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Plant-Based Meat Alternatives in the Context of Sustainable Nutrition and Tourism: A Conceptual Assessment for the Tourism Industry**

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Abstract

This study aims to conceptually evaluate the opportunities and potential implications of plant-based meat alternatives for the tourism industry within the framework of sustainable nutrition and tourism. The study was designed as an exploratory qualitative study employing document analysis. The sources forming the findings section were identified through a structured literature identification and selection process and evaluated using thematic content analysis. The analytical corpus consisted of 61 unique sources directly contributing to the thematic synthesis. The findings were organized under three themes: plant-based meat alternatives in the context of sustainability, plant-based meat alternatives in the context of health and ethics, and the relationship between tourism and plant-based meat alternatives. The results indicate that plant-based meat alternatives may function as a complementary component of sustainable food and tourism practices by supporting menu diversification, gastronomic inclusivity, destination image, and value-oriented food services. In conclusion, these products are considered to have the potential to play an innovative, inclusive, and transformative role in the tourism industry.

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INTRODUCTION

Sustainable nutrition is increasingly conceptualized as a multidimensional dietary approach that integrates environmental responsibility with human health and long term food security. Rather than focusing solely on nutritional adequacy, this perspective emphasizes the protection of ecosystems and biodiversity, the responsible use of natural and human resources, and the alignment of dietary practices with cultural, social, and economic contexts. From this viewpoint, sustainable nutrition encompasses not only health-promoting and safe food choices but also considerations of accessibility, affordability, and social equity across generations (Burlingame & Dernini, 2012; Dernini et al., 2017). Considering the continued growth of the global population, Mambo and Lhermie (2024) noted that global food demand may increase by 60% by 2050, highlighting the growing challenge of feeding humanity within planetary limits. Comparable concerns remain relevant today, with global food demand anticipated to rise by nearly 70 percent by 2050 (UN, 2019; Leite et al., 2025). This increase will cause global food systems to expand further; however, it is thought to create significant challenges in terms of protecting the ecosystem, meeting the nutritional needs of the growing population, and maintaining a sustainable diet (Bakhsh et al., 2021; Uyarcan et al., 2022).

Livestock production has become a foundational component of contemporary global food systems. Worldwide meat output has expanded markedly over recent decades, with total production increasing from 70.57 million tonnes in 1961 to 355.46 million tonnes by 2022 (Ritchie et al., 2023). Global meat production has reportedly increased by approximately 45 percent between 2000 and 2020. As of 2023, the average per capita meat consumption worldwide is estimated to be 28.5 kg (Meat and Milk Board, 2024). If this trend continues, meat production is estimated to reach 400 million tons by 2030 and 500 million tons by 2050 (Lazic et al., 2023). In parallel, current agricultural and livestock production systems place substantial pressure on natural resources, as agrifood systems contribute to approximately one-third of anthropogenic greenhouse gas emissions, while agriculture accounts for nearly 70% of global freshwater withdrawals (Mekonnen & Hoekstra, 2012; Govoni et al., 2024; FAO, 2025). These data indicate that current production patterns threaten environmental sustainability by making it difficult to establish sustainable food systems in the future (Steffen et al., 2015). Pekcan (2019) also assessed this situation as a reflection of increasing environmental pressures on current food systems. Excessive consumption of meat, particularly red and processed types, has been widely discussed in relation to increased risks of chronic health conditions such as diabetes, cardiovascular disease and certain cancers (Giromini & Givens, 2022). Several studies suggest that higher intake levels of red and processed meat are linked to elevated mortality risk and stroke incidence, with reported increases of approximately 22% and 18%, respectively (Abete et al., 2014; Kim & Je, 2018).

Considering increasing environmental and public health concerns related to conventional meat production, plant-based meat alternatives have gained attention as a complementary strategy rather than a major stand-alone solution for sustainable food supply chains. Global modelling suggests that replacing 50% of major animal-source products with plant-based alternatives by 2050 could reduce agriculture- and land-use-related greenhouse gas emissions by 31% and water use by 10%. Therefore, plant-based meat alternatives should be discussed as one component of broader dietary, technological, and supply-chain changes rather than as the primary solution to sustainability challenges (Santo et al., 2020; Kozicka et al., 2023).

On the other hand, in line with shifting tourist expectations, the increasing tendency to learn about and engage with other cultures, a dimension that is increasingly recognized as an essential part of contemporary tourism. This growing cultural curiosity plays a notable role in shaping tourists' destination choices and is considered an important motivational factor driving travel behavior (Güllü & Atasoy, 2019). In recent years, gastronomy has emerged as a prominent subcomponent of culture and an integral element of the tourism experience. The desire to explore and engage with diverse culinary traditions has increasingly begun to shape destination preferences, establishing itself as a significant determinant of tourist decision-making (Kivela & Crotts, 2006; Kim et al, 2010; Björk & Räisänen, 2014). However, data reported by Park et al. (2022) indicate that, as of 2021, approximately 79 million individuals worldwide adhered to a vegan diet, and this number is projected to approach 10 percent of the global population by 2030 (Ottenbacher et al., 2025). Accordingly, the demand for plant-based dietary patterns and alternative protein sources is expected to increase steadily. This trend is anticipated to generate a need for transformation not only in individual consumption preferences but also in the products and services offered by tourism destinations. Plant-based alternative consumption, shaped by multifaceted motivations such as health, ethics, and environmental sustainability, encompasses not only vegan and vegetarian individuals but also a broader group that includes flexitarians, environmentally conscious consumers, and those pursuing healthy lifestyles. However, the lack of suitable gastronomic options for such individuals at destinations has been identified as a significant barrier to travel (Lee et al., 2014; Eren, 2020; Huang, 2020). In this context, plant-based meat alternatives hold multifaceted strategic potential for tourist destinations. These products can enable destinations to develop sustainable gastronomy strategies, diversify the dining experiences offered to tourists, and create value-oriented services that appeal to environmentally conscious

consumers. Furthermore, destinations can contribute to increasing innovative gastronomy practices that are compatible with local culinary culture by developing a sustainability image.

This study aims to identify the opportunities that plant-based meat alternatives offer to the tourism industry within the framework of sustainable nutrition and tourism, and to conceptually evaluate the potential implications of these products for destination sustainability strategies through a document analysis approach. In this regard, the study first introduces plant-based meat alternatives within a conceptual framework and then discusses the potential contributions and transformative effects that these products can bring to the tourism industry in the context of gastronomic tourism, destination image, and sustainable consumption practices. Ultimately, this study seeks to offer a comprehensive perspective on the potential transformative role of plant-based meat alternatives within the tourism industry, positioning them not simply as innovative menu items but as elements that may contribute meaningfully to sustainable destination management and contemporary gastronomy.

2. CONCEPTUAL FRAMEWORK

2.1. Gastronomic tourism

The concept of gastronomic tourism began to attract scholarly attention in the late 1990s and has since evolved into a significant area of interest within both tourism research and practice (Long, 2004). Over time, gastronomy has been increasingly recognized not only as a distinctive attribute that enhances destination competitiveness but also as a standalone component of the tourism market. This evolving understanding has been reflected in international tourism discussions, including the Third Gastronomy Tourism Forum organized by the United Nations World Tourism Organization in 2017, where gastronomy was highlighted as a strategic driver of tourism development. From this perspective, gastronomic tourism is commonly understood as a form of tourism centered on food-related experiences, encompassing the products, activities, and cultural encounters that visitors engage with through cuisine during their travels. Thus, gastronomic elements function as the primary motivation for travel, rather than merely as a secondary or complementary attraction (Yıldız, 2016; Akbulut & Yazıcıoğlu, 2020; World Tourism Organization, 2025). Especially at this point, gastronomy has become one of the key factors influencing destination choice, beyond being an integral part of tourism, and plays a powerful role in determining the direction of tourism (Kim et. al., 2010; Björk & Raisanen, 2014). Gastronomic tourism extends beyond the mere tasting of local flavors; it provides visitors with multidimensional cultural experiences, including engagement with traditional, authentic, and innovative culinary practices, interaction with local producers, and participation in gastronomy-themed festivals and educational initiatives (Akbaba & Kendirci, 2016). In this context, gastronomy provides visitors with the opportunity to establish a deeper connection with a region's cultural heritage, traditions, and history (Kyriakaki et al., 2013). Accordingly, a substantial relationship has been identified between the gastronomic richness of a destination and the underlying factors influencing tourists' destination preferences (Fields, 2002; Long, 2004; Phau et al., 2014).

Gastronomic tourism is considered an integrated sensory experience beyond the basic physical act of consumption (Suryana et al., 2025). In recent years, tourist profiles have notably transformed, influenced by factors such as environmental sustainability, ethical values, and the pursuit of healthy living. Consumers are now turning to health-conscious dietary alternatives that reflect environmental and ethical sensibilities rather than focusing solely on the feeling of satiety. In this context, interest in plant-based dietary patterns, such as vegan, vegetarian, and flexitarian diets, has increased internationally (Willett et al., 2019; Coe & Spiro, 2022). This trend has the potential to evolve into a significant and distinctive thematic focus within gastronomic tourism over time. Accordingly, the diversification of traditional local cuisines to accommodate plant-based preferences is viewed not only as a means of meeting tourist demand but also as a strategic element that may enhance destinations' competitive advantage.

A review of the existing literature indicates that the role of plant-based meat alternatives in tourism remains insufficiently explored. In particular, limited research has examined how these products may contribute to gastronomic tourism or how they can be integrated into food-related tourism experiences. Instead, existing research predominantly addresses the challenges encountered by vegan and vegetarian individuals during tourism activities. Sünnetçioğlu et al. (2017) analyzed the difficulties faced by vegan consumers in restaurant settings in relation to menu composition, staff attitudes, and organizational responsiveness, whereas Dilek (2018), provided a conceptual examination of the infrastructural capacities for vegan and vegetarian tourism in Türkiye. Tabu (2020), presents an inventory by classifying traditional dishes suitable for vegan, vegetarian, and pescatarian individuals in different regions of Turkey. Similarly, Li et al. (2021) investigated vegan tours organized in China and delineated the general characteristics of thematic tourism within this domain. Kara and Bilim (2022) examined this consumer group through the lens of "accessible tourism," underscoring the necessity of developing menus aligned with universal design principles. Aldemir (2024) addressed the challenges encountered by vegan tourists traveling in Anatolia, highlighting conceptual awareness gaps and deficiencies in the menu offerings of food and beverage establishments as key concerns.

2.2. Plant-based meat alternatives

Plant-based meat alternatives are conceptualized as sustainable products derived from the processing of high-protein plant sources to emulate the sensory and chemical properties of conventional animal meat (Joshi & Kumar, 2015; Choudhury et al., 2020). An examination of the historical development of such products indicates that their earliest forms were traditional foods characteristic of Asian culinary traditions, including tofu, seitan, and tempeh. Furthermore, these products have long been used as substitutes for meat in Asian cultures (Elzerman et al., 2013). In recent years, growing attention to environmental sustainability, heightened individual health concerns, and increased awareness of animal welfare have collectively intensified interest in alternative products that replicate the qualitative attributes of meat, thereby accelerating the development of meat analogs (Michel et al., 2021). These dynamics have driven consumer demand towards new formulations, particularly plant-based meat alternatives designed to more closely mimic the sensory characteristics of traditional meat (including taste, texture, appearance, and mouthfeel) (Ali & Bharali, 2025). Currently, the proliferation of such products on supermarket shelves appears unavoidable, and numerous global food and beverage companies have begun incorporating these alternatives into their menus (Brooker et al., 2022).

Plant-based meat alternatives have evolved into a prominent segment of the global food industry, characterized by a rapidly expanding consumer base and strong market performance. Industry reports estimate that over 400 million consumers worldwide now consume these products, with market projections indicating continued expansion over the coming years (Markets & Markets, 2022; Zhao et al., 2022). In this context, this expansion is not limited to vegan or vegetarian consumers. Instead, product development strategies increasingly target flexitarians and conventional meat eaters by replicating key sensory characteristics of animal-based meat, including taste, texture, aroma, and visual appeal, thereby reducing perceptual barriers to adoption (Ismail et al., 2020; Ye & Mattila, 2021). Concurrently, increasing societal awareness of the environmental consequences of conventional livestock production underscores the urgency of developing alternative systems that mitigate greenhouse gas emissions and reduce the pressure on natural resources (Zhao et al., 2023). In addition, recent years have witnessed a marked expansion in scholarly research employing terminology such as “plant-based meat alternative,” “protein alternative,” and “meat analog” (Font-i-Furnols, 2023). Considering the growing world population in the coming years, meat consumption must be reduced by approximately 40% to maintain healthy and sustainable diets (Kemper et al., 2023).

Recent advances in food processing technologies have enabled the conversion of plant-derived, protein-rich raw materials, such as soy, pea, and sunflower, into products that approximate the sensory and structural attributes of conventional meat (Tonheim et al., 2022). These products typically comprise substantial proportions of water, plant-based proteins, flavoring agents, lipids, colorants, and texturizing or thickening agents (Ahmad et al., 2022). As the principal building blocks of meat analogs, plant proteins exert a critical influence on structural integrity, color development, texture formation, and flavor characteristics. Proteins utilized in plant-based meat formulations are primarily derived from legumes, such as soybeans, peas, chickpeas, and lentils. These proteins are critical for the sensory quality of the final product, contributing through a range of key functional properties, including solubility, emulsification, gelation, and flavor-binding capacity (Boukid, 2021). In addition to these core protein sources, various functional ingredients are incorporated to further optimize textural performance and overall product functionality. Common plant-based binding and structuring agents include soy protein isolates and concentrates, wheat gluten, methylcellulose, pectin, carrageenan, guar gum, xanthan gum, locust bean gum, dietary fibers, and starches. (Esmer et al., 2024). The fats used in these products are critical for flavor and texture. In particular, fats such as coconut, avocado, sunflower, and rapeseed are often preferred to mimic the juiciness and mouthfeel of meat (Dekkers et al., 2018; Isusi et al., 2023). To capture the taste of real meat, natural flavor components such as red pepper, sugar, spices, and aromatic herbs, as well as sweeteners are added to the product. These additives help create a meat-like aroma profile by masking the distinctive taste of plant-based proteins (Jung et al., 2024). In the formulation of plant-based meat alternatives, various natural and bioengineered ingredients are strategically employed to replicate the visual and structural characteristics of conventional meat. To achieve meat-like coloration, pigment sources such as annatto extracts, lycopene, and compounds derived from beetroot and leghemoglobin are commonly utilized. Simultaneously, polysaccharides play a functional role in enhancing the texture, water-holding capacity, and structural stability of the final product (Boukid, 2021). Despite these technological advancements, the nutritional composition of plant-based meat analogs differs from that of animal-derived meat in several critical respects. Previous studies indicate that the main nutritional limitation of plant-based meat alternatives is related to protein quality, particularly imbalances in essential amino acid profiles and the presence of limiting amino acids. Although micronutrients such as vitamin B12, iron, and omega-3 fatty acids remain relevant, these concerns are secondary to the need to improve amino acid balance and protein digestibility through appropriate protein source selection, blending, and processing strategies (Öztürk et al., 2024; Domić et al., 2025). Consequently to address these nutritional limitations, manufacturers commonly use protein complementation, ingredient blending, and targeted fortification strategies. These approaches may involve

combining complementary plant protein sources or adding selected limiting amino acids, together with micronutrients such as iron, zinc, vitamin B12, and other B-complex vitamins, to better approximate both the protein quality and micronutrient profile of conventional meat (Curtain & Grafenauer, 2019; Öztürk et al., 2024; Domić et al., 2025).

The production of plant-based meat alternatives is a multi-layered process consisting of a series of complementary stages, such as ingredient selection, processing, texturization, and shaping. Although various technological methods have been developed, the most commonly used technique for the production of these products is extrusion technology. In this method, the formulated food matrix is first hydrated by incorporating a controlled amount of water and subsequently subjected to intensive mechanical treatment under elevated temperature and pressure. These processing conditions facilitate matrix restructuring, enabling plant-derived proteins to develop a fibrous, meat-like structure (Zhao et al., 2022; Wang et al., 2022). Production typically begins with the selection of protein isolates or concentrates derived from soy, peas, wheat, or other high-protein legumes, as the choice of protein source determines both the nutritional profile and structural attributes of the final product. Vegetable oils, hydrocolloids, binding agents, and natural flavor constituents are then incorporated to optimize the sensory properties, including flavor, texture, and color. Following formulation, the composite mixture is blended with water to achieve a defined moisture level, yielding a hydrated premix commonly referred to as "green mass" (Petrat-Melin & Dam, 2023). This mass is subsequently processed in an extrusion system operating under high-temperature and high-pressure conditions, during which the material undergoes alignment and is transformed into a structure resembling muscle fibers (Ferawati et al., 2021). Upon exiting the extruder, rapid cooling is applied to stabilize the anisotropic structure, after which the product advances to the shaping stage of the process. In certain production systems, an optional fermentation step may be introduced to further enhance the functional and sensory characteristics. Fermentation is preferred to improve the sensory profile of the product and increase its nutritional value (Elhalis et al., 2023). Thus, the final product can mimic not only the appearance and texture of meat but also its taste and aromatic properties in a more realistic manner.

3. METHODOLOGY

This study was designed as an exploratory qualitative study employing document analysis, supported by a structured literature identification and thematic content analysis process. Exploratory research is particularly useful when a research topic has not yet been sufficiently developed, when its conceptual boundaries remain unclear, or when the relationships between relevant variables have not been clearly defined. In such cases, exploratory studies contribute to a better understanding of the phenomenon under investigation and provide a conceptual basis for future research (Stebbins, 2001). In the present study, an exploratory approach was adopted because the relationship between plant-based meat alternatives and tourism remains relatively limited in the existing literature. Therefore, rather than testing empirical relationships, this study aims to conceptually organize, connect, and interpret the existing literature from the perspective of the tourism industry. Document analysis is defined as a qualitative research technique that seeks to generate meaning through the systematic examination, evaluation, and interpretation of written and electronic documents (Bowen, 2009). Accordingly, academic and institutional sources related to plant-based meat alternatives, sustainable nutrition, health, ethics, gastronomy, and tourism were evaluated within the scope of document analysis.

The sources forming the findings section of the study were identified through a structured literature identification and selection process. Relevant sources were accessed through Google Scholar, ScienceDirect, PubMed, DergiPark, the YÖK National Thesis Center, relevant publisher websites, and backward citation tracking. These source channels were selected because the study is related to multiple disciplines, including food science, nutrition, sustainability, health, ethics, gastronomy, and tourism. The literature identification process was structured around three main concept clusters. The first concept cluster focused on plant-based meat alternatives and included keywords such as "plant-based meat alternatives," "plant-based meat," "meat analogues," "meat substitutes," "alternative proteins," "bitki bazlı et alternatifleri," "bitki bazlı et," "et analogları," and "alternatif proteinler." The second concept cluster covered sustainability, health, and ethics and included terms such as "sustainable nutrition," "sustainable food systems," "environmental impact," "greenhouse gas emissions," "carbon footprint," "water footprint," "health," "nutrition," "protein quality," "animal welfare," "sürdürülebilir beslenme," "sürdürülebilir gıda sistemleri," "sağlık," "beslenme," and "hayvan refahı." The third concept cluster focused on tourism and gastronomy and included keywords such as "gastronomic tourism," "food tourism," "culinary tourism," "hospitality," "vegan tourism," "vegetarian tourism," "gastronomi turizmi," "yemek turizmi," "vegan turizm," and "vejetaryen turizm."

The inclusion criteria were determined in line with the exploratory and conceptual purpose of the study. Accordingly, sources were included if they were published between 2012 and 2025; were accessible in English or Turkish; and were directly related to plant-based meat alternatives, sustainable nutrition, health, ethics, gastronomy, tourism, vegan/vegetarian travel experiences, or destination-level food and beverage practices. Peer-reviewed research articles, review articles, academic book chapters, graduate theses, international reports, and reliable institutional documents were included in the scope of the study. While this date range applied to the sources constituting the

findings, methodological references used to justify the research approach were exempt from this limitation. Exclusion criteria were also determined in accordance with the focus of the study. Sources were excluded if they addressed veganism or vegetarianism only in general terms without establishing a connection with gastronomy or tourism; focused on alternative protein sources unrelated to plant-based meat analogues; discussed cultured meat, insect protein, or single-cell protein without relating them to plant-based meat alternatives; or lacked sufficient academic or institutional reliability. In addition, some sources cited in the introduction and conceptual framework were used only to establish the background of the topic, define key concepts, and support the rationale of the study; therefore, they were not included in the findings section.

During the source selection process, the identified studies were first examined at the title and abstract level. Sources that were found to be directly related to the aim of the study and the inclusion criteria were then evaluated at the full-text level. Following the identification and eligibility assessment process, the analytical corpus was formed from 61 unique sources that directly contributed to the thematic synthesis. These sources were classified according to the three main headings of the findings section: sustainability, health and ethics, and the relationship with tourism. Thus, the analytical corpus was limited to the sources that directly contributed to the conceptual synthesis developed in the findings section.

The analysis process was conducted in accordance with the thematic content analysis approach used in qualitative research. Thematic analysis is a flexible analytical approach that enables the identification of recurring patterns of meaning, concepts, and themes within qualitative data (Braun & Clarke, 2006). Accordingly, in the first stage, the documents were read holistically and evaluated in terms of their relevance to the research aim. In the second stage, recurring concepts, arguments, and findings were coded according to their thematic contribution. In the third stage, related codes were grouped under three main themes. The first theme focused on environmental impact, greenhouse gas emissions, water and land use, and sustainable food systems. The second theme covered nutritional quality, protein quality, dietary fiber, processed meat debates, animal welfare, and ethical consumption. The third theme addressed gastronomic tourism, vegan/vegetarian/flexitarian tourist experiences, menu diversity, destination image, hospitality services, and the potential integration of plant-based meat alternatives into tourism practices. Through this thematic structure, the potential contributions, limitations, and strategic implications of plant-based meat alternatives for sustainable nutrition and tourism were conceptually synthesized.

4. FINDINGS

4.1. Plant-based meat alternatives in the context of sustainability

Traditional meat production generates multidimensional environmental impacts, including greenhouse gas emissions, land use, water consumption and loss of biodiversity. Approximately 15 percent of global greenhouse gas emissions originate from animal production systems, positioning this sector as one of the primary drivers of climate change (Kroliczewska et al., 2023; Ali & Bharali, 2025). Environmental assessments increasingly highlight animal-based food production as a major contributor to climate change and freshwater depletion. Recent projections continue to identify animal-source food production as a major contributor to climate change. Under current dietary and production patterns, meat and dairy are expected to account for more than half of projected food-related warming by 2100, highlighting the continuing climate pressure associated with livestock-based food systems (Ivanovich et al., 2023). In particular, ruminant livestock production is characterized by high carbon intensity and extensive water use, with beef production generating approximately 28 kg of CO_2 equivalents per kilogram and exhibiting one of the highest water footprints among food products. Moreover, animal-based food production is estimated to account for nearly one-third of the total water footprint of global agriculture, underscoring its disproportionate pressure on freshwater resources (Jeong et al., 2022; Mekonnen & Hoekstra, 2012). Consequently, meat production necessitates extensive land use. Efforts to meet the rising meat demand within existing production systems intensify the pressure to convert new areas into agricultural land, thereby accelerating deforestation. In ecologically sensitive regions, such as the Amazon Basin, extensive forest areas are being cleared for livestock production, diminishing carbon sequestration capacity, and posing significant threats to biodiversity (Carvalho et al., 2020). Taken together, these findings demonstrate a clear link between high levels of meat consumption and environmental degradation, underscoring the imperative to transition toward more sustainable production and consumption frameworks within food systems. If meat production and consumption continue to increase at the current rate, depletion of environmental resources and disruption of ecosystem balance seem inevitable (Scarborough et al., 2014; Ali & Bharali, 2025).

