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## The role of ChatGPT in vegetarian menus

### Vejetaryen menülerde ChatGPT'nin rolü

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#### ABSTRACT

This research aims to analyze the ability of ChatGPT-4, an artificial intelligence-based language model, to create menus in line with different vegetarian dietary types for professional and amateur chefs, individuals who have taken up cooking as a hobby, and vegetarian individuals. For this purpose, ChatGPT-4 was given ingredients for various dietary types: Lacto-Vegetarian, Ovo-Vegetarian, Lacto-Ovo Vegetarian, Pescatarian, Pollo-Vegetarian, Vegan, Semi-Vegetarian, Raw Vegan, and Fruitarian. It was then asked to create a daily menu consisting of three meals from these ingredients. By adding prohibited ingredients to the ingredient list for each type of vegetarian diet, it was analyzed whether ChatGPT-4 could distinguish these prohibited ingredients and create an accurate menu. As a result of the research, ChatGPT was able to correctly prepare Lacto-Ovo Vegetarian, Lacto-Vegetarian, Vegan, and Raw Vegan menus. However, errors were observed in the menus created in Ovo-Vegetarian, Semi-Vegetarian, and Pollo-Vegetarian diet types. Half correct and half incorrect results were obtained in the Fruitarian diet. ChatGPT-4 has used prohibited ingredients in its Ovo-Vegetarian, Semi-Vegetarian, Pollo-Vegetarian, and Fruitarian menus. These findings show the potential of artificial intelligence in gastronomy but also emphasize the need for users to verify the information.

#### ÖZET

Araştırma, yapay zeka tabanlı bir dil modeli olan ChatGPT-4'ün profesyonel ve amatör şefler, yemek yapmayı hobi edinmiş bireyler ve vejetaryenler için farklı vejetaryen beslenme türlerine uygun menüler oluşturma becerisini analiz etmeyi amaçlamıştır. Bu amaçla ChatGPT-4'e Lakto-Vejetaryen, Ovo-Vejetaryen, Lakto-Ovo Vejetaryen, Pesko-Vejetaryen, Polo-Vejetaryen, Vegan, Semi-Vejetaryen, Raw Vegan ve Fruitarian beslenme türleri için malzemeler verilmiştir. Daha sonra bu malzemelerden üç öğünden oluşan günlük bir menü oluşturması istenmiştir. Her vejetaryen diyet türü için içerik listesine yasaklı malzemelerde eklenerek ChatGPT'nin bu yasaklı malzemeleri ayırt edip edemeyeceği ve doğru bir menü oluşturup oluşturamayacağı analiz edilmiştir. Araştırma sonucunda ChatGPT-4, Lakto-Ovo Vejetaryen, Lakto-Vejetaryen, Vegan ve Raw Vegan menülerini doğru bir şekilde hazırlayabilmiştir. Ancak Ovo-Vejetaryen, Semi-Vejetaryen ve Polo-Vejetaryen diyet türlerinde oluşturulan menülerde hatalar gözlemlenmiştir. Fruitarian diyetinde ise yarı doğru yarı yanlış sonuçlar elde edilmiştir. ChatGPT-4, Ovo-Vejetaryen, Semi-Vejetaryen, Polo-Vejetaryen ve Fruitarian menülerinde yasaklı içerikler kullanmıştır. Bu bulgular yapay zekanın gastronomi alanındaki potansiyelini göstermekle birlikte kullanıcıların bilgileri doğrulaması gerektiğini de vurgulamaktadır.

## 1. Introduction

Developments in Information and Communication Technologies have affected the fields of gastronomy and nutrition, as in many other fields. Information and Communication Technologies are basically capable of meeting certain needs expressed by consumers, such as healthy nutrition (Ge et al., 2015a), balanced nutrition (Yang et al., 2017), and food taste (Ge et al., 2015b). However, with the latest developments in machine learning, artificial intelligence, and cloud computing technologies, smart food recommendation systems have been significant developments for consumers or users. For example, a cloud-based smart restaurant

management system can offer its users easy-to-use interfaces for food menu recommendations (Li et al., 2018). In addition, thanks to technological development, special diet menu recommendation applications have been developed according to customers' diseases and demographic information (Kim et al., 2009). These applications can provide balanced nutrition recommendations using consumers' nutrition records (Li et al., 2010). But in recent years, there has been a growing interest in artificial intelligence technology among consumers, industries, and communities (Nozawa et al., 2022). The interest in artificial intelligence in gastronomy and nutrition is also increasing. The applications of artificial intelligence in gastronomy and nutrition have become promising recently

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(Berezina et al., 2019; Uribe & Patterson, 2023). At the same time, it is possible to say that interest in artificial intelligence has increased among consumers and society. Consumers have information on topics they are curious about, such as nutrition and diet, through artificial intelligence applications (Gursoy et al., 2023; Chatelan et al., 2023). Because chatbots are designed in such a way that people can follow healthy eating plans and achieve behavior change goals (Zhang et al., 2020).

