



# Article Dietary Catering: The Perfect Solution for Rational Food Management in Households

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Abstract: The problem of food waste is a global phenomenon. Food waste occurs at all stages of the food chain. Households, especially in developed countries, produce the most food waste. In order to effectively prevent consumers from throwing food away, it is important to understand the factors that determine these behaviors in the household. The aim of this study was to define the goal of using dietary catering in Polish society as a form of consumption of wholesome meals with a specific calorific value and distribution of macronutrients in the aspect of reducing losses related to food waste. The research was carried out online in the years 2020–2022 among the clients of a catering company. The survey respondents were residents of the Małopolskie Voivodeship in Poland. The research tool was an original anonymous questionnaire in the form of a shortened nutritional interview. On the basis of the obtained results, it can be concluded that factors such as age and gender influence consumer behavior. The reasons for the decision to choose dietary catering were mainly indicated as wasting and throwing away food, as well as inadequate management of food supplies and preparing too large portions of meals.

Keywords: food waste; food loss; consumers; dietary catering; food choices; health

# 1. Introduction

In recent years, the food product market in Poland has seen the development of new trends resulting from economic and social conditions. The needs and expectations of consumers towards food producers are constantly changing [1]. Due to the dynamic development of the food market, there is an evolution in the subjective, objective, and quality dimensions. These changes mainly result from the behavior of consumers and the increase in their awareness of the impact of the quality of consumed food on the human body. Another factor is the increase in the consumption of convenient and functional food, which is directly related to the dynamic growth in the availability of innovative products. This phenomenon is observed in various groups of consumers who use many forms of distribution [2].

The goal of food production enterprises is to meet the needs and expectations of consumers, which is directly correlated with the development of enterprises [2]. The increase in the consumption of convenient and innovative food observed in the Polish market is related to the improvement of the quality of life and the financial situation of society. Access to a wide range of foods and an increase in nutritional awareness, however, lead consumers to reflect and make food choices characterized by beneficial effects on health. The existing relationship between the effects of nutrition on health means that consumers are more interested in foods that are minimally processed. At the same time, the increase in lifestyle intensity makes them more likely to reach for partially pre-treated or heat-treated products and ready meals provided by restaurants and catering companies [3]. According to Pyrzyńska [3], the increase in the wealth of society and the interest in high-quality convenient food determine the development of the catering services sector, which



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**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). is dietary catering. Along with the increase in the popularity of consumption outside the home, the catering service sector is the main factor in food supply. The size of the global food and catering services market is estimated at USD 3.4 trillion, which accounts for nearly 40% of the global agri-food industry [4]. The size of this sector may be a factor influencing the promotion of sustainable consumption and favoring the development of healthy eating habits [5,6].

Sustainable food choices can contribute to the effective management of food resources and, consequently, to the reduction of losses related to food waste in the agri-food chain [7]. Food loss and waste represent a global problem in the ethical, social environmental, and economic contexts [8,9], estimated to concern one-third of all food produced worldwide [10]. According to Bilska et al. [11], the problem of food wastage is the result of many complex factors and consumer behavior. Numerous studies have shown a correlation between the occurrence of food waste and demographic factors, especially the size of the household. The authors also point to the fact that the larger scale of the problem of food wastage especially concerns young people, lonely people, and children. A similar phenomenon was also observed by others, pointing to the large scale of the problem in this study group [12,13]. Zielińska et al. [14] pointed out that many consumers find it difficult to distinguish and understand the terms on the label and, in particular, do not understand the difference between "best before" or "use by", which can also contribute to food waste. It should also be emphasized that the current challenges and problems of cities have become extremely complex and complicated; therefore, radical measures are necessary to ensure a sustainable environment that will enable future generations to live on this planet [15]. Dietary catering is most often used by young people who want to regulate their body weight or who are following a specific nutrition model or an elimination diet. The decisive factor for the growth in the development of this sector is the lack of time to independently prepare wholesome meals, which are the source of the necessary nutrients to ensure proper functioning [3]. The aim of this study was to define the goal of using dietary catering in Polish society as a form of consumption of wholesome meals with a specific calorific value and distribution of macronutrients in the aspect of reducing losses related to food waste.

