

# **EXPLORATORY RESEARCH OF FOOD WASTE GENERATION AND FOOD WASTE PREVENTION IN THE HOSPITALITY INDUSTRY – THE CASE OF ZAGREB RESTAURANTS**

**Ana-Maria Cuglin**

University of Zagreb, Faculty of Economics & Business, Croatia

E-mail: [anamariacuglin@icloud.com](mailto:anamariacuglin@icloud.com)

**Kristina Petljak**

University of Zagreb, Faculty of Economics & Business, Croatia

E-mail: [kpetljak@efzg.hr](mailto:kpetljak@efzg.hr)

**Dora Naletina**

University of Zagreb, Faculty of Economics & Business, Croatia

E-mail: [dora.naletina@efzg.hr](mailto:dora.naletina@efzg.hr)

## ***Abstract***

Food supply chains and their coordination (delivering requested amounts of food on time, to the right location, with minimum food waste) are becoming more complex nowadays and they present a growing challenge for all food supply chain participants, from producers and retailers in service industries to end consumers. It is beyond doubt that food waste has become a global issue of our time as a result of mass food production. Researches have shown that most food is wasted at the end of the supply chain, i.e. in the hospitality industry and in households. It is precisely for this reason that this paper aims at a more detailed research of food waste in catering facilities, i.e. in restaurants. For the purpose of this paper, exploratory research was conducted on a sample of 20 restaurants in Zagreb via an anonymous questionnaire which analysed food waste and the possibilities of its prevention. Results indicate that restaurants are familiar with food waste issues and that most food is wasted in the process of food preparation (before serving). Restaurants are getting more and more concerned regarding waste, but recycling or food donating is still not a part of standard restaurant business practice. In conclusion, there is a necessity of raising employee and guest awareness of the growing food waste quantities, as well as of proper methods of food waste management that can prevent it.

**Key words:** food supply chain, food waste, hospitality industry, restaurants, food waste prevention methods, Zagreb

## **1. INTRODUCTION**

Today, when almost 800 million people in the world are starving, food waste has certainly become a global issue as a consequence of mass food production. According to the data from the Food and Agriculture Organization of the United Nations (FAO),

1.3 billion tons of food is globally wasted every year. In developed countries, over 40% of food is wasted in retail and consumption phases, while in developing countries, the percentage pertains to the loss of food during harvest and processing (FAO, 2016). In Croatia, more than 400,000 tons of food gets wasted annually, i.e. 90 kg per capita (The Croatian Environment Agency, 2014). The consequences of food waste are significant because they affect the environment and climate change.

The existing researches show that most food is wasted by consumers at the end of the supply chain, i.e. in the hospitality industry and in households. Besides the available handbooks for consumers and hospitality facilities, no research on food waste in restaurants has been conducted in Croatia. This is the reason why this paper carried out a research of Zagreb restaurants, with the aim of providing answers to the following questions: 1) *Do these restaurants take care of the food waste?*; 2) *What happens to the food that is no longer suitable for use in restaurants?*; 3) *Are there activities which help prevent food waste in restaurants?*; and 4) *In what way is the food waste dealt with in Zagreb restaurants?* The paper will also analyse the methods and activities which can significantly help prevent food waste during the supply, storage, preparation and serving stages.

## 2. FOOD WASTE IN THE SUPPLY CHAIN

### 2.1. Terminology

According to FAO (2016), there is a difference in the definition of food loss and food waste in the UN “Save Food” Initiative. Food loss refers to the decrease in food mass or in its quality, which makes it unsuitable for human consumption (FAO, 2011). Food losses are present in the production process and during the distribution in the food supply chain. On the other hand, food waste (which is a component of food loss) implies any kind of food being removed from the supply chain. This food has been or was suitable for human consumption at some point, or its shelf-life has expired, which most often is caused by poor food management or by the negligence of employees. According to Buzby *et al.* (2014), food loss is defined as the amount of edible food available for human consumption, which has for some reason not been consummated, while food waste refers to edible food not consumed because of certain human factors and actions.