Nowadays, with globalization, rapid changes have occurred in lifestyles. This situation has also affected individuals' nutritional behavior (Akova et al., 2016). Vegetarian nutrition is the best example of this situation. For many vegetarians, issues such as sensitivity to the world's resources and the environment, ethical issues related to animals, and health advantages are the basis for their dietary choices (Shipman, 2021). Today, artificial intelligence tools offer significant advantages and ease of application in vegetarian diets. For example, ChatGPT, one of the artificial intelligence models developed by OpenAI, can be used for various tasks, such as providing information about recipes and healthy nutrition (Dwivedi et al., 2023; Çolak, 2023). When the literature was examined, it was seen that studies were conducted on the Renal diet support performance of ChatGPT (Qarajeh et al., 2023), the reliability of ChatGPT's dietary recommendations (Niszczota & Rybicka, 2023), the role of ChatGPT in the treatment of malnutrition (Khan, 2023), and the effect of ChatGPT on certified nutrition and dietetics practitioners (Chatelan et al., 2023). However, when the literature was examined, it was understood that there was no study on the ability of chatbots using machine learning algorithms such as ChatGPT to prepare vegetarian menus. This research aims to determine how accurately ChatGPT creates menus for vegetarian diet types with the ingredients presented to them.

## 2. Literature Review

A vegetarian is a person who consumes plant foods and either avoids animal foods (such as red meat, chicken, fish, milk, dairy products, and eggs) entirely or consumes them in very limited amounts (Fraser, 1999). Vegetarianism, on the other hand, is generally defined as a diet that involves the consumption of plant-based foods instead of animal-based foods (Perry et al., 2001). The reasons why people

adopt vegetarianism vary. These may include health, ethical, environmental, religious, or economic perspectives (Hoffman et al., 2013). In the digital age we live in, vegetarianism has become a lifestyle that is spreading rapidly worldwide thanks to people's use of technology as information transfer on the internet and in social life, the rapid population growth in society, and the increase in education level (Clarys et al., 2014; Altaş, 2017). This situation has also created a growing market. In this market, there are manufacturers producing substitute products to meet the demands, hotels, and restaurants opened for vegetarians, and sectoral staff trained in accordance with this understanding and endeavor to prepare menus in this direction.

Vegetarianism is characterized mainly by the exclusion of meat and the inclusion of foods such as legumes, cereals, vegetables, and fruits in the diet. However, there is diversity and variation within vegetarian diets (see Table 1 for further details). The basis of the differences is the consumption of animal foods such as eggs, milk, and seafood, as well as the free consumption of some animal foods or absolutely no animal foods (Seçim et al., 2022).

A new era has started with the prominence of technology in the developing world order. Revolutionary changes and transformations have been experienced in this period in all sectors. These technological developments in the world increase the demand for artificial intelligence. This demand has led to radical changes in gastronomy, and artificial intelligence tools have taken their place in many businesses. Because it is difficult to find the wishes of consumers, businesses are trying to overcome this difficulty by using artificial intelligence (Çerkez & Kızıldemir, 2020). Technological applications such as robots, smart menus, and advice robots used in the field of gastronomy in artificial intelligence applications have provided many benefits to the sector (Türkoğlu & Yılmaz, 2022). One of these benefits is to plan artificial intelligence-supported menus with nutritious, appetizing, and appropriate ingredient usage (Petot et al., 1998). From the past to the present, many artificial intelligence tools have been created to provide nutrition or food menu advice (Casas et al., 2018). For example, CAMPER is a tool for planning and designing daily menus based on individual customers' nutritional needs and personal preferences (Petot et al., 1998). MIKAS is an AI-assisted menu design tool that allows incremental knowledge

**Table 1.** Type of Vegetarians

Type of Vegetarians	Definition
Lacto-Vegetarian	Eats dairy products but avoids eggs, meat, poultry, and seafood.
Ovo-Vegetarian	Eats eggs but avoids dairy products, meat, poultry, and seafood.
Lacto-Ovo Vegetarian	Eats dairy products and eggs but avoids meat, poultry, and seafood.
Pescatarian	Avoid eating meat and poultry, but consume fish, seafood, and other animal-based foods.
Pollo-Vegetarian	In addition to plant foods, it only consumes poultry meat.
Vegan	Avoids all animal products, including dairy, eggs, and honey.
Semi-Vegetarian	Consume animal-based foods but exclude red meat (beef and lamb)
Raw Vegan	Only eats uncooked and unprocessed plant foods. Avoids all animal products and food cooked above a specific temperature, typically 118°F or 48°C.
Fruitarian	Primarily consumes raw fruit. Some might eat nuts and seeds as well.

Source: (Herrmann & Geisel 2002; Shani & Di Pietriro, 2007; Rivera & Shani, 2013; Dilek & Fennell, 2018; Vatan & Türkbaş, 2018)

base development (Khan & Hoffmann, 2003). MenuGene is a tool designed as a diet menu builder for Cordelia, a web-based lifestyle counseling system that provides personalized advice (Gaál et al., 2007). In addition to these tools, ChatGPT, developed by OpenAI and designed based on GPT language model technology, is a tool that can be used in the field of menu planning and design (Fusté-Forné & Orea-Giner, 2023). Because ChatGPT is an advanced chatbot that can guide people and fulfill their requests (Göktaş, 2023; Ülkü, 2023).

Like those with other dietary habits, vegetarians often eat out. However, many find it challenging to locate restaurants that offer suitable options and are concerned about a lack of understanding of their specific needs (Amato & Partridge, 2013). Although the number of vegetarian restaurants is increasing, vegetarians often find themselves eating out in places that do not have specialized services for vegetarians. Reasons for this may be the difficulty of finding a suitable restaurant in certain areas or accompanying people who prefer a meat-based meal (Shani & Di Pietrio, 2007). This may cause vegetarians to create menus and often consume their meals at home. In recent years, there has been an increase in the number of amateur cooks or people who consider cooking a hobby. These people cook for themselves, their friends, family, and loved ones to meet their nutritional needs and to make them feel special (Hartel, 2010; Hartel, 2011). These meals must appeal to the people they are made for and are suitable for their eating habits. At this point, artificial intelligence tools such as ChatGPT based on language modeling technology can help people who have difficulties in the menu creation process (Tsai et al., 2023). For example, ChatGPT can provide information on how people can eat healthily, give recipes, and suggest diets (Chatelan et al., 2023; Carvalho & Ivanov, 2023). Nevertheless, whether these artificial intelligence tools can generate menus that align with people's eating habits remains unclear. Certain foods are prohibited in some diets, so amateur cooks or hobbyists might not always be aware of these restrictions. Thus, the ability of artificial intelligence tools, like ChatGPT, to create accurate menus becomes crucial.

It is possible to say that ChatGPT has some limitations, although its capabilities in menu preparation are quite high (see Table 2 for further details). ChatGPT has a comprehensive database and can provide flexible and customized answers according to user requests (Shelkande et al., 2023). It is also trained on nutrition-related data and continues its learning process in line with users' feedback (Niszczota & Rybicka, 2023; Frosolini et al., 2023). However, accepting all the

information about ChatGPT without questioning may have negative consequences (Niszczota & Rybicka, 2023; Sng et al., 2023). Because ChatGPT is not as experienced as a real chef.

### 3. Methods

The increasing number of people adopting a vegetarian diet in societies underscores the need for a nutrition guide to ensure adequate and balanced nutrition. To address this, it's essential to create menus that not only provide balanced nutrition and the necessary daily nutrients for vegetarians but also avoid prohibited products. Expert chefs incorporate suitable menus for vegetarians in restaurant offerings or share them with consumers via the Internet, newspapers, and books. However, with the significant rise in amateur cooks and those who pursue cooking as a hobby, there can be challenges in crafting the right menus. These challenges drive individuals to seek assistance from artificial intelligence tools. This research aims to determine the efficacy of ChatGPT, one of these artificial intelligence tools, in creating vegetarian menus. ChatGPT-4, the paid and plus version of ChatGPT, was used in the study. ChatGPT-4 was given separate ingredients for Lacto-Vegetarian, Ovo-Vegetarian, Lacto-Ovo Vegetarian, Pescatarian, Pollo-Vegetarian, Vegan, Semi-Vegetarian, Raw Vegan, and Fruitarian diet types (see Table 3 for further details) and asked to create a menu consisting of three meals for one day. Prohibited products were added to the list of ingredients for each vegetarian diet type, and whether ChatGPT could distinguish these prohibited products and create a correct menu was analyzed. The fact that this is the first study conducted in gastronomy is considered an important factor that makes the study important. Within the given ingredients, for the Lacto-Ovo Vegetarian menu, shrimps and chicken; for the Lacto-Vegetarian menu, eggs and salmon; for the Ovo-Vegetarian menu, milk, and sea bass; for the Pescatarian menu, chicken; for the Semi-Vegetarian menu, beef; for the Pollo-Vegetarian menu, beef and tuna; for the Vegan menu, yoghurt, and sea bream; for the Fruitarian menu, honey, red onion, lettuce, rocket, fresh mint, rice, wheat, and beef; and the Raw Vegan menu, milk and yoghurt have been designated as prohibited ingredients.

### 4. Results

ChatGPT used the materials provided effectively to create menus for each vegetarian diet type for breakfast, lunch, and dinner (see Table 4 for further details). ChatGPT also created a snack menu for each vegetarian diet type, although ChatGPT

**Table 2.** Capabilities and Limitations of ChatGPT in Food Menu Preparation

Comprehensive Database	ChatGPT has been trained on millions of texts. This provides ChatGPT with a wide range of recipes and nutritional information, enabling it to offer a variety of recipes.
Flexibility and Customization	ChatGPT is able to make recommendations according to the user's special requests and limitations. It can offer suggestions suitable for different dietary needs or eating habits.
Nutrition Information	ChatGPT is trained on nutrition-related data. It can provide appropriate meal recommendations for specific calorie or macronutrient targets.
Continuous Updating	ChatGPT continues the learning process by taking user feedback into account. This enables it to offer continuously improving vegetarian menu suggestions.
Limitations	ChatGPT cannot be compared to the experience of a real chef. It may have limitations in making suggestions specific to local ingredients or cultural food preferences.

Source: Created by the author.

was not asked to do so. The vegetarian menus created by ChatGPT are given in Appendix 1.

ChatGPT has prepared a correct menu by separating the prohibited products (shrimp and chicken) from the products provided for Lacto-Ovo Vegetarian menus. In addition, ChatGPT included ingredients such as salt, black pepper, olive oil, and mustard, which are not provided on the menu, in order to create integrity and flavor to the dishes while preparing the menu. Thus, ChatGPT not only eliminated the prohibited products but also listed the missing ingredients for the menu. ChatGPT prepared a correct menu by separating the prohibited products (eggs and salmon) from the products given for Lacto-Vegetarian menus. ChatGPT also used products such as salt, black pepper, and olive oil, not provided in its menus, to create integrity and flavor. ChatGPT also gave the recipes of the menus in detail.

ChatGPT identified the prohibited products (milk and sea bass) among the products given for Ovo-Vegetarian menus but stated that the given products are more suitable for Pescatarian menus rather than Ovo-Vegetarian. However, it still included the prohibited products in the menus and prepared incorrect menus. ChatGPT identified the prohibited product (chicken) among the products given for Pescatarian menus and did not include this product in the menus it created. In addition, the recipes of the menus were given in detail.

ChatGPT failed to identify the prohibited ingredient (beef) from the list provided for semi-vegetarian menus and included this item in the dinner menu. ChatGPT made a statement contrary to the literature and stated that Semi-vegetarians consume chicken, fish, and sometimes other meats in addition to plant foods. However, when the literature

is examined, it is stated that semi-vegetarians do not consume beef (Dilek & Fennell, 2018; Erk et al., 2019). ChatGPT also detailed the recipes of the menus while creating Pollo-Vegetarian menus but could not determine the prohibited products (beef and tuna) among the products given. The menus it has created are contrary to the literature and incorrectly created. Because when the literature is examined, pollo-vegetarians do not consume beef and tuna (Çakıcı et al., 2020).

While creating vegan menus, ChatGPT identified the prohibited products (yoghurt and seabream) and detailed the menus' recipes. In addition, ChatGPT prepared the menus by stating that the yoghurt added to the menu was a prohibited product, but ChatGPT assumed that this yoghurt was a plant-based yoghurt (such as almond, soy, or coconut yoghurt). This situation revealed to ChatGPT the need to present the products in detail. In addition, it was seen that ChatGPT also warned and stated how the content of the product that was not detailed should be.

ChatGPT identified some of the prohibited products (wheat and beef) among the products given for Fruitarian menus. However, honey, red onion, lettuce, rocket, fresh mint, and rice products were included in the menus. ChatGPT was not successful enough in creating Fruitarian menus. Because when the literature is examined, Fruitarians do not consume animal foods but generally prefer to consume products that do not kill the plant (Phillips, 2005). ChatGPT identified prohibited products (cow's milk and yoghurt) among the products given for Raw Vegan menus. It also stated that ChatGPT would prefer plant-based yoghurt, such as almond or coconut yoghurt, and that ChatGPT would use zucchini instead of traditional spaghetti to keep it raw. ChatGPT was very successful in preparing a raw vegan menu.

**Table 3.** Type of Vegetarians and The Ingredients Given to ChatGPT to Create a Food Menu

Type of Vegetarians	Ingredients Are Given to ChatGPT to Create a Food Menu
Lacto-Ovo Vegetarian	oats, milk, bananas, walnuts, avocado, eggs, honey, spinach, tomatoes, <b>shrimp</b> , mushrooms, cheese, yoghurt, strawberries, chia seeds, broccoli, cauliflower, carrots, red peppers, garlic, rice, rocket, spinach, <b>chicken</b>
Lacto-Vegetarian	milk, yoghurt, oats, dried fruit, nuts, chia seeds, flax seeds, feta cheese, cheddar cheese, green tea, coffee, broccoli, cauliflower, carrots, béchamel sauce, <b>eggs</b> , red lentils, aubergine, red peppers, cucumber, cherry tomatoes, smoked, <b>salmon</b> , walnuts
Ovo-Vegetarian	eggs, <b>milk</b> , <b>sea bass</b> , spinach, onion, black pepper, chili flakes, olive oil, tomatoes, cucumber, wheat bread, green tea, red pepper, carrots, broccoli, whole wheat spaghetti, potatoes, celery, parsley, lemon juice, salt, red beans
Pescatarian	avocado, smoked salmon, whole wheat bread, spring onion, lemon juice, yoghurt, chia seeds, honey, strawberries, bananas, apples, coffee, tuna, corn, olive oil, carrots, potatoes, broccoli, salt, sea bass, <b>chicken</b> , fresh thyme, quinoa, mango, pineapple, almonds, nuts, milk, garlic
Semi-Vegetarian	milk, oats, dried fruit, nuts, honey, chicken breast, lettuce, tomato, green tea, quinoa, red pepper, cucumber, cherry tomato, olive oil, lemon juice, fresh mint, salmon, fresh thyme, garlic, black pepper, potato, carrot, broccoli, cauliflower, almond, walnut, yoghurt, <b>beef</b>
Pollo-Vegetarian	chicken, egg, black pepper, chili, tomato, cucumber, milk, honey, lettuce, rocket, fresh mint, cherry tomato, cucumber, red pepper, olives, lemon juice, olive oil, carrot, potato, broccoli, garlic, fresh thyme, onion, tomato paste, cinnamon, watermelon, melon, almond, hazelnut, <b>beef</b> , <b>tuna</b>
Vegan	chia seeds, almond milk, dried apricots, raisins, bananas, strawberries, avocado, lemon juice, salt, black pepper, whole wheat bread, green tea, quinoa, red pepper, cucumber, cherry tomatoes, olive oil, red lentils, onion, carrot, <b>yoghurt</b> , potatoes, broccoli, cauliflower, thyme, soy sauce, garlic, ginger, <b>sea bream</b> , hazelnut
Fruitarian	Mango, papaya, pineapple, dragon fruit, banana, strawberry, chia seeds, apple, pear, grape, kiwi, pomegranate, walnut, <b>honey</b> , dried figs, dried apricots, raisins, almonds, avocado, tomatillo, <b>red onion</b> , lemon juice, <b>lettuce</b> , <b>rocket</b> , <b>fresh mint</b> , cucumber, cherry tomato, olive oil, <b>rice</b> , <b>wheat</b> , <b>beef</b>
Raw Vegan	raw oats, chia seeds, bananas, strawberries, blueberries, almond milk, <b>cow's milk</b> , spinach, walnuts, zucchini, carrots, basil, pine nuts, garlic, lemon juice, olive oil, tomato sauce, spaghetti, cucumber, avocado, red pepper, cabbage and lettuce, nori seaweed, celery, nuts, <b>yoghurt</b>