The transition from conventional meat consumption to alternative protein sources is regarded as a substantive advancement in sustainable development objectives. From an environmental standpoint, plant-based meat products demonstrate markedly lower ecological intensity than animal-based counterparts with respect to natural resource use, energy requirements, and carbon emissions (Hadi & Brightwell, 2021; Manus et al., 2021). Kling et al. (2023) similarly report that increased reliance on plant-derived options is positively associated with reduced greenhouse gas

emissions and diminished land use. Within this framework, decreasing the consumption of beef and lamb contributes substantially to mitigating carbon footprints and preserving water and land resources (Ridoutt et al., 2014). Empirical evidence further indicates that substituting plant-based burgers for conventional beef burgers results in an 87–96 percent reduction across all assessed environmental impact categories. This outcome aligns with contemporary findings demonstrating that plant-based meat alternatives exhibit the lowest environmental burden per kg (Kustar & Patiño-Echeverri, 2021). The widespread adoption of plant-based meat alternatives also plays a critical role in sustainable water resource management, soil fertility preservation, and ecosystem restoration. The rapid growth of the global population continues to push the environmental limits of existing food production systems, emerging as a key factor threatening future food security. Therefore, the transition to sustainable food systems has become imperative not only to reduce environmental impacts but also to meet the nutritional needs of the growing population. At the heart of this transition is the development and widespread adoption of plant-based alternatives that minimize the environmental footprint and preserve nutritional diversity (Huang & Uehara, 2023). Numerous studies have emphasized the strong relationship between plant-based meat alternatives and sustainability. The adoption of these products is said to offer significant gains in terms of reducing greenhouse gas emissions, conserving natural resources, and alleviating pressure on the ecological balance. Therefore, the shift towards plant-based diets is considered not only an individual consumption choice but also a strategic necessity for mitigating environmental crises on a global scale and building sustainable diets for the future.

Although plant-based meat alternatives are generally regarded as more environmentally favorable than animal-derived meat products, their sustainability should not be assessed solely at the level of the final product. Aimutis and Shirwaiker (2024) emphasize that many plant-based meat analogues rely substantially on plant-based protein concentrates and isolates as key functional ingredients. The environmental profile of these ingredients may vary depending on the source of the raw material and the processing route used for protein extraction, concentration, purification, and drying. These stages can involve considerable inputs of energy, water, chemicals, and specialized equipment, which are not always fully captured in conventional environmental assessments. The large-scale cultivation of inputs, such as soybeans, to meet rising demand has been associated with ecological challenges, including deforestation, biodiversity loss, and declining soil fertility (Molotoks & West, 2021). Meta-analytic evidence by Herrmann et al. (2024) also underscores that the degree of processing involved in producing plant-based alternatives remains a substantive concern because of its potential environmental implications. Moreover, Hai et al. (2023) highlighted that although plant-based meat alternatives generally align with environmentally sustainable principles, extrusion and other specialized processing techniques may foster the formation of pathogenic microorganisms, thereby introducing food safety risks.

4.2. Plant-based meat alternatives in the context of health and ethics

Scholarly discussions on the health implications of meat consumption have increasingly focused on the long-term risks associated with high intake levels, particularly in relation to red and processed meat. A growing body of evidence links excessive consumption of these products to a range of chronic conditions, including cardiometabolic disorders and certain forms of cancer (Abete et al., 2014; Kim & Je, 2018). An increased risk of colorectal cancer has been associated with processed meat products such as bacon, ham, sausages, salami, and processed deli meats, which typically undergo preservation methods including salting, curing, fermentation, smoking, drying, or chemical preservation (Sui et al., 2016; Springmann et al., 2018). Against this backdrop, plant-based meat alternatives have emerged in the literature as a dietary strategy aimed at mitigating health risks commonly attributed to conventional meat consumption. Previous studies indicate that many of these products are characterized by lower levels of saturated fat and the absence of cholesterol, factors that may contribute positively to cardiovascular health outcomes (Fresán & Sabaté, 2019; Harnack et al., 2022). Moreover, the dietary fiber present in many plant-based meat alternatives may contribute to metabolic health by satiety, gastrointestinal function, glycemic regulation, and lipid metabolism. Through these mechanisms, higher dietary fiber intake has been associated with a lower risk of diet-related non-communicable diseases, particularly cardiovascular disease, type 2 diabetes, and obesity-related metabolic disorders (Uyarcan et al., 2022). Nevertheless, the nutritional quality of industrially processed plant-based meat alternatives remains contested, as these potential benefits depend strongly on product formulation, fiber content, sodium level, fat composition, and overall degree of processing. The main nutritional limitation of plant-based meat alternatives is related to protein quality, particularly the balance of essential amino acids, the presence of limiting amino acids, and protein digestibility. Since these products are commonly formulated with selected plant protein isolates or concentrates, their nutritional adequacy depends not only on total protein content, but also on the amino acid profile and digestible protein quality of the ingredients used. Evidence from plant-based protein ingredients and meat analogue digestion studies indicates that differences in protein source, structural organization, processing conditions, fiber content, and formulation matrix may influence protein digestibility and peptide release. Therefore, when plant-based meat alternatives are consumed as direct substitutes for conventional meat, their nutritional assessment should

prioritize essential amino acid balance, protein digestibility, and protein-source complementarity. Micronutrient concerns, including iron, zinc, and vitamin B12, as well as elevated sodium levels, remain important; however, these should be considered as secondary formulation-related issues within the broader evaluation of protein quality and overall nutritional adequacy (Gorissen et al., 2018; Zhou et al., 2021; Ohlau et al., 2022; Xie et al., 2022; Flint et al., 2023;Huybers & Roodenburg, 2023; Wang et al., 2023).

Traditional meat production has become a focal point of intense environmental and ethical debates. Industrial-scale livestock systems raise substantial concerns regarding animal welfare. Within such systems, animals are commonly kept in highly confined environments that restrict their mobility and prevent the expression of natural behaviors. These conditions elevate stress levels and adversely affect physiological health. Moreover, the concentration of large numbers of animals in limited spaces increases competition for essential resources, such as space, water, and feed, which in turn contributes to aggression, injury, and various physiological disorders (Brown & Vosloo, 2017; Tiezzi et al., 2019). In this context, the adoption of plant-based meat alternatives is considered not only from an environmental sustainability perspective but also as an ethical imperative for consumers. Plant-based production systems are regarded as more sensitive and fair food production models, contributing to the elimination of exploitation, suffering, and stress experienced by animals (Ali & Bharali, 2025). Shan et al. (2022) emphasized that increasing environmental awareness, ethical concerns regarding animal welfare, and food safety concerns in the Asian market have significantly increased interest in plant-based meat alternatives. Similarly, in Western societies, a notable increase in the adoption of vegan and vegetarian diets has been observed in line with animal welfare awareness (Hopwood et al. 2020). Consequently, the demand for plant-based meat alternatives reflects not only a transformation in dietary patterns but also a structural shift in ethical awareness and consumer consciousness. Current scholarship has identified a significant association between heightened concern for animal welfare and the adoption of plant-based dietary patterns (Ghaffari et al., 2021).

4.3. The relationship between tourism and plant-based meat alternatives

An analysis of the current body of literature indicates that existing studies have predominantly concentrated on the travel motivations, expectations, and challenges encountered by vegan and vegetarian tourists (Li et al., 2021; Ottenbacher et al., 2025). Nevertheless, it is consistently underscored that comprehensive research addressing the diverse trends within the broader profile of plant-based tourists remains insufficient (Handayani et al., 2025). This limited body of knowledge highlights notable gaps at both the academic and industry levels. Individuals adhering to such dietary patterns face various difficulties during travel, stemming from factors such as unfamiliar cultural norms, language barriers, and an overall lack of awareness (Aldemir, 2024). A key challenge for tourists who follow plant-based or animal-product-restricted diets is that their dietary preferences are either inadequately understood or misinterpreted by service providers in the tourism industry. This situation is particularly pronounced in rural destinations and negatively affects tourists' travel experiences (Kansanen, 2013; Ottenbacher et al., 2025). Furthermore, it has been noted that a central challenge faced by these tourists in their interactions with tourism businesses is a lack of trust during marketing and promotional processes. Inadequate or inaccurate information, misrepresentation of products, and unconvincing promotional strategies have been shown to adversely affect tourist satisfaction (Eren, 2020). The limited availability of plant-based alternatives in traditional restaurants makes it difficult for tourists to maintain their lifestyle, with many individuals stating that they have to compromise their diet during their travels (Kansanen, 2013; Nguyen, 2019). Individuals who can locate suitable options frequently report that the available products fail to meet their expectations regarding taste, variety, and quality (Son & Xu, 2013). This issue extends beyond restaurants and is also observed in accommodation establishments. For instance, İkiz and Solunoğlu (2018) found that most hotels lacked dedicated vegetarian menus and did not employ chefs with relevant expertise. Likewise, Barrero Toral (2016) highlights that cruise tourism often fails to provide food options that satisfy vegan tourists' expectations of sustainability. Consequently, many tourists feel compelled to bring their own food while traveling (Kansanen, 2013; Eren, 2020).

The behavioral tendencies of plant-based tourists are critical for understanding the dynamics of this emerging market. Research indicates that the motivations of these tourists extend beyond mere food consumption, encompassing deeper psychosocial needs such as cultural experiences, exploration of local traditions, personal development, awareness, and adherence to ethical values (Li et al., 2021; Zouni & Klouvidaki, 2022). Studies by Yeşilçimen and Akın (2025) and Molina-Gomez et al., (2018) further highlight that food-related behaviors directly influence destination choice, with this effect being particularly pronounced among vegan and vegetarian tourists. However, as noted by Aldemir (2024) and Zouni and Klouvidaki (2022), these tourists continue to encounter significant challenges during travel, including limited menu options, misunderstandings of the concept, and information gaps. Moreover, Lochman and Vágner (2024) emphasized that promoting meat-free gastronomy can stimulate the local economy and contribute to sustainable development rather than negatively impacting tourism. Analyzing the Didim case, Başol and Alvarez (2024) stress that for a destination to successfully brand itself as vegan-friendly, it must adopt genuine values,

offer diverse culinary options, and facilitate community engagement, while noting that infrastructural deficiencies and inadequate marketing remain substantial barriers. Similarly, Yu et al. (2024) observed that the perceived ethical, environmental, and health benefits of vegan-friendly hotels significantly enhance customer satisfaction, revisit intentions, and positive word of mouth behavior. This evidence clearly demonstrates that providing a holistic vegan-friendly experience beyond merely adding menu options can serve as a critical competitive advantage for companies. Taken together, these studies indicate that the main challenge for tourism businesses is not limited to the symbolic recognition of vegan or vegetarian tourists, but extends to the practical provision of reliable, diverse, and clearly communicated food options. In this context, plant-based meat alternatives may contribute to the food-related dimension of tourism services by expanding menu variety, improving the accessibility of meat-free choices, and reducing the need for tourists to compromise their dietary preferences during travel. However, direct research on the integration of plant-based meat alternatives into hotel, restaurant, and destination-level gastronomic offerings remains limited, which points to an important gap in the tourism literature.

Conversely, studies within the Turkish context highlight a different perspective, emphasizing that, contrary to common assumptions, Turkish cuisine provides an exceptionally diverse range of options suitable for vegan and vegetarian diets. Önçel et al., (2018) map this diversity from a geographical perspective, while Tekiner (2021) notes that Turkish cuisine inherently contains elements that are planet-friendly and compatible with vegan cuisine. Studies conducted in different regions, such as Erzincan (Özdokur, 2022), Giresun (Avcıoğlu, 2022), Ordu (Yavuz, 2018), Yenice (Türker & Ayyıldız, 2021) and Gaziantep (Parlak, 2020), provide concrete evidence of this potential. The identification of 121 vegetarian dishes in Gaziantep, a region traditionally renowned for its meat-based cuisine, is particularly noteworthy (Parlak, 2020). Furthermore, Doğan (2012) study on edible plants in the Aegean Region underscores Turkey's abundant diversity of raw materials suitable for diets that restrict meat consumption. Building on this, Tabu (2020) systematically cataloged local culinary knowledge at the national level, establishing a strategic resource for destinations seeking to promote plant-based options.

CONCLUSION

This study investigated the current status, developmental dynamics, and potential implications of plant-based meat alternatives in the tourism industry, framed by the concepts of sustainable nutrition and tourism. A review of the existing literature indicates that the global climate crisis, the nutritional demands of a growing population, and evolving tourist expectations underscore the need for transformative changes in both the food and tourism industries. The research findings show that plant-based meat alternatives are not just a product group that meets individual preferences but also a tool that can offer strategic solutions to multidimensional problems related to the environment, ethics, and health. From the perspective of the tourism industry, it has been observed that vegan, vegetarian, flexitarian, and other tourists adhering to plant-based diets encounter the challenge of "gastronomic exclusion" (Li et al., 2021; Ottenbacher et al., 2025). Inability to access suitable food options, limited menu variety, lack of information, misunderstandings, and infrastructure deficiencies in businesses (Kansanen, 2013; Nguyen, 2019; Eren, 2020; Aldemir, 2024) negatively affect the satisfaction of this tourist group. (Yu et al., 2024). These findings indicate that the tourism industry needs to adopt alternative sustainable gastronomy practices to respond to rapidly changing consumer expectations.

Plant-based meat alternatives are increasingly recognized as offering comprehensive solutions to the challenges faced by the tourism industry, both in the short term and at a strategic level. Due to standardized production methods, these products can be readily integrated into restaurants and hotels, effectively enhancing tourist satisfaction and improving the travel experience by directly addressing the fundamental needs of vegan and vegetarian visitors. Moreover, incorporating plant-based alternatives can support the development of gastronomic practices aligned with sustainability objectives, thereby contributing to the creation of an environmentally conscious and innovative destination image. The high carbon emissions and water footprint associated with conventional meat production (Jeong et al., 2022) exacerbate the indirect environmental impact of the tourism industry. Consequently, adopting plant-based alternatives in tourism settings can mitigate this burden. For instance, selecting plant-based burgers over traditional beef burgers can reduce environmental impact by 87% to 96% across all examined categories (Kustar & Patiño-Echeverri, 2021). In the context of today's increasingly diverse gastronomic tourism, developing plant-based adaptations of traditional dishes enables the reinterpretation of local cuisines through a sustainability lens, while offering innovative experiences that preserve cultural identity. This approach can enhance the attractiveness and competitiveness of destinations for tourists seeking distinctive and responsible culinary experiences.

Research findings suggest that plant-based meat alternatives provide substantial competitive advantages for tourism businesses. As environmental awareness and ethical sensitivity increase, the adoption of vegan-friendly practices has emerged as a powerful marketing strategy, with businesses implementing these practices reporting notable improvements in customer satisfaction and intentions to repeat visits (Yu et al., 2024). Accordingly, integrating plant-based alternatives into the tourism industry should not be viewed merely as a trend driven by

individual consumer preferences but as a strategic imperative aligned with sustainable tourism policies. In this regard, plant-based meat alternatives offer tourism operators a valuable opportunity to diversify their menus, promote inclusivity, and attract environmentally conscious tourists. By replicating the sensory attributes of traditional meat, these products act as a bridge not only for vegan consumers but also for a broader audience seeking sustainable options without sacrificing familiar taste.

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Ethical Approval

This study is among the studies that do not require ethics committee approval.

Researchers' Contribution Rate

The authors contributed equally to the study.

Conflict of Interest

There is no potential conflict of interest in this study.