4	8.9	15.6	17.0	19.9	30.1
I believe seasonal foods have a fresher taste compared to non-seasonal options	4.4	3.7	9.8	16.0	17.4	19.1	29.7
Foods in season are more nutritious than foods out-of-season	3.5	4.8	11.6	19.1	15.1	17.2	28.6
Eating seasonally has significant environmental benefits (less energy consumption, transport emissions, chemical inputs, etc.	3.1	5.8	11.6	21.0	16.4	15.1	27.0
Eating seasonal foods is an important part of my diet	5.0	7.1	9.5	19.5	19.5	16.0	23.4

Items are arranged in descending order based on the frequency of the response "7: Totally agree"

4.2.13 Nutrition literacy

To assess participants' nutrition literacy, a section of the survey using 5 Likert-scale statements (1=never, 5=always) was designed to explore the challenges encountered when processing information related to healthy eating. Results are summarized in Error! Reference source not found..

Table 19 Distribution of Nutrition literacy statements (%) (1: never, 5: always) (n=482)

	1	2	3	4	5
Understand information about why some foods are healthy and others are not?	2,5	10,0	30,7	33,4	23,4
Find out what to look for in a healthy diet?	3,7	10,0	30,5	35,7	20,1
Understand dietary recommendations that tell you how often, what, and how much you should eat and drink to maintain a healthy	4,6	10,0	33,2	32,4	19,9
Decide what to eat and drink more or less of in order to maintain a healthy diet?	4,1	10,2	29,0	37,3	19,3
Understand the information about ingredients on food packaging (list of ingredients and nutritional table)?	4,6	12,7	34,6	29,9	18,3
Find or get useful information about which foods are healthy and which are less healthy?	4,6	7,1	35,7	34,6	18,0
Find or get useful information about what you should eat and drink more or less of to maintain a healthy diet?	4,4	10,6	31,1	36,1	17,8
Judge whether information about healthy eating is right or wrong?	4,8	10,2	34,6	33,0	17,4
Judge how trustworthy information about healthy eating is on the internet and social media?	5,8	10,8	39,6	27,2	16,6
Follow recommendations for a healthy diet?	4,6	11,6	36,7	30,7	16,4
Explain to others in an understandable manner what a healthy diet is all about?	6,0	13,1	35,9	29,0	16,0
Judge whether you can trust food advertising?	6,6	15,1	31,1	31,3	15,8

Items are arranged in descending order based on the frequency of the response "5: Always."

The results on participants' self-reported nutrition literacy are also illustrated in **Figure 13**. Overall, participants exhibit a moderate level of nutrition literacy, with most mean scores ranging between approximately 3.4 and 3.7 (range: 1-5). Notably, "understanding information why some foods are healthy and others are not" shows a slightly higher average, while "judging whether you can trust food advertising" appears to have a somewhat lower mean, indicating a need for improved critical evaluation skills concerning food information.
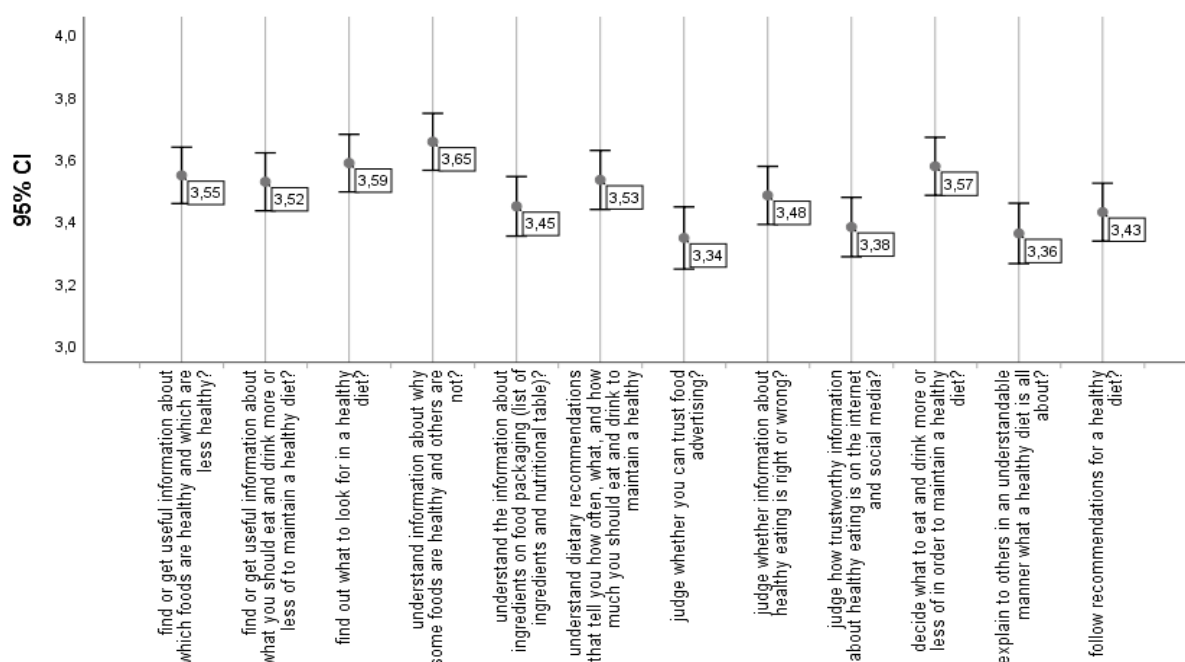
Figure 13 Mean scores and corresponding 95% confidence intervals for respondents' nutrition literacy statements.

Additionally, the focus was on evaluating consumer understanding of food labeling terms, specifically the distinctions between 'best before' and 'use by' dates in relation to food safety and quality" as shown in Error! Reference source not found..

A majority (67.8%) correctly identified that food past the 'best before' date may still be safe but of lower quality, while nearly half (44.4%) incorrectly believed food should not be eaten past that date. Confusion is also evident in responses to 'use by' dates, although 58.7% correctly recognized it as a safety limit, a significant portion (27.8%) still believed it was safe beyond that date. These findings suggest a need for clearer public education on the distinction between quality-based and safety-based date labels.

Table 20 Assessment of consumer understanding of 'best before' and 'use by' dates related to food safety and quality.