## 5. Conclusion and Suggestion

ChatGPT is an artificial intelligence tool that can help cooks and consumers with menu planning, recipe suggestions, substitution ideas, dietary preferences, nutritional information, techniques and tips, scaling recipes, seasonal recommendations, food preservation, shopping list preparation, and food safety.

This research was carried out to analyze the ability of ChatGPT-4, an artificial intelligence-based language model, to create menus for different vegetarian diet types. According to the research results, ChatGPT can create menus for various vegetarian diet types and successfully distinguish the prohibited products in certain situations. Especially when preparing Lacto-Ovo Vegetarian and Lacto-Vegetarian menus, ChatGPT created correct menus by effectively distinguishing prohibited products. At the same time, it added integrity to the meals by listing the missing ingredients. However, the model's menu generation capability contains some errors for Ovo-Vegetarian and semi-vegetarian diet types. Especially for the Semi-Vegetarian type, menus contrary to the literature information were created. The model prepared menus that did not match the literature information for the Pollo-Vegetarian diet type.

ChatGPT showed a successful result for the vegan diet type and emphasized the need to detail specific products. For the Fruitarian diet, the performance of the model is mixed. While it could distinguish some of the prohibited products specified for Fruitarian, it could not distinguish others. ChatGPT prepared very successful menus for Raw Vegan. ChatGPT stated that some products whose contents are not detailed in the ingredient list are prohibited and included in their menus in a form suitable for raw vegans.

These findings provide important clues for using artificial intelligence in gastronomy. The inability of the model to recognize some types of diets and its inability to adapt to the literature information fully indicate that users need critical thinking and validation in the answers they will receive from the model. However, the fact that ChatGPT can prepare successful menus for most dietary types reveals that artificial intelligence can be used as a potential assistant in the field of

gastronomy and nutrition science. ChatGPT can pave the way to a delicious and nutritious dining experience for amateur cooks, hobbyists, experienced vegetarians looking for new ideas, and those just starting their meat-free journey.

### 5.1. Theoretical Implications

The study results indicate that ChatGPT can significantly enhance individuals' culinary and nutritional experiences. However, the research also pinpointed limitations in ChatGPT's capability to generate accurate menus for various vegetarian diets consistently. While ChatGPT stands as a valuable tool, it doesn't always deliver flawless solutions. Users should exercise critical thinking when relying on content generated by ChatGPT.

One key insight from the study is the importance of providing detailed and clear input to artificial intelligence models. As demonstrated with the vegan and raw vegan menus, the accuracy of artificial intelligence outputs often hinges on the clarity and specificity of the data provided. Discrepancies in artificial intelligence outputs, especially when they diverge from established literature, underscore the need for continuous feedback loops. Artificial intelligence models like ChatGPT can benefit from iterative feedback, refining their outputs over time. Furthermore, the results suggest that artificial intelligence tools, including ChatGPT, can be seamlessly integrated into culinary education. They can assist budding chefs in understanding dietary needs, exploring new recipes, and fostering innovation in the kitchen. However, it's equally crucial to train students to critically assess artificial intelligence-generated recommendations.

### 5.2. Practical Implications

Restaurants and food service businesses can leverage artificial intelligence tools like ChatGPT for menu planning. This can aid in crafting diverse and appealing menus that cater to various dietary preferences, including vegetarian and vegan options. However, it's crucial to ensure that artificial intelligence-generated menus adhere to dietary restrictions and preferences. Culinary schools and institutions might consider integrating artificial intelligence tools into their curriculum. This would educate future chefs and culinary professionals

**Table 4.** Food Menus Created by ChatGPT

Type of Vegetarians	Breakfast	Lunch	Dinner
<b>Lacto-Ovo Vegetarian</b>	Banana-Walnut Oatmeal Bowl	Spinach and Mushroom Omelette with Avocado Toast	Cheesy Broccoli-Cauliflower Rice Bake with a Side Salad
<b>Lacto-Vegetarian</b>	Creamy Fruit & Nut Oat Porridge	Red Lentil & Vegetable Salad	Cheesy Aubergine Bake
<b>Ovo-Vegetarian</b>	Spicy Scrambled Eggs on Toast	Sea Bass Salad	Whole Wheat Spaghetti with Red Beans
<b>Pescatarian</b>	Fruit & Yoghurt Smoothie Bowl	Tuna & Quinoa Salad	Pan-Seared Sea Bass with Mango-Pineapple Salsa
<b>Semi-Vegetarian</b>	Nutty Oat & Fruit Bowl	Grilled Chicken Salad	Herb-crusted Salmon with Roasted Vegetables
<b>Pollo-Vegetarian</b>	Spicy Scrambled Eggs with Rocket and Tomato	Grilled Chicken Salad with Fresh Mint Dressing	Beef and Vegetable Stew
<b>Vegan</b>	Chia Seed Pudding with Fruits & Nuts	Quinoa Salad with Avocado Dressing	Red Lentil Soup with Roasted Vegetables
<b>Fruitarian</b>	Tropical Fruit Salad with Nutty Topping	Fruity Lettuce Wraps	Rice & Fruit Medley Salad
<b>Raw Vegan</b>	Raw Oat and Berry Parfait	Raw Zucchini "Pasta" with Basil Pesto	Raw Vegan Sushi Rolls

on utilizing artificial intelligence for menu planning, recipe development, and nutritional analysis, thereby enhancing the skill set of the next generation of culinary experts.

Artificial intelligence tools can also be harnessed to access information regarding consumers' nutrition and diet planning. Food and nutrition apps can integrate artificial intelligence functionalities to offer personalized nutritional recommendations based on individual health goals and dietary preferences. However, businesses and individuals must exercise caution when relying on artificial intelligence-generated content, especially in critical areas like diet planning. It's imperative to have quality control mechanisms in place to ensure that artificial intelligence-generated menus align with dietary guidelines and restrictions.

In conclusion, while artificial intelligence holds the promise to transform our approach to gastronomy and nutrition, its limitations and the necessity for user verification cannot be overlooked. Both businesses and individuals stand to gain from artificial intelligence tools in menu planning and nutritional guidance, but a judicious and responsible approach is essential to harness artificial intelligence's full potential in these domains.

### 5.3. Limitations and Future Research

Like other studies, this study is not free from limitations. Firstly, the study was carried out only via ChatGPT. Other chatbots are not included in the scope of the study. In addition, questions to ChatGPT were asked in English, and the success rate in other languages has not been fully investigated. Artificial intelligence systems, like ChatGPT, can evolve over time with user feedback. Future studies might delve into how artificial intelligence models can continuously adapt to user needs and preferences, particularly within the realms of gastronomy and nutrition.

Future research could compare the performance of different artificial intelligence models and algorithms in menu planning, recipe recommendations, and dietary guidance to determine which models are most effective in specific culinary and nutritional contexts. In future studies, it is important to carry out menu studies on different types of nutrition or diets in different languages. Because in this study, questions were asked in English, and answers were received in this direction. However, when the research was completed, the same products were given to ChatGPT in Turkish, and it was observed that it was more unsuccessful in creating a menu.

**Ethics Statement:** Ethics committee approval was not obtained for this study as it did not require ethics committee approval. In case of detection of a contrary situation, TO&RE Journal has no responsibility, and all responsibility belongs to the author(s) of the study.

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#### Appendix 1

Vegetarian menus created by ChatGPT-4:

[https://harranedutr-my.sharepoint.com/personal/leventselman-goktas\\_harran\\_edu\\_tr/\\_layouts/15/onedrive.aspx?id=%2Fpersonal%2Fleventselmangoktas%5Fharran%5Fedu%5Ftr%2FDocuments%2FChatGPT%20Vegetarian%20Men%C3%BCs&ga=1](https://harranedutr-my.sharepoint.com/personal/leventselman-goktas_harran_edu_tr/_layouts/15/onedrive.aspx?id=%2Fpersonal%2Fleventselmangoktas%5Fharran%5Fedu%5Ftr%2FDocuments%2FChatGPT%20Vegetarian%20Men%C3%BCs&ga=1)