### 2. Materials and Methods

The research was carried out among the clients of a catering company located in Małopolska (Poland), dealing in the preparation of dietary meals with delivery to the consumer, thereby maintaining the cold chain. The catering company participates in a project aimed at reducing food losses and wastage as part of cooperation with Food Banks dealing with the recovery and distribution of food overproduction. The survey was conducted online via the CMS (Content Management System) internet platform in the period from September 2020 to April 2022 on 6531 clients of the company (n = 6531). The participation of all respondents was voluntary and included inhabitants of the Małopolskie Voivodeship in Poland. They were informed about the use of the collected results of an anonymous questionnaire for scientific purposes. The research tool was an original anonymous questionnaire in the form of a shortened nutritional interview. The questions concerned socio-demographic data, body weight, height, physical activity, reasons for using the company's services, and the intended goal. Based on the respondents' body weight and height data, the body mass index (BMI) was calculated. All survey responses were collected using CMS software and then exported to Excel for analysis. The obtained results were statistically analyzed using the Statistica 13.3 program (StatSoft, Krakow, Poland). Demographics, height, weight, and BMI are presented as descriptive statistics. The significance of differences in BMI was verified using Duncan's test (p < 0.05). The remaining results were prepared using count tables and presented in the form of graphs prepared in Excel Microsoft Office.

## 3. Results

The demographic profiles of the respondents are presented in Table 1. There were 3988 women and 2543 men (n = 6531) among the respondents. People living in the city dominated (83%). The average age of women and men was similar, approximately 36 years. Young women predominated (mode 18 years old); 25% of women in the study group were below 27, and 25% were above 44 years of age. Among men, 25% were under 27, and 25% were over 43 years of age. The mean weight of women was 74.71 (25% under 63 and 25% over 83 kg) and of men, 83.65 kg (25% under 68 and 25% over 95 kg). There were no differences in the BMI of men and women, which on average was 26.65 (25% below 23 and 25% over 29 kg·m<sup>-2</sup>) and 27.74 kg·m<sup>-2</sup> (25% below 24 and 25% over 31 kg·m<sup>-2</sup>) (Table 1).

Table 1. Characteristics of participants.

Parameter	Women	Men
Sex [number of people]	3988	2543
Age [years]	$36.23 \ ^{1} \pm 11.99 \ (35 \ ^{2}; 18 \ ^{3}; 18 \ ^{4}; 89 \ ^{5}; 27 \ ^{6}; 44 \ ^{7})$	$35.82 \pm 11.69$ (35; 18; 19; 84; 27; 43)
Weight [kilograms]	$74.71 \pm 16.83$ (71; 70; 50; 150; 63; 83)	$83.65 \pm 19.91$ (81; 70; 50; 150; 68; 95)
Height [centimeters]	$167.24 \pm 7.23$ (167; 164;150; 200; 163; 171)	$173.23 \pm 9.86$ (173; 170; 150; 208; 165; 180)
Average BMI	26.65 $^{\rm a} \pm 5.39$ (25; multiple; 16.33; 62.43; 23; 29)	27.74 $^{\rm a} \pm 5.60$ (27; multiple; 15.61; 58.59; 24; 31)

Explanatory notes: <sup>1</sup> mean  $\pm$  SD; <sup>2</sup> median; <sup>3</sup> mode; <sup>4</sup> minimum; <sup>5</sup> maximum, <sup>6</sup> Q1; <sup>7</sup> Q3 mean values in rows denoted by different letters differ statistically significantly (p = 0.05).

Analyzing the BMI, among the participants of the study, both men and women were dominated by people with normal body weight (42 and 32%, respectively) and overweight (34 and 37%). People with first-degree obesity constituted 15% of women and 19% of men, and those with second-degree obesity constituted 5 and 7% (Table 2).

Table 2. Body Mass Index of participants.

Ranges of BMI Values	Women	Men
Less than 16—severely underweight	0	2
16–16.99—moderately underweight	11	6
17-18.49-mildly underweight	55	33
18.5–24.99—normal	1674	821
25–29.99—overweight	1348	938
30–34.99—obese class I	618	479
35–39.99—obese class II	183	177
more than 40—obese class III	99	87

The respondents were characterized by low (53%) and moderate (33%) physical activity, and only 12% were highly or very highly active (Figure 1).

The reasons for the decision to choose dietary catering were mainly indicated as preparing too large portions of meals (65%), insufficient culinary skills (58%), as well as wasting and throwing away food, and inadequate management of food supplies (48% in total) (Figure 2).



Figure 1. Physical activity.



Figure 2. Reason for choosing dietary catering.

#### 4. Discussion

The aim of this study was to determine the factors related to the choice of dietary catering as a form of everyday nutrition. In total, 6531 respondents participated in the survey, the majority of whom were women. Human nutrition is conditioned by both individual factors, i.e., biological and psychological, as well as external factors, which undoubtedly include geographic, cultural, and socio-economic factors. Tomaszewska et al. [16], in their study on hygiene, while shopping and preparing meals at home in the context of food waste among Polish consumers, identified five segments among them who differed in their behavior and knowledge regarding food safety, including socio-demographic features such as sex, age, education, and professional activity. The least knowledge and practices were demonstrated by two segments consisting mainly of men of different ages, with a clear prevalence of people with primary and secondary education and a part of the labor force. According to Grzymsławska et al. [17], women more often than men attach importance to the quality of the diet, especially in terms of the nutritional value of the consumed food products. Other studies [3] also indicate a higher level of interest in the box diet in women than in men. Women make up the majority of household food suppliers. As a result of concern for their health or the environment, they influence the formation and change of eating habits [18]. The possibility of using meal delivery without interaction with staff is a

relatively new solution, which shows a different level of development depending on the geographic zone. The COVID-19 pandemic and numerous restrictions aimed at reducing the frequency of movement as well as the need to maintain social distance and isolation have undoubtedly intensified the use of this form of food delivery. Promoting this type of solution was a convenient and safe form of food delivery without the risk of disease transmission [19]. The consumption of meals in the form of dietary catering is especially popular among young people living in cities. The conducted research showed that the age of men and women interested in the distribution of meals in the form of dietary catering was similar, about 36 years. A review of the literature shows that the modern lifestyle and the lack of time have contributed to the increase in the consumption of meals prepared outside the home. It is also estimated that the current upward trend will continue [20]. Young adults and people of working age spend a significant part of their expenses on the consumption of meals prepared outside the home. This situation applies to European countries [20], the UK [21], and the United States [22]. According to *The Lancet* [23], the relationship between eating habits in society and the incidence of chronic disease has been widely studied. The conducted research confirmed potential causal relationships between certain nutritional factors and chronic diseases. Improving the quality of nutrition in society around the world could prevent nearly 11 million premature deaths worldwide each year. The variation in the quality of the diet differs from country to country [24]. The results of the research showed that among those interested in the consumption of dishes provided as part of dietary catering, people with a correct BMI index dominated. Among the respondents, 15% of women and 19% of men, respectively, were characterized by first-degree obesity. BMI indicative of second-degree obesity was a minority in both women and men and accounted for 5% and 7%. A global comparative risk assessment conducted over the period 1990–2013 in 188 countries indicated that in Central Europe, Eastern Europe, and Central Asia, the leading risk factor for both sexes combined is high systolic blood pressure, followed by smoking or high BMI [25].

The range of diets available in dietary catering is based on the latest nutritional recommendations. The meals are characterized by a low degree of processing and a significant proportion of vegetables, fruit, and whole grain cereal products. Bilska et al. [26], in their research on managing the risk of food waste in foodservice establishments using the Ishikawa diagram, identified four main categories of causes of food waste: materials, management, methods, and people. Additionally, two levels of risk were identified: medium for fruit and vegetables and bread and high (unacceptable) for the remaining six foods. The authors recommend a risk management model for food waste in the catering industry based on the ISO 31000: 2018 standard so that the production of food waste can be included in their operational processes. These actions can contribute to reducing food waste [26]. Tomaszewska et al. [27], in their studies on the estimation of the scale of food waste in hotels, indicated that almost three-quarters of food was wasted in the serving department. The share of food waste made up of food left on plates by customers was almost half. The mass of plate waste generated was correlated with the type and form of catering service provided, the largest share being plate waste after breakfasts served as a self-service buffet. The à la carte serving method produces the least waste. The authors emphasize that in order to reduce food waste, both food service workers and consumers must be educated. In order to achieve the intended effect, it is necessary to educate both gastronomy employees and consumers. Workers should be trained in proper food handling, hygiene, and administration. On the one hand, consumer education should be multilateral. On the other hand, raising awareness of the negative impact of food waste, for example, on the natural environment, should be sought. It should indicate what actions everyone can take to limit this negative phenomenon, be it at home, in the workplace, or in a restaurant [27]. Research conducted by Springmann et al. [28] indicated that a diet based on minimally processed food products, consisting mainly of plant raw materials and a flexitarian diet model, may reduce the risk of premature mortality by up to 19–30% by 2030. The author also points out that the normalization of body weight is an integral part of the decline in premature

mortality. Our research showed that the choice of meals in the form of dietary catering is correlated with the growing awareness of consumers regarding the impact of diet on health and the incidence of chronic diseases. Factors influencing the choice of this form of meal are the willingness to change eating habits and promote the trend for wholesome meals, and concern for one's health [3]. In the form used, the respondents indicated the level of demonstrated physical activity. The respondents were characterized by low and moderate physical activity. The test result confirms low physical activity, which may be related to professional work and a lot of time for self-preparation of meals. De Queiroz et al. [29] cite the term "nutritional competence" (EC) as a behavioral perspective of nutritional practices that are directly related to dietary quality, the health of different population groups, and obesity prevention. Increasing the consumption of vegetables and fruits, following the principles of the Mediterranean diet, and the ability to manage the nutritional context are in line with the recommendations of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) for healthy eating. According to these guidelines, the development of decision-making skills regarding a healthy diet is part of a nutritional education strategy, as it supports the individual in understanding the determinants of eating practices and encourages the adoption of health-promoting behaviors. The choice of the form of meals planned by dietitians in dietary catering may support the development of the above competencies and constitute a motivating factor to increase physical activity. Additionally, a systematic review and meta-analysis by Nitschke [30] indicated that doctors, nutritionists, and trainers can improve lifestyle behaviors and thus play a key role in improving the health of the population by working with clients who are healthy or have cardiometabolic risk factors, to reduce the risk of disease. The authors point to the need for further research in this area in order to be able to define further consistent and effective forms of intervention depending on the type of clients. However, what is certain is that this type of intervention would undoubtedly enable contact with specialists before the onset of the disease due to early educational intervention. Although we did not observe a correlation between low physical activity and an increased BMI in our research, we can assume that the cause of this phenomenon may be the higher awareness of the study participants and the choice of the appropriate caloric content of meals adjusted to age, gender, and low physical activity related to, e.g., sitting work. The undoubted benefit of using dietary catering is the possibility of dietary consultation while using the diet. The literature review draws attention to a wide-ranging problem on a global scale, where the correlation we did not observe occurs, especially in the case of performing sedentary work, which is usually associated with low physical activity [31–34].

The main factor determining the choice of meals in the form of dietary catering was the desire to reduce body weight. Among the respondents, as many as 87% of respondents expressed the desire to reduce body weight as the goal related to the consumption of meals in the form of dietary catering. Additionally, in research by Pyrzyńska [3] on consumer behavior in the catering services market, based on the example of dietary catering, 56% of respondents showed a similar relationship. Juraszek et al. [35], examining the effectiveness of the use of dietary catering in combination with physical exercise, concluded that this form of meal delivery is a beneficial solution, especially in the case of sports-active people, thus supporting the consolidation of proper eating habits. The study also aimed to determine the factors determining the choice of catering companies as a source of the full board. The reason for choosing this form of nutrition was mainly the preparation of too large meals, the lack of culinary skills, and insufficient time. May [36], examining the motivation of people using ready-made dietary catering, identified mainly the desire to reduce body weight and the inability to prepare meals on their own. It is worth mentioning that the self-preparation of meals is directly related to the need to plan and stock up on food. A Czech research team also undertook an analysis of the nutritional value of box diets, which indicated that they are properly balanced and ensure sufficient or almost sufficient consumption of important nutrients with the supplied diet. For comparison, when analyzing the diet of young students, the authors detected insufficient or excessive consumption of nutrients. Therefore, it can be concluded that the inclusion of box diets may have a positive effect on the nutritional status [37].

Although the study was not specially adapted to testing a statistically significant effect in terms of food waste, it can be concluded that the use of the form of prepared meals as dietary catering is an important element related to the formation of appropriate behaviors related to the ability to plan and prepare the size of consumed portions, care for food hygiene as well as reducing losses related to the excessive supply of food by households, which was pointed out by other authors [9,16,26,27]. According to Brennan [38], this factor is an integral part of environmental and public health. The author also points out that the actions undertaken by the United Nations in the field of sustainable development aim to "halve global food waste per capita at the retail and consumer level" and "significantly reduce waste generation through prevention, reduction, recycling and reuse" by 2030. Kretschmer and Dehm [39] reported that the food service sector, due to its purchasing power, can be seen as a potential factor in the transformation toward sustainable food systems. Unfortunately, a review of the literature shows that current food systems cannot be classified as sustainable. This is especially due to the lack of food security in the world and the negative impact on the environment [40-42]. According to Bilska [11], it is estimated that nearly one-third of the food produced worldwide is wasted. This phenomenon is most often attributed to households, where the scale of the problem is the highest (47 million tonnes). The author also points out that food waste is a multifactorial phenomenon directly related to consumer behavior. Importantly, food is most often wasted, which results from overproduction and food being opened but not used for consumption purposes. This phenomenon confirms the observations from our own research, where 65% of the respondents stated that they prepared too much food. Other research by Bilska [43], based on a specially designed questionnaire on consumer behavior in relation to food, along with an indication of demographic and social data, showed that as many as 65.25% of respondents throw away food due to its spoilage, and nearly 42% due to exceeding its use-by date for consumption. The author also points to the problem of waste, which results from the overproduction of food (26.5%) and purchasing too much (22.2%). Therefore, it can be concluded that the use of the form of prepared and personalized meals in the form of dietary catering with a specific calorific value consistent with individual energy needs may reduce losses resulting from overproduction of food in households and the related cause of food waste. Both Bilska [11] and Hanssen [44] reported that young people and their families generate the greatest losses related to food waste.

Consumer behavior in the food product market is the subject of research by many scientists, although the gastronomy sector of dietary catering is not fully understood and requires in-depth analysis. Thanks to the observations, it is possible to determine what factors affect the purchasing decisions of young consumers, who are characterized by a fast pace of life and, at the same time, care about their health and physical condition [3]. According to Khalid [18], high-quality food is perceived by consumers as safe. The author also indicates the conscious activity of food-producing enterprises in order to reduce environmental degradation and involvement in social activities creates a positive image of the company and confirms consumers in making the right choice.

It is worth noting that the catering company in which the research was conducted is a participant in the project entitled "Development of a food waste monitoring system and an effective program of rationalizing food losses and reducing food waste", the aim of which was, inter alia, to examine how much food is wasted in Poland in the entire production chain, "from farm to fork". Among the respondents, 39% provided the reason for choosing dietary catering as a lack of meal planning skills, 35% food waste in the household, 25% a lack of ideas for using food at home, and 16% a lack of rational inventory management skills. Based on these responses, it can be concluded that the company's customers are aware of wasting food in households, and the choice of dietary catering was not accidental. In the Food Waste Index Report 2021 [45], prepared by the United Nations Environment Program, it is noted that food waste should also be viewed from an environmental aspect. This

phenomenon generates about 8% to 10% of global greenhouse gas emissions, which means that it is responsible for more greenhouse gases than all individual countries in the world except China and the USA. The latest estimates suggest that in 2019 about 931 million tonnes of food waste were generated, of which as much as 61% came from households. It should also be borne in mind that the farther down the supply chain the food losses occur, the greater the related emissions. This is because production has consumed more resources that have accumulated in the supply chain related to, for example, processing, transportation, retail, packaging, and storage. It is also important to remember that different food products have different impacts on the environment. For example, the volume of meat that is wasted and lost is lower than in the case of foods such as grains and vegetables. However, meat requires much more resources to produce, so meat waste still has a significant impact on climate change (estimated to be responsible for 20% of the carbon footprint of total food waste and loss) [45].

## 5. Conclusions

Based on the analysis, it can be concluded that using the services of the catering industry, including dietary catering, may be a good solution to reduce food losses in households. The choice of dietary catering is related to adjusting the diet to individual energy needs as well as proteins, fats, and carbohydrates. The size of portions is adjusted individually, which reduces wastage by preparing too large portions of meals, which is a common problem in one-person households. It is also worth paying attention to the necessity of education in this area from an early age in order to shape a conscious consumer who chooses a sustainable diet and cares about the environment. A serious problem is also the skillful management of food stocks in households and skillful planning of purchases.

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