	True	False	I don't know
'Best before' date means it can be eaten after this date, but may not be best quality	67.8	19.7	12.4
'Best before' date means it can be eaten up to date, but should not be eaten past this date	43.6	44.4	12.0
'Use by' date means it can be eaten after date, but may no longer be best quality	51.2	35.5	12.3
'Use by' date means it will be safe up to this date, but not be eaten past this date	58.7	27.8	13.5

4.2.14 Digital literacy

Regarding the technology adoption of the participants, varying tendencies were observed among respondents. For the statement, "Among my peers, I am usually the first to try out new online tools or mobile applications" responses had a mean of 3.9 (±1.9) as well as for "I must see other people using new online tools or mobile applications before I will consider them". This suggests a neutral disposition of the majority of the respondents. Similarly, respondents showed a slightly stronger inclination towards active exploration, with the statement "If I heard about new online tools or mobile applications, I would look for ways to experiment with them" yielding a higher mean of 4.1(±1.8) (**Figure 14**).
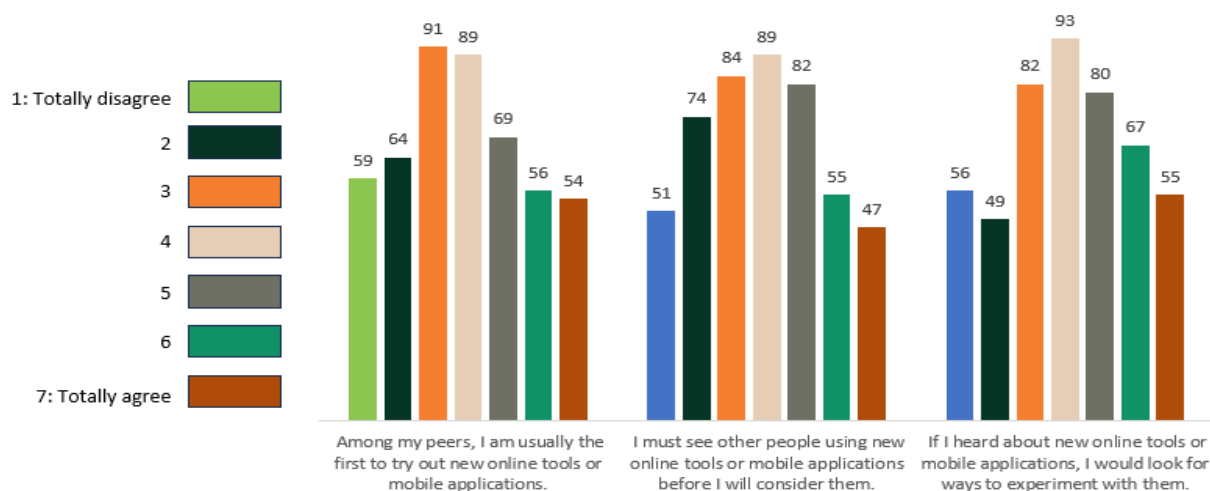
Figure 14 Distribution (%) of the technology adaptation statements (1: Totally disagree – 7: Totally agree)

4.2.15 Summary of vulnerable citizens' harmonized scoring (range: 0-10) in the examined features

Table 21 Average (m) and Std Deviation (s) of the nutrition related dimensions of the questionnaire

	m	s	Examined behavior
Nutrition literacy	6.6	1.7	Knowledge
Digital literacy	7.4	2.4	Knowledge
Food skills	6.3	1.7	Skills
Food and health	6.4	1.3	Attitudes
Food and food waste	6.2	1.1	Attitudes
Seasonal food orientation	7.1	2.2	Attitudes
Local food orientation (Consumer ethnocentrism)	5.7	2.3	Attitudes
Cultural and regional aspects of nutrition	6.1	1.8	Attitudes

Abbreviations: m (mean); s (standard deviation)

4.2.16 Intention to use cooking apps

The questionnaire's multiple dimensions aim to uncover confounding variables that may influence users' intention to adopt cooking applications.

The intention to use cooking apps was assessed through two distinct dimensions: one relating to willingness to use apps that provide healthier recipe suggestions, and the other to apps offering more sustainable recipe suggestions. Both dimensions were measured on a 7-point Likert scale (1 = not willing at all, 7 = very much willing). For each dimension, responses above the median were classified as indicating high willingness, while those below the median were classified as low willingness.

Thus, there appears to be a stronger tendency among participants to adopt apps offering healthier recipes compared to those promoting more sustainable options, although in both cases, the majority of respondents expressed a high level of intention to use such apps (**Error! Reference source not found.**).

Table 22 Distribution (%) of intention of willingness to use apps (n=482)

	Low intention	High intention
Healthier recipes	38.6	61.4
More sustainable recipes	45.9	54.1

Regarding the relevant sources, the participants look for recipes, the majority reported searching online—such as using Google—as their primary method, accounting for over three-quarters of responses. Nearly half indicated they use traditional sources like cookbooks, while about one-third rely on cooking websites. Social media platforms such as TikTok, Instagram, and Facebook were also mentioned, though by a smaller proportion—approximately one-quarter or fewer. In contrast, specialized cooking apps and platforms like Pinterest were used by only a small fraction, with each attracting fewer than 10–20% of participants (**Error! Reference source not found.**).

Table 23 Distribution (%) of intention of willingness to use apps

Relevant sources	N	%
Searching online (e.g., on Google)	363	75.3%
Cookbooks	187	38.8%
Cooking websites	149	30.9%
TikTok	124	25.7%
Supermarkets recipe apps/websites	107	22.2%
Facebook	97	20.1%
Cooking blogs	96	19.9%
Instagram	87	18.0%
Cooking apps	48	10.0%
Lifestyle magazines	45	9.3%
Pinterest	41	8.5%
Other	24	5.0%

4.2.17 Intention to use cooking apps in association with vulnerability elements

The questionnaire's multiple dimensions were designed to identify potential confounding variables that may influence users' intention to adopt cooking applications.

4.2.17.1 Age factor

Regarding the age factor, a statistically significant difference in the perceived importance of more sustainable recipes between the age groups 36–60 and 60 and above was observed, indicating greater willingness among the younger group to consider using a novel online recommendations tool that can suggest how to make more sustainable recipes (**Figure 15**).

Figure 15 Mean scores and corresponding 95% confidence intervals of the average of intention to use cooking apps per age group

4.2.17.2 Socioeconomic factor

No statistically significant differences were found between participants of different SES in their willingness to use a novel online recommendation tool, either for healthier or more sustainable recipes, as it can be seen in **Figure 16**.

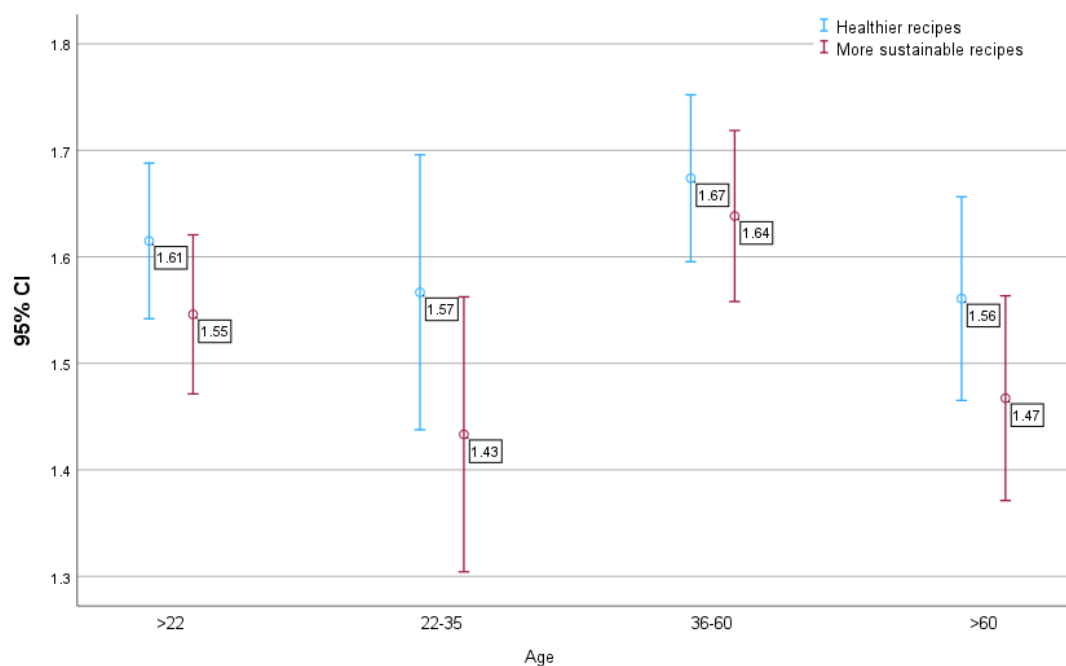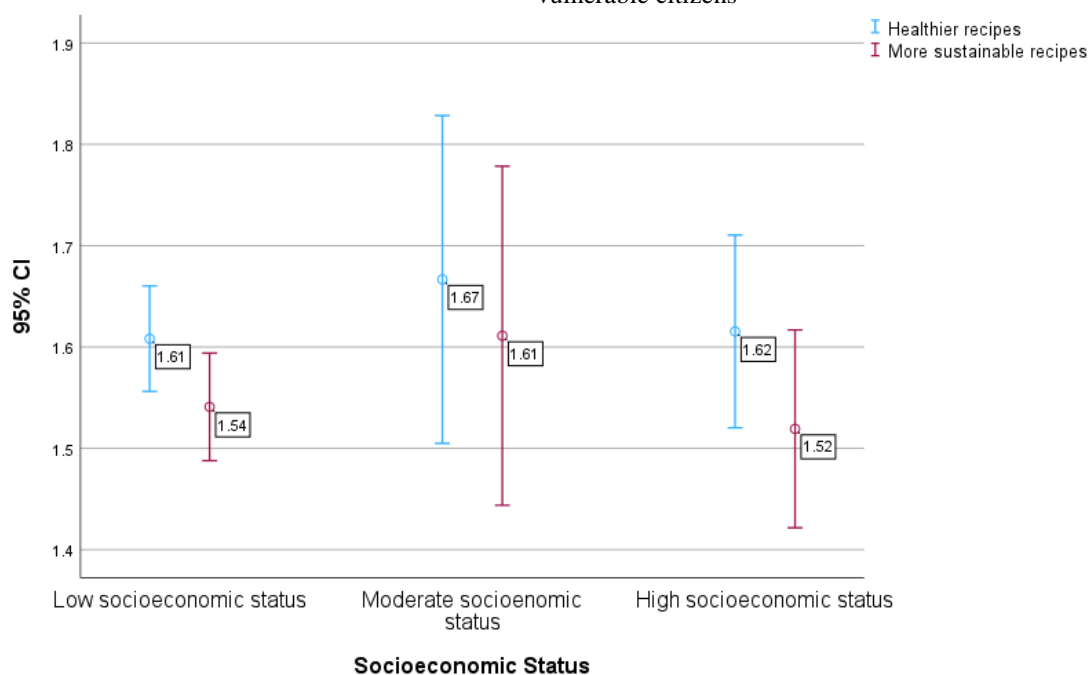**Figure 16 Mean scores and corresponding 95% confidence intervals of the average of intention to use cooking apps per SES**

4.2.17.3 Nutrition and Digital literacy

Respondents with high intention to use applications in order to make the recipes healthier were to score significantly higher in the scales of nutrition literacy and digital literacy ($p<0.001$), as it is illustrated in **Figure 17**.
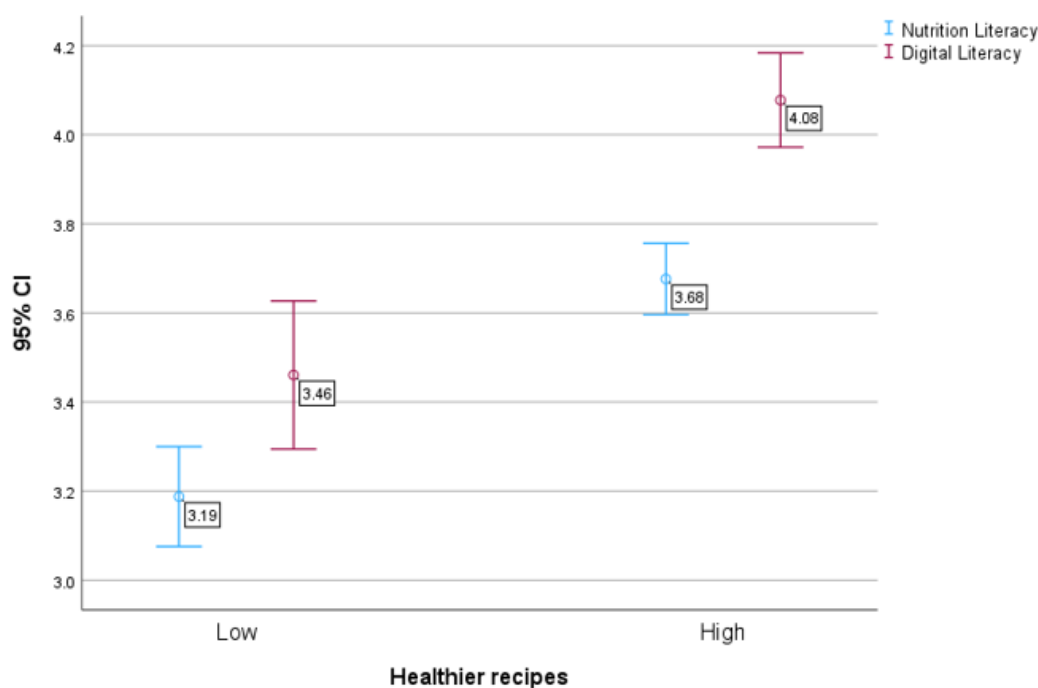
Figure 17 Mean scores and corresponding 95% confidence intervals of the average nutrition and digital literacy according to "the intention to use a novel online recommendations that can suggest how to make the recipe they find online healthier"

Similar trends were observed when it comes to the tendency to use applications in order to make the recipes more sustainable (*p<0.001*). More details are illustrated in **Figure 18**.
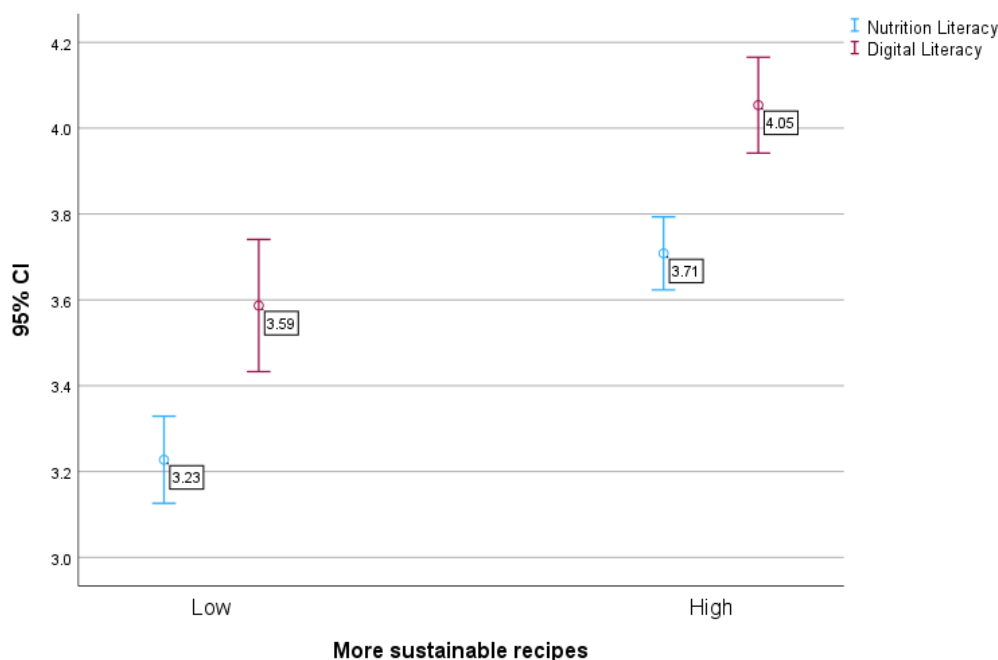
Figure 18 Mean scores and corresponding 95% confidence intervals of the average nutrition and digital literacy according to "the intention to use a novel online recommendations that can suggest how to make the recipe they find online more sustainable"

4.2.17.4 Food security status

The role of respondents' food security status on their intention to use online applications to make the recipes healthier or more sustainable are presented in **Figure 19** and **Figure 20**, respectively. As it is illustrated, the higher the severity of

experienced food insecurity the higher the reported intention to use applications so as to make recipes healthier or more sustainable, even if the associations were borderline significant (*p-value=0.07*).
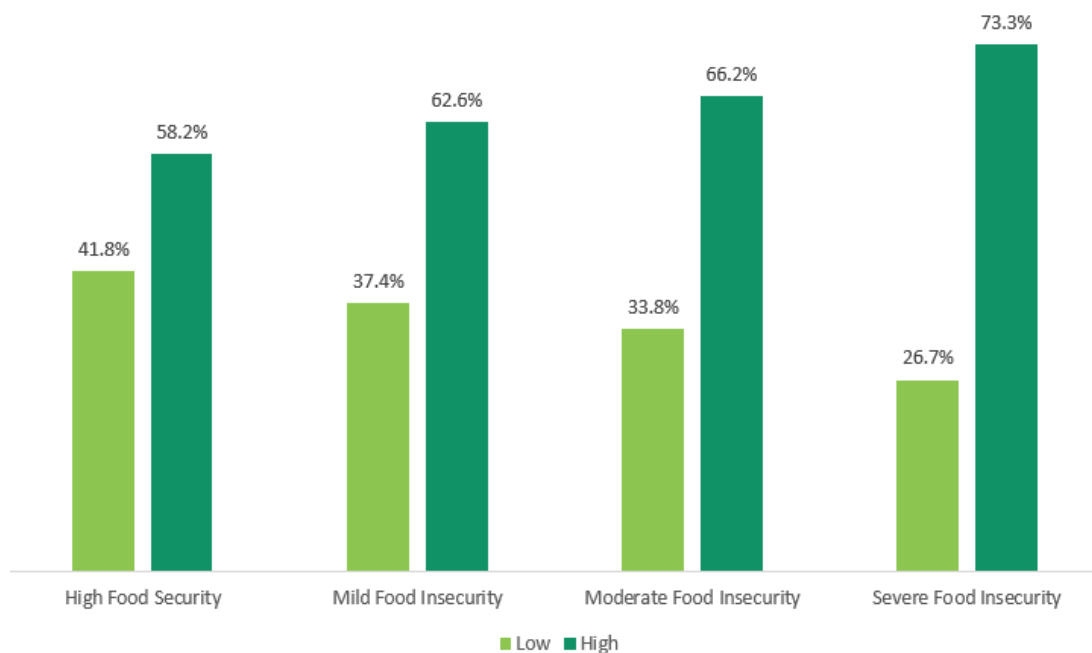
Figure 19 Distribution (%) of food security status per low and high "intention to use a novel online recommendations that can suggest how to make the recipe they find online healthier"
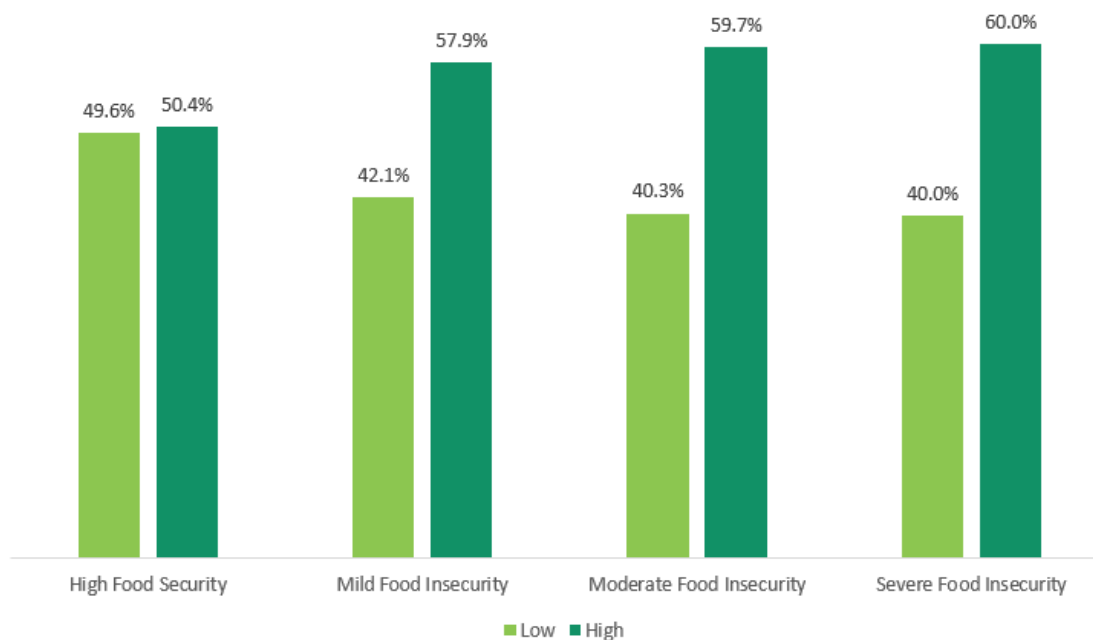
Figure 20 Distribution (%) of food security status per low and high "intention to use a novel online recommendations that can suggest how to make the recipe they find online more sustainable"

4.3   Main conclusions of the quantitative survey

4.3.1   Health Awareness & Nutrition Literacy

High self-awareness about health (e.g., frequent reflection on health) is a strong motivator for healthy behaviors. While most individuals understand what makes food healthy, many struggle with interpreting food labels and trusting food advertising. Notably, those with higher nutrition literacy show a greater willingness to use cooking apps, especially for healthier recipe suggestions.

4.3.2   Food Security Status

- A considerable proportion reported mild to severe food insecurity, including:
    o   Eating fewer or less varied foods.
    o   Skipping meals or cutting portions, especially for children.
- Food-insecure individuals showed greater intention to use apps for healthier/sustainable recipes, possibly as a coping mechanism to improve food choices under constraints.

4.3.3   Attitudes Toward Food and Health

- Preference for fresh, unprocessed foods and avoidance of additives.
- Low reliance on ready-to-eat or heavily processed items.
- Participants are motivated by food price and practicality rather than nutritional content or ethical concerns.

4.3.4   Food Waste & Sustainability Awareness

- Strong concern about financial loss and ethical issues (e.g., hunger, waste of nutritious food).
- Less concern about environmental impacts (e.g., climate change).
- Many feel unsure how to reduce waste, suggesting a need for food waste literacy tools.

4.3.5   Food Skills & Shopping Behaviors

- Strong food safety habits (e.g., reading expiration dates).
- Weaker skills in meal planning, budgeting, and prepping in advance.
- Shopping habits show intentionality: label checking, list following, and bulk buying to save money.

4.3.6   Cultural and Ethnocentric Food Views

- Food is closely tied to family and cultural identity.
- High preference for local and seasonal foods, viewed as tastier, more nutritious, and environmentally friendly.
- Mild to moderate consumer ethnocentrism: local food is preferred, but not from a strong anti-import stance.

4.3.7   Digital Literacy and App Adoption

- Moderate to neutral digital adoption readiness.
- Participants are more willing to adopt apps for healthier recipes than for sustainability.
- Higher digital literacy strongly correlates with app adoption intention.

4.3.8   Vulnerability & Technology Use

- Younger participants more likely to adopt apps for sustainable recipes.
- No strong SES-related differences in willingness to use tools.
- Higher nutrition and digital literacy levels are associated with greater willingness to use recipe apps, although significance was borderline.

4.3.9   Barriers & Emotional Ambivalence

- Moderate emotional conflict/indecision about changing cooking habits for health or sustainability.
- Potential resistance to change, even when intention is present.

5   General Conclusions

The general conclusions of the desktop research, qualitative and quantitative research implemented are summarized in **Table 24**.

Table 24 Summary of the findings for vulnerable citizens and impact for the DietWise project

Summary	Lever (+) or barrier (-)	How the DietWise project should address this finding
Health Awareness & Nutrition Literacy		
High self-awareness about health (e.g., frequent reflection on health)	+	Leverage this motivation by emphasizing personal health tracking and positive reinforcement in the app.
Moderate nutrition literacy	+	Use simple, visual aids, and avoid jargon. Offer educational features on interpreting food information.
	-	Include onboarding support and introductory content to raise literacy and foster trust.
Food Security Status		
A considerable proportion reported mild to severe food insecurity, including: ▪ Eating fewer or less varied foods. ▪ Skipping meals or cutting portions, especially for children.	+	Provide budget-friendly, nutrient-dense recipes and tips for stretching food. Highlight cost-saving features. Target this group with supportive messaging and easy-to-access resources in the app.
Attitudes Toward Food and Health		
Preference for fresh, unprocessed foods and avoidance of additives. Low reliance on ready-to-eat or heavily processed items.	+	Emphasize whole food-based recipes and avoid promoting processed options.
Participants are motivated by food price and practicality rather than nutritional content or ethical concerns.	+	Focus recipe suggestions on affordability and ease, rather than sustainability messaging alone.
Food Waste & Sustainability Awareness		
Strong concern about financial loss and ethical issues (e.g., hunger, waste of nutritious food).	-	Avoid guilt-based messages. Instead, show how reducing food waste saves money.
Less concern about environmental impacts (e.g., climate change).	-	
Many feel unsure how to reduce waste, suggesting a need for food waste literacy tools.	-	Include food waste literacy tools: portion planning, leftovers recipes, expiry reminders.
Food Skills & Shopping Behaviors		
Strong food safety habits (e.g., reading expiration dates).	+	Reinforce these habits through app features like reminders for expiration dates.
Weaker skills in meal planning, budgeting, and prepping in advance.	-	Offer pre-made meal plans, shopping lists, and budgeting tools.
Shopping habits show intentionality: label checking, list following, and bulk buying to save money.	+	Align app content with existing behaviors: bulk cooking tips, sales alerts, etc.
Cultural and Ethnocentric Food Views		
Food is closely tied to family and cultural identity.	+	Personalize content to reflect cultural food traditions. Allow filtering by cuisine or region.

High preference for local and seasonal foods, viewed as tastier, more nutritious, and environmentally friendly. Mild to moderate consumer ethnocentrism: local food is preferred, but not from a strong anti-import stance.	+	Highlight seasonal/local recipes and enable location-based suggestions.
Digital Literacy and App Adoption		
Moderate to neutral digital adoption readiness.	-	Ensure app remains accessible regardless of economic background—keep it free or low-cost.
Higher digital literacy strongly correlates with app adoption intention.	-	
Younger participants more likely to adopt apps for sustainable recipes.	-	Design features that appeal to younger demographics (gamification, social sharing).
Barriers & Emotional Ambivalence		
Moderate emotional conflict/indecision about changing cooking habits for health or sustainability.	-	Incorporate motivational support, success stories, and gentle nudging.
Potential resistance to change, even when intention is present.	-	Use behavioral design (e.g., small wins, reminders, habit tracking) to ease users into change.

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Annexes

Annex I Interview Guide

Section 1: General Context

1. **For nutrition experts:** Can you describe your role and experience in promoting nutrition guidelines or tools related to nutrition guidelines promotion in your country?

Section 2: Identification of needs, barriers and facilitators of vulnerable groups in terms of nutritional habits

2. Based on your experience to date, which groups do you consider vulnerable in terms of their dietary habits and why? Which is their sociodemographic profile? Are there any gender-related vulnerability issues?

3. Can you describe what are the needs of these vulnerable target groups in terms of dietary habits? Describe the special needs of each target group. Please consider issues related with food insecurity, food literacy, digital literacy etc.

4. What are the key facilitators that enhance compliance with nutrition guidelines through tools and applications for these vulnerable target groups?

5. What are the major barriers to implementing effective interventions or promoting tool uptake for vulnerable target groups? How can these be mitigated?

Section 3: Existing promotion systems for vulnerable target groups

6. What strategies or systems are currently in place to promote proper dietary habits to these vulnerable groups;

7. What role do government, private sector, and non-governmental organizations play in these promotion efforts?

8. How effective are these strategies or systems in achieving their goals? Can you share examples or success stories?

9. What behavioral interventions are implemented to support compliance with nutrition guidelines for the vulnerable populations that you mentioned in your country?

10. Which of these interventions are most successful, and what factors contribute to their success?

11. How do you address cultural or societal barriers to implementing these interventions?

Section 4: Tools and applications for nutrition (digital tools) for vulnerable target groups

12. Do you know any digital tools or applications that are being used in your country to encourage healthier eating habits for the vulnerable populations that you mentioned?

13. Do you think they are an effective health promotion tool? Which tools or applications have proven most effective, and why?

14. Are there any gaps or limitations in the tools currently available? How can they be improved?

15. Do you experience cultural or societal barriers to implement digital interventions? How would you address them?

Section 5: Recommendations and Insights

16. Based on your experience, what interventions would you recommend for improving the uptake of tools and applications promoting healthier eating habits for these vulnerable target groups?

17. How can national nutrition guidelines be better integrated into everyday tools and platforms used by individuals who belong to these vulnerable target groups?

Section 6: Final Thoughts

18. What additional insights or considerations do you think are important for us to understand about promoting compliance with nutrition guidelines for these vulnerable populations?

Annex II Definition of socioeconomic status

Educational level
e1. Less than primary education
e2. Primary or first stage of basic education
e3. Lower secondary or second stage of basic education
e4. Upper secondary education
e5. Post-secondary non-tertiary education (vocational)
e6. Tertiary Education
e7. Master's Degree
e8. Doctoral Degree

Occupation
o1.   Employed manager or business executive with 6+ subordinates
o2.   Self-employed professional (i.e. physician, lawyer, accountant, etc.)
o3.   Employed professional (i.e. physician, lawyer, accountant, etc.)
o4.   Employed manager or business executive with 0-5 subordinates
o5.   Employed supervisor with 6+ subordinates
o6.   Employed supervisor with 0-5 subordinates

o7.   Entrepreneur, business/shop owner with 6+ employees
o8.   Office worker in non-manual labor
o9.   Entrepreneur, business/shop owner with 0-5 employees
o10.   Student
o11.   Employee outside of the office in non-manual labor
o12.   Farmer, breeder/poultry breeder, fisherman.
o13.   Housewife/househusband
o14.   Manual labor occupation either with specialization or in a supervisory position
o15.   Manual labor occupation with no specialization and in a non-supervisory position
o16.   Retired (with previous occupation), temporarily unemployed

Definition of socioeconomic status according to educational level and occupation							
	o1+o2	o3+o5	o4+o6+o7	o12	o8+o9+o16	o11+o14	o10+o13+o15
e6+e7+e8	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	LOW
e5	HIGH	HIGH	HIGH	HIGH	MODERATE	MODERATE	LOW
e4	HIGH	HIGH	HIGH	MODERATE	MODERATE	LOW	LOW
e3	HIGH	LOW	LOW	LOW	LOW	LOW	LOW
e1+e2	LOW	LOW	LOW	LOW	LOW	LOW	LOW

Socioeconomic status categories:
▪   **High socioeconomic level:** Business executives or professionals or high educational level employees in non-manual labor or specialized employees or retired with high educational level.
▪   **Moderate socioeconomic level:** Employees in non-manual labor or specialized employees or retired.
▪   **Low socioeconomic level:** Unskilled employees in manual labor or low educational level employees or permanently unemployed or students or retired with low educational level.

Annex III Survey Questionnaire

SOCIODEMOGRAPHIC CHARACTERISTICS

1. **How many children do you have at home?**
    •   0
    •   1
    •   2
    •   3
    •   4
    •   5 or more

2. **How many people live in your household, including yourself?**
    •   1
    •   2
    •   3
    •   4
    •   5
    •   6
    •   7 or more

3. **Place of residence:**
   - Village (up to 500 inhabitants)
   - Town (501 - 10,000 inhabitants)
   - Medium-sized city (10,001 - 100,000 inhabitants)
   - Large city (100,001 inhabitants and above)

4. **Marital status:**
   - With a partner (married or living in an unregistered marriage)
   - Single (widow/widower, divorced, without a partner)

5. **What is your average monthly household income (after taxes and deductions)?**
   - Under 500 EUR
   - 501 EUR to 1500 EUR
   - 1501 EUR to 2500 EUR
   - 2501 EUR to 3500 EUR
   - 3501 EUR to 4500 EUR
   - 4501 EUR to 5500 EUR
   - 5501 EUR and above
   - Prefer not to say

6. **Do you consider yourself to be:**
   - Catholic
   - Orthodox Christian
   - Protestant
   - Other Christian
   - Jewish
   - Muslim - Shia
   - Muslim - Sunni
   - Other Muslim
   - Sikh
   - Buddhist
   - Hindu
   - Atheist
   - Other [indicate]
   - Don't know
   - Non-believer or agnostic
   - Prefer not to say

ABOUT YOU

Please read the statements below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)
1. I reflect about my health a lot.
2. I'm very self-conscious about my health.
3. I'm generally attentive to my inner feelings about my health.

Please read the statements below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)
1. Among my peers, I am usually the first to try out new online tools or mobile applications.
2. I must see other people using new online tools or mobile applications before I will consider them.
3. If I heard about new online tools or mobile applications, I would look for ways to experiment with them.

NUTRITION LITERACY

It is not always easy to get understandable, reliable, and useful information about nutrition. With the following questions, we would like to find out what challenges exist when dealing with information about healthy eating. How easy would you say it is for you to … (5-point scale, where 1 = never; 5 = always)
1. find or get useful information about which foods are healthy and which are less healthy?
2. find or get useful information about what you should eat and drink more or less of to maintain a healthy diet?

3. find out what to look for in a healthy diet?
4. understand information about why some foods are healthy and others are not?
5. understand the information about ingredients on food packaging (list of ingredients and nutritional table)?
6. understand dietary recommendations that tell you how often, what, and how much you should eat and drink to maintain a healthy diet?
7. judge whether you can trust food advertising?
8. judge whether information about healthy eating is right or wrong?
9. judge how trustworthy information about healthy eating is on the internet and social media?
10. decide what to eat and drink more or less of in order to maintain a healthy diet?
11. explain to others in an understandable manner what a healthy diet is all about?
12. follow recommendations for a healthy diet?

DIGITAL LITERACY

Please read the statements below and indicate your agreement. (5-point scale, where 1 = strongly disagree; 5 = strongly agree)
1. I can use applications/programs (like Zoom) on my cell phone, computer, or another electronic device on my own (without asking for help from someone else).
2. I can set up a video chat using my cell phone, computer, or another electronic device on my own (without asking for help from someone else).
3. I can solve or figure out how to solve basic technical issues on my own (without asking for help from someone else).

ATTITUDES TOWARDS FOOD AND FOOD CHOICES
Please read the statements below and indicate your agreement. (5-point scale, where 1 = totally disagree; 7 = totally agree)
1. I compare labels to select the most nutritious food
2. I have more confidence in food products that I have seen advertised than in unadvertised products
3. I try to avoid food products with additives
4. I make a point of using natural or ecological products
5. I prefer to buy meat and vegetables fresh rather than pre-packed
6. I frequently use ready-to-eat foods in our household
7. I frequently use mixes, for instance, baking mixes and powder soups

FOOD SKILLS
Please read the statements below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)
1. Planning meals ahead (e.g., for the day/week ahead)
2. Preparing meals in advance e.g., packed lunch, partly preparing a meal in advance
3. Following recipes when cooking
4. Shopping with a grocery list
5. Shopping with specific meals in mind
6. Planning how much food to buy
7. Comparing prices before you buy food
8. Knowing what budget you have to spend on food
9. Buying food in season to save money
10. Buying cheaper cuts of meat to save money
11. Cooking more or double recipes which can be used for another meal
12. Preparing or cooking a healthy meal with only few ingredients on hand
13. Preparing or cooking a meal with limited time
14. Using leftovers to create another meal
15. Keeping basic items in your cupboard for putting meals together? e.g., herbs/spices, dried/tinned goods
16. Reading the best-before date on food
17. Reading the storage and use-by information on food packets
18. Reading the nutrition information on food labels
19. Balancing meals based on nutrition advice on what is healthy

FOOD SECURITY STATUS

During the last 12 months, was there a time when, because of lack of money or other resources (Scale:

Yes, No, I don't know, Prefer not to say)
1. You were worried you would not have enough food to eat?
2. You were unable to eat healthy and nutritious food?
3. You ate only a few kinds of foods?
4. You had to skip a meal?
5. You ate less than you thought you should?
6. Your household ran out of food?
7. You were hungry but did not eat?
8. You went without eating for a whole day?

If the answer is 1 or higher in Question 2 of the Sociodemographics section
During the last 12 months, was there a time when, because of lack of money or other resources (Scale:
Often, Sometimes, Never true)
9. You relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food
10. You couldn't feed our children a balanced meal, because we couldn't afford that.
11. The children were not eating enough because we just couldn't afford enough food.

If the answer is 1 or higher in Question 2 of the Sociodemographics section
During the last 12 months, was there a time when, because of lack of money or other resources (Scale:
Yes, No, I don't know, Prefer not to say)

12. Did you ever cut the size of any of the children's meals because there wasn't enough money for food?
13. There the children ever hungry but you just couldn't afford more food?
14. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food?
15. *If yes to question 14,* how often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
16. Did any of the children ever not eat for a whole day because there wasn't enough money for food?

FOOD PREFERENCES
1. **Which if any of the following food issues concern you? (Up to 3 answers)**
   - The price of food
   - Food waste
   - How long fresh food lasts for
   - The way that food products are packaged
   - Seasonality of food
   - Food labelling (e.g. 'use by' date, storage instructions)
   - Food miles (the distance that food travels)
   - Food ingredients (e.g. salt, fat, sugar, additives)
   - Food safety (e.g. Salmonella, E. coli)
   - Genetically Modified (GM) foods
   - Nutritional content of food
   - The welfare of animals
   - Shortages in food supply
   - None of these

FOOD WASTE ATTITUDES
And now focusing your attention to food waste in particular, how concerned are you about the following? (5-point scale, where 1 = not at all concerned; 5 = extremely concerned)
1. Resources that went into food are wasted
2. People go hungry every day
3. Wasted money from throwing out food
4. Impact on biodiversity by using fertilizers and pesticides
5. Contribution to Climate Change - growing, processing, disposal of food
6. Unnecessary packaging waste
7. Waste of healthy/nutritious ingredients
8. Waste of time and effort by farmers/ food producers

When you do your main food shopping, how frequently does the following apply to you? (This often applies to me; This sometimes applies to me; This rarely applies to me; This never applies to me)

1. Choose a smaller trolley or shopping basket
2. Stick to a shopping list
3. Buy an item wih reduced price - near its expiry date
4. Buy bigger pack because cheaper
5. Check labels for use by / best before dates
6. Buy unplanned item family wanted
7. Buy bigger than needed - smaller unavailable

For each of the following statements tell us if it is true, or false or whether you just don't know? (True; False; I don't know)

1. 'Best before' date means it can be eaten after this date, but may not be best quality
2. 'Best before' date means it can be eaten up to date, but should not be eaten past this date
3. 'Use by' date means it can be eaten after date, but may no longer be best quality
4. 'Use by' date means it will be safe up to this date, but not be eaten past this date

To what extent do you agree or disagree with the following statements? (5-point scale, where 1 = totally disagree; 5 = totally agree)

1. Food waste is a serious environmental issue like climate change
2. Minimizing my food waste is one of my top priorities
3. I am concerned about the cost of the food that goes to waste in my home.
4. I want to save money by reducing the amount of food I waste   Throwing away uneaten food is the same as throwing money in the bin
5. I believe it will make a real difference if I reduce the amount of food that I waste
6. I would like to reduce my food waste but I don't know how

Cooking-related Ambivalence

Please indicate the extent to which the following words describe your feelings toward changing your cooking habits to become healthier habits. (5-point scale, where 0 means „don't harbor this feeling", 1 means „slightly" and 5 „extremely")

1. Conflicted
2. Mixed
3. Indecision

Please indicate the extent to which the following words describe your feelings toward changing your cooking habits to become more sustainable habits (5-point scale, where 0 means „don't harbor this feeling", 1 means „slightly" and 5 „extremely")

1. Conflicted
2. Mixed
3. Indecision

CULTURAL AND REGIONAL ASPECTS OF NUTRITION

Please read the statements below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)

1. Food is a central part of my family's traditions and celebrations.
2. I tend to participate in preparing traditional dishes for special occasions.
3. I am knowledgeable about the food-related customs of my culture.
4. I enjoy learning about and trying dishes from other cultures.
5. My culinary practices have been influenced by the foods of other regions.
6. I see food as a way to bridge cultural differences and foster understanding.

Please read the statements below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)

1. Locally produced foods just taste better.
2. All else equal, there is no taste difference between a locally produced food and one that was shipped from somewhere else.
3. Locally produced foods are more nutritious than foods that have been shipped from somewhere else.
4. Locally produced food has lower environmental impact. (this item will be analyzed separately from this scale)

CONSUMER ETHNOCENTRIS   M

Please read the statements about your diet below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)

1. One should not buy imported food because it hurts local farmers.
2. It is not right to purchase imported food because it causes the loss of jobs in [adapt country].
3. One should only buy domestic food.
4. I always prefer local food over imported products.

SEASONAL FOOD ORIENTATION

Please read the statements about your diet below and indicate your agreement. (7-point scale, where 1 = totally disagree; 7 = totally agree)

1. Seasonal vegetables taste better than out-of-season produce
2. Foods in season are more nutritious than foods out-of-season.
3. Eating seasonal foods is an important part of my diet
4. I believe seasonal foods have a fresher taste compared to non-seasonal options
5. I prefer to eat foods that are naturally available during their peak season
6. Eating seasonally has significant environmental benefits (less energy consumption, transport emissions, chemical inputs, etc.)

INTENTION TO USE COOKING APPS

Imagine that you are about to cook dinner at home, and you are searching for a recipe on the internet.

1. Would you be willing to use a novel online recommendations tool that can suggest you how to make your recipes you find online **healthier**? (1 = not willing at all, 7 = very much willing)
2. Would you be willing to use a novel online recommendations tool that can suggest you how to make your recipes you find online **more sustainable**? (1 = not willing at all, 7 = very much willing)
3. Mark all relevant sources where you look for recipes when cooking at home:
    •   Searching online (e.g., on Google)
    •   Supermarkets recipe apps/websites
    •   Cookbooks
    •   Cooking blogs
    •   Cooking websites
    •   Cooking apps
    •   TikTok
    •   Pinterest
    •   Instagram
    •   Facebook
    •   Lifestyle magazines
    •   Other [indicate]

4. Which of the following would motivate you to start using a cooking app or online tool?
(Multiple answers possible)
    •   To gain insight into healthiness of recipes
    •   To gain insight into sustainability of recipes
    •   To gain insight into specific products or nutrients or ingredients
    •   To gain insight in possible alternatives for certain products
    •   To gain insight into the intake of key nutrients, such as proteins
    •   To reduce the amount of leftovers
    •   To be reminded about products that I need to buy
    •   I need help with selecting foods that I am not allergic to
    •   I need help with selecting quality foods that are cheaper than others
    •   I need help with selecting foods that are appropriate for my religion
    •   I need help with selecting foods that fit my diet type
    •   Other: ………………….