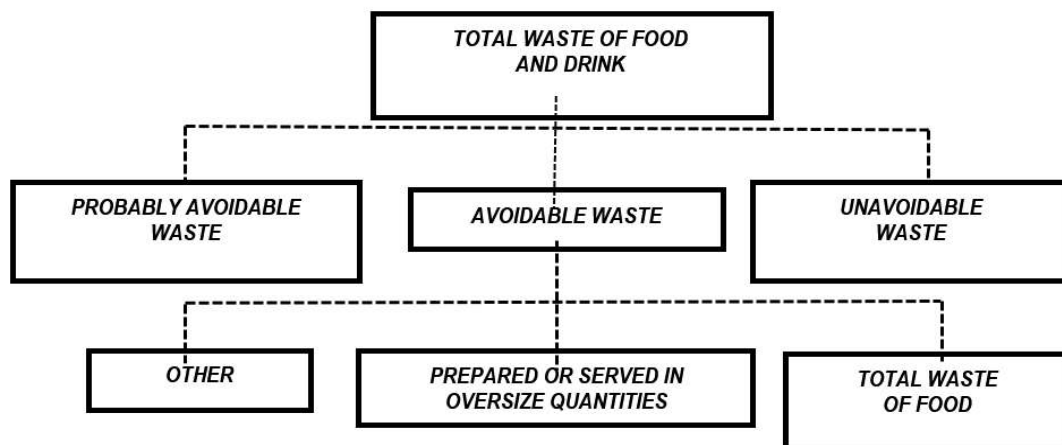
Costello *et al.* (2016) define two types of food waste:

- food waste before its consumption – it involves kitchen leftovers (any organic material that is thrown away during food preparation, like peels, grease, fruit and vegetable parts; it is considered inedible) and food which has rotten (either the shelf-life has expired or it is decomposing; it is considered inedible), and
- food waste after consumption – it includes the food served to the guests that has not been eaten.

The European and Croatian healthcare define bio waste as biologically degradable waste from parks and gardens, food and kitchen waste from households, restaurants, hospitality facilities and retail stores, including similar waste in food

product processing (Voća, 2014). The term bio waste is often confused with biodegradable waste which, along with bio waste, includes other types of biodegradable waste, such as the waste from the forestry sector, fertilizer waste, paper, cardboard, textile etc. When considering the possibility of its mitigation, food waste can be classified into several basic categories:  $\frac{3}{4}$  the waste which can be avoided (avoidable waste), like food that was edible before being thrown away (like bread, apple, meat);  $\frac{3}{4}$  of the waste that has a large potential of being mitigated (likely avoidable waste), such as food being consumed by some people and not by the others (like bread crumbs) or, food which can be edible based on its preparation (like potato peel);  $\frac{3}{4}$  the waste which could not be avoided (unavoidable waste), like the waste produced during food preparation which is not and never has been edible (like bones, egg shells, tea bags), as shown in Figure 1.

**Figure 1.** Classification of food and drink waste relating to the possibility of mitigating their production



Source: Voća (2014:8)

The waste that can be avoided refers to the food that has been prepared or served in excessive amounts, food that has been damaged during the preparation (burnt food, for example) and food products that have not been consumed i.e. their shelf-life has expired. In providing hospitality services, most waste is not hazardous and, if it cannot be reused in the very facility, it is important to separate and store it and hand it to the authorized waste management company. Almost all types of not hazardous waste produced by the hospitality industry can be processed, i.e. can be used for making raw materials or new products. For example, food waste can be used for anaerobic digestion, composting, production material or energy production; waste packaging can be used as materials or for recycling materials and the production of new ones; wood and paper waste can also be reused for material and energy recycling (Voća, 2014).

## 2.2. Sources of food waste in the supply chain

According to FAO, one third of total food mass produced for human consumption is wasted. At the same time, global food production uses 25% of

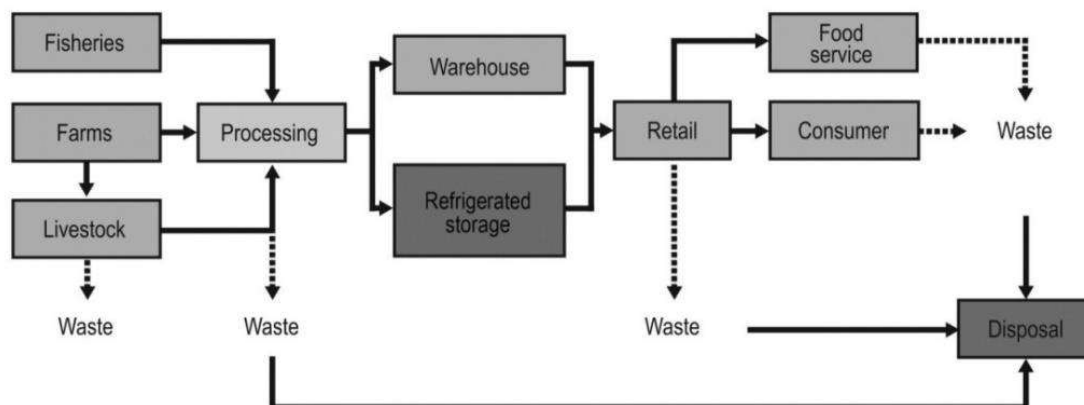
inhabitable land, spends 70% of drinking water supply, causes 30% of greenhouse gas emission and 80% of deforestation (FAO, 2016). Food production is one of the leading factors of change in the use of land and in the loss of biodiversity, and food waste poses a missed chance for improvement in the field of global food supply, as well as in the mitigation of negative influence on the environment, human health and natural resource exploitation.

The awareness of food waste as being problematic and irrational has been rising in Europe and in the world, especially because it is not just the environment that is in question, but socio-economic and moral issues as well. Many countries have diligently begun collecting data and information on this type of waste to reduce food waste. They are also trying to define waste production management and are making efforts to educate and inform the public.

When observing the food waste issue as a whole, it is necessary to focus on the waste prevention concept and the evaluation of its impact on the environment through the product life cycle analysis (LCA). The life cycle analysis includes the primary (agricultural) production, handling and storage after the harvest, processing, distribution, consumption and the end of the life cycle i.e. becoming waste. Food waste quantity could be also affected by problem of pure motivational compensation of employees on closest supply chain level to final consumer (Turkalj et al., 2010), who are not adequately motivated for proper handling and exploitation of food products.

The causes of food loss in the supply chain are various (Parfitt *et al.*, 2010): for example, losses due to improper storage of raw materials or products, wasting of food during its handling or transportation, waste production in the distribution phase because of the expired shelf-life, etc. More effective implementation of measures for mitigating food waste in the first stage of the supply chain means reducing negative influence on the environment and less food losses. During transportation, preparation, distribution and consumption there are additional risks of food waste, which also implies the accumulation of negative influences on the environment and food loss risks. Food supply chain consists of five phases and there is a risk of food wastage in all of them (Figure 2.).

**Figure 2.** Critical points of food waste in the supply chain





In the long chain, between production and consumption, there are multiple stages at which some form of loss, spillage, waste or loss of food might take place, be it in the production, storage, distribution or during actual consumption (Jagau and Vyrastekova, 2016). However, the food waste occurs mainly in the final stages of the supply chain – during the food distribution and consumption phases.

### 2.3. Secondary data on food waste

Today, when almost 800 million people in the world are starving, food waste has certainly become a global issue mass food production has created. Despite that, according to the data from FAO, 1.3 billion tons of food is globally wasted every year – double than what is needed to feed all the hungry people in the world (Royte, 2016). Where does all this food go? Only in Croatia, more than 400,000 tons of food is wasted, which is 90 kg per capita (The Croatian Environment Agency, 2014), while the number for the entire world goes up to one third of the produced food. In developing countries, plenty of food is wasted after the harvest due to inconvenient storage, poor road conditions and cooling systems (Gustavson *et al.*, 2011). In comparison, developed countries waste more food further down the supply chain - traders order, serve or display too much food, while consumers ignore the leftovers in the back of the refrigerators or throw away perishable foods before the expiration date. The remarkable fact is that almost one third of edible parts of food produced for human consumption is being wasted, which is around 1.3 billion tons a year (Royte, 2016).

Food is wasted throughout the supply chain (Bloom, 2011), from the initial agricultural production, to the final household consumption. In developed countries, food is being wasted in huge amounts, which means that it is thrown away even if still edible and good for preparation and consumption. In underdeveloped countries, food is mostly wasted in the early and middle stages of the supply chain; least is wasted in the consumption phase (Gustavson *et al.*, 2011). Food loss per capita in Europe and North America is 280-300 kilograms per year. In sub-Saharan Africa and in South/Southeast Asia the loss is 120-170 kg per year. The entire production of edible food for human needs per capita is around 900 kg in Europe and North America, while in sub-Saharan Africa and South/Southeast Asia it adds up to 450 kg a year. European and North American consumers waste about 95-115 kg of food every year, while the data for sub-Saharan Africa and South/Southeast Asia shows that they waste only about 6-11 kg per year. Food waste in industrialized countries is as high as in developing countries, but the latter produce more than 40% food waste after the harvest and during the production processes, while industrialized countries create 40% food waste at the end of the supply chain, i.e. in retail (Gruber *et al.*, 2016) and during the consumption phase. Food waste by consumers in developed countries (222 million tons) almost equals the total net food production in sub-Saharan Africa (230 million tons).

Food waste also takes its toll on the environment (Royte, 2016). Food that is produced and left uneaten – be it meat or cakes – means wasting water, fertilizers, pesticides, seed, fuels and land necessary for its growth. The amounts are not insignificant. The annual production of uneaten food “drinks up” as much water as

the annual water flow in the Volga, the water-richest European river (Tristram, 2009). These stunning figures do not even include losses on the farms, watercrafts and slaughter houses. If food waste was seen as a country, it would be the third largest greenhouse gas emitter in the world, right behind China and the USA.

On the planet with limited resources and anticipated population growth of at least two billion by the year 2050, many activists have been putting forward their arguments for reducing food waste, which has now become an international issue (Maddyck, 2015). The French Senate, for example, has unanimously adopted the law proposed by the local councillor Arasha Derambarsha, which dictates that all supermarkets are obliged to donate foods that cannot be sold due to their appearance or their short shelf-life to public community kitchens and charities. The fines for not obeying the law are up to 75 thousand euros.

In September 2015, the UN committed to cut food waste in half by the year 2030. In December, the European Union issued a proposal for a directive according to which all Member states have to take measures for food waste mitigation in accordance with the goals of 2030 Agenda for Sustainable Development (reducing retail and consumer food waste per capita by at least half the current state and reducing food waste in production and supply chains). Specific mechanisms of this ambitious plan have not been defined. Nevertheless, some countries and companies have already been designing and adopting standards for determining quantities of food waste. In October 2015, Croatia adopted the Regulation on the conditions, criteria and ways of donating food and feed. Although with many defects, the Regulation has led to donation exemption from the VAT system in December (Sokolić, 2015). If the goal of the UN is achieved, enough food will be saved to feed at least one billion people.

### 3. PREVIOUS RESEARCH

Over the last few years, the issue of food waste has imposed itself as an extremely important and taunting research area (Principato et al., 2015; Blondin et al., 2014; Charlebois et al., 2015). The existing researches point out that food is being wasted in huge amounts and that solutions must be found and individuals warned about food waste consequences. Up until now, researches have been focusing on the specific phases of the supply chain, such as food waste in retail (Gruber et al., 2016), or household food wasting (Silvennoinen et al., 2014; Lanfranchi et al., 2016). The research focus has been directed towards consumers (Principato et al., 2015; Setti et al., 2016; Grandhi and Singh, 2016), while the hospitality industry has been neglected or extremely rarely researched (Christ & Buritt, 2017). In the existing empirical research, case studies dominate, although the interest in food waste in hospitality industry is increasing. Researches on food waste in Croatia are rare (Kalambura et al., 2014; Knežević et al., 2017), especially in the hospitality industry. Therefore, to elaborate on this current and complex theme, for the purpose of this research and during research instrument design, the guidelines of the previous researches have been followed with the focus on the hospitality industry, specifically the food waste in the hospitality industry (Principato et al., 2015; Charlebois et al., 2015).

The research conducted by Principato et al. (2015) in Italy focuses on household food waste, which includes food grown at home, food bought at stores and food waste from the restaurants. The research was conducted due to the fact that younger population wastes more food than adults, which has also been shown by the researches conducted in Great Britain (Osner, 1982; Lyndhurst, 2007). The research was conducted on a sample of 233 students and the results have shown that 84% of the participants are familiar with the economic and environmental issues concerning food waste. The most popular communication channel through which they receive information on food waste is television (78.6%). About  $\frac{3}{4}$  of the examinees stated that they had reduced the quantity of wasted food, while 68.5% said they regularly went shopping for groceries with a shopping list.

The research by Blondin et al. (2014), conducted in America, was initiated by the concern of school employees (principals, teachers, cooks) on increasing food wastage. The research was conducted in ten schools and it pointed out three factors that explain food waste: the first factor is connected to the food itself, the second to the children and the third to the programmes. Regarding the first factor, food waste can be the result of the expired shelf-life, even if it is just one day overdue, or the food does not appeal to children and is left untouched and therefore thrown away due to regulations, or the food that should be served hot or warm gets cold because children did not arrive on time and is also thrown away. As for the second factor, children decide for themselves how much they will eat - sometimes they eat everything, sometimes nothing, because they are either not hungry or they do not like what is on the menu. The third factor relates to food waste due to short breaks. According to the research, food products that are thrown away the most are milk and fruits.

One of the most significant researches on food waste is a research conducted in Canada in the famous Delish restaurant chain (Charlebois et al., 2015). According to this research, there are several reasons for food waste. Food industry needs suppliers and different inputs on all levels in order to create dishes for their guests. Also, another important determinant is the management which plans and manages the budget and risk reduction. There are strict regulations on the conditions in which food should be preserved. It is up to the management to decide which methods to adopt regarding food safety requirements in restaurant kitchens, including the supplies and storage control. Furthermore, it is necessary to anticipate costs before they arise. Cost prevention factors include good employees, effective training and equipment maintenance. Making a mistake in any of these variables may lead to guest complaints and sales reductions. The research also focuses on kitchen management and organization. The key emphasis is put on kitchen hygiene because many employees do not regard it as important and constant training is needed in order to make it an everyday practice in restaurant kitchens. Communication and trust between the management and the employees is also crucial in order to achieve the goals of the organization. If the conditions at work are good, employees will perform better. The last determinant is the supply and demand management. Food demand can be influenced by the weather and local events, and these unexpected fluctuations can influence the already prepared food by going bad before being eaten. That is why it is very difficult to plan and order goods ahead. Food waste occurs because of over-processed food, inadequate preserving temperatures, the equipment not functioning

properly or inappropriate menus. According to the research results, relations with the suppliers do not have much influence on food waste prevention. The communication between the management and the employees is often not at its best and it mostly comes down to the communication between the manager and the chef who is responsible for everything. The employees are not involved in the food waste prevention programme and are only included when they feel the wasted food is their fault. There is no recycling and the food is directly thrown away. New employees are blamed if something goes wrong, for example when the waiter is not familiar with the menu or if portions are larger than usual and guests return the food which is then thrown away.

#### 4. EMPIRICAL RESEARCH ON FOOD WASTE IN HOSPITALITY INDUSTRY – THE CASE OF RESTAURANTS IN ZAGREB

##### 4.1. Research methodology and sample

In order to research food waste in the hospitality industry in more detail, an exploratory research was conducted via face to face method with the research instrument in a form of a questionnaire consisting of 28 questions. The research was conducted on a sample of 20 respondents working in hospitality facilities in Zagreb (Table 1.). Most facilities are restaurants (75.00%), then bistros (10.00%) and pizzerias (10.00%), and fast food restaurants (5.00%). According to the respondents' assessments, more than 4.000.00 kuna are spent on the daily purchase of food in the surveyed restaurants.

**Table 1.** Socio-demographic characteristics of the respondents

variable	category	n
gender	male	18
	female	2
age of respondents	15 – 24 year	1
	25 – 34 year	8
	35 – 44 year	5
	45 – 54 year	1
	55 – 64 year	5
	older than 65 years	0
working place	owner of the restaurant	10
	restaurant manager	6
	chef	4

Source: empirical research

Participants in the research were mainly male (90.00%). Most respondents were between the age of 25 and 34 (40.00%) and between the age of 55 and 64 (25.00%). The average working life of the younger participants was between 5 and 10 years, while the average working life of the older respondents was between 20 and 30 years. The respondents were asked to state their position in the restaurant. Restaurant owners participated in the research for the most part (50.00%), followed by restaurant

managers (30.00%) and chefs (20.00%). When analysing the number of employees, the data varies. Most restaurants have 10 to 20 employees, while two of them have 72 and 28 employees respectively. Out of the total number of restaurants participating in the research, only four have fewer employees than the average (two smaller restaurants, a bistro and a fast food restaurant).

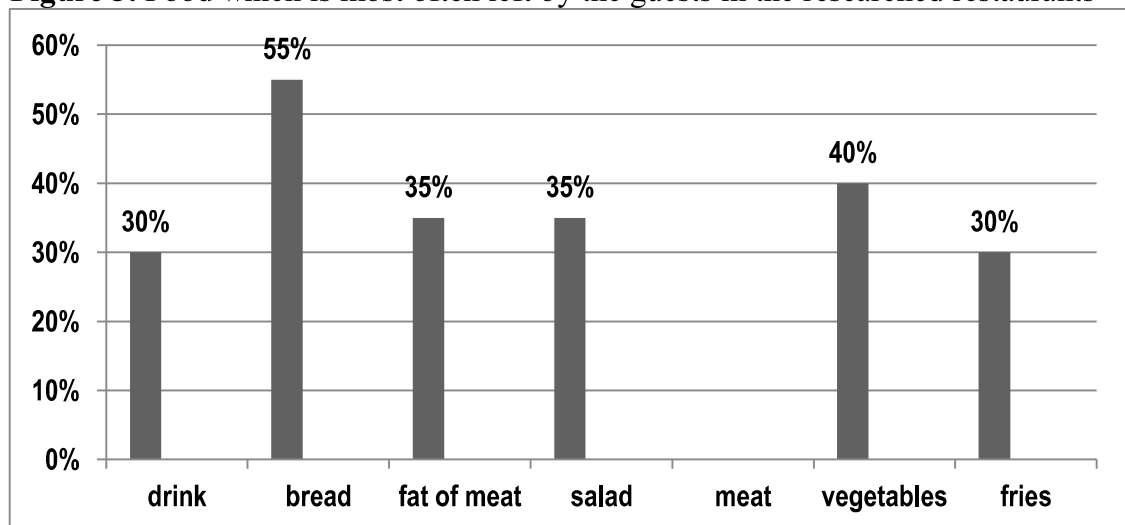
#### 4.2. Research results

Out of the 20 restaurants the research was conducted on, 6 restaurants purchase fresh groceries twice a week, while 14 of them make the purchase more than 3 times a week i.e. almost every day. All restaurants state that they easily store perishable foods like milk, eggs, fish, meat or seashells in the refrigerators. Most of the restaurants do not have a vegetable or herb garden at the facility, while few state that they grow culinary herbs like basil, thyme, oregano, rosemary or chilli peppers in containers.

When analysing food waste in these restaurants, one part accounts for the waste which occurs in the kitchen, i.e. it occurs before the food reaches the guest. The other part is the food that is thrown away after the guests leave, i.e. leftover food from the plates. In the research, 9 restaurants stated that almost 20% of the purchased food is thrown away before being served, 7 restaurants waste 10%, while 4 restaurants waste between 30 and 40% of the purchased food. Evidently, it is a high percentage of food being wasted in the preparation phase, before it arrives on the table.

The respondents were further asked to assess the percentage of prepared food (entrée, main course, dessert, menu) which is thrown after the guests leave. Most restaurants (n=14) said they throw away 10 to 20% of food after the guests leave, 4 restaurants throw away 20 to 40% and two respondents could not give the approximate data. The research has revealed that in most restaurants guests almost never choose to take their leftovers home (*doggy bag*). Restaurants have noticed there are certain groceries that are most often left by the guests. Those are, in order of frequency, bread, vegetables, fats (e.g. from meats), salad and fries (*Figure 3.*).

**Figure 3.** Food which is most often left by the guests in the researched restaurants

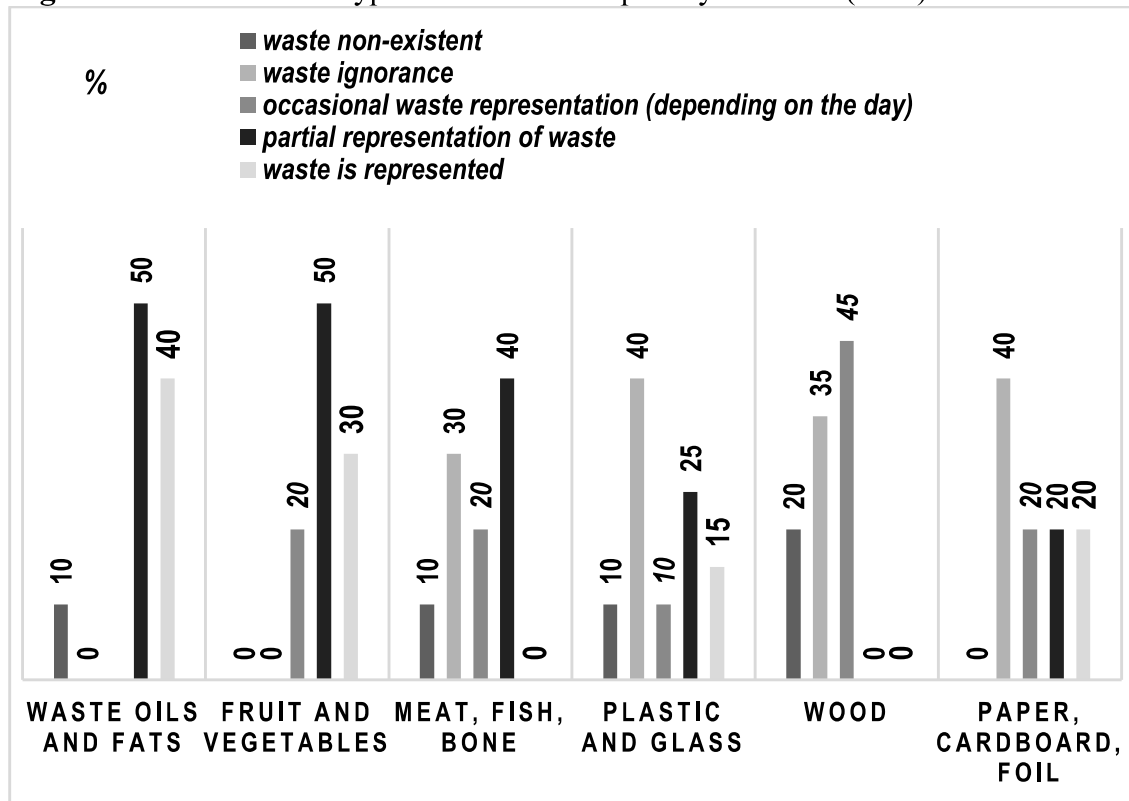




Source: empirical research

Every hospitality facility creates waste during food preparation and strives to find the best way for its disposal. The respondents were therefore asked to state the quantity of certain type of waste in their facility (waste oils and fats; fruits and vegetables; meat, fish and bones; plastic and glass, wood and paper, cardboard and foil). Figure 4. shows the most common types of waste in hospitality facilities.

**Figure 4.** Most common types of waste in hospitality facilities (in %)

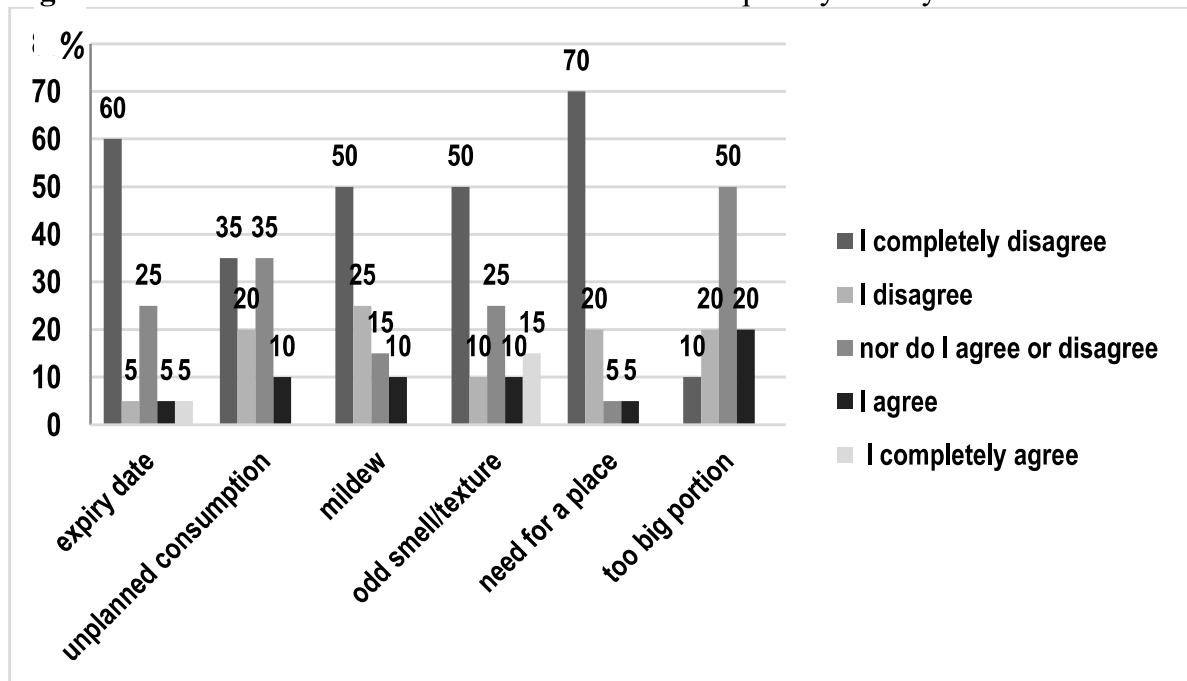


Source: empirical research

The most common types of waste in restaurants are: (1) waste oils and fats, (2) fruits and vegetables, (3) paper, cardboard and foil, (4) plastic and glass, (5) meat, fish, bone and (6) wood. The first category, waste oils and fats, is partially present in all researched restaurants (almost 50%) and the same is with fruits and vegetables. The category of meat, fish and bones is partially present in 40% of the restaurants, while it does not exist in 30% of the restaurants. Plastic and glass category is not present in 40% of the restaurants, while in 10% of them it does not even exist because they recycle these materials. Other restaurants do not recycle them, so this type of waste is partially present. The next category includes wooden packaging for fruits and vegetables and is not present in 35% of the restaurants because the packaging is returned. In 45% of the restaurants, wood is sometimes present and sometimes it is not, depending on the day. The last category of paper, cardboard and foil is not present in 40% of the restaurants because they recycle these materials, while in other restaurants it is present or partially present.

Further on, on a scale from 1 to 5 the respondents were asked to express the level of agreement or disagreement relating to the most common reasons of food waste in their restaurants (for example, *'because the shelf-life has expired'*, *'because we bought more food than was needed (we planned it poorly)'*, *'because food went mouldy'*, *'because food had strange odour and texture'*, *'because we needed more space in the refrigerator or other places we store food in'*, *'because portions were too big'*. The scale from 1 to 5 reads as follows: 1 = do not agree at all, 2 = do not agree, 3 = do not agree and do not disagree, 4 = agree, 5 = agree completely.

**Figure 5.** Most common reasons of food waste in a hospitality facility



Source: The research

There are a number of reasons why food is being wasted in restaurants. Some of them include expired shelf-life, ill-planned purchase, mouldy food or food that smells strange and has a strange texture, need for more storage space in refrigerators or simply too big portions (Figure 5.). Concerning food with the expired shelf-life, mouldy food or food that has strange smell or strange texture, 45-60% of the restaurants do not agree with the statement because the food with the expired shelf-life is returned to the supplier (in line with their agreement). 30% of the restaurants do not agree at all with the statement *"we throw food because we bought more than was needed"*, while 20% of them do not agree because without good purchase planning they could not survive on the market and would suffer losses. As much as 70% of the restaurants in question completely disagree with the statement that *'they throw away food because they need more space in refrigerators or other places they store food in'*, because when they notice that much more food is stored than usual, they buy additional refrigerators. 50% of the restaurants neither agree nor disagree with the statement that *'they throw away food because the portions are too big'*. 20% of the respondents agree and 20% of them disagree with the same statement.

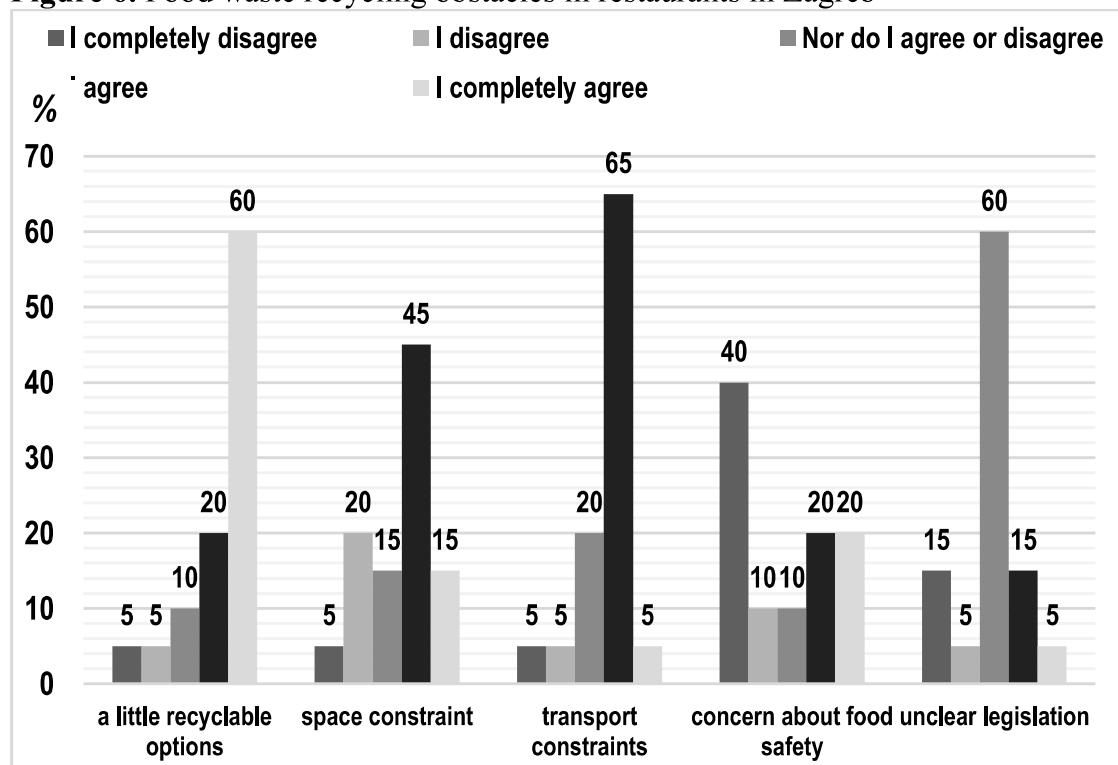
The restaurants estimate that they throw more than 20 kg of food (30% of the restaurants) on a weekly basis, 30% of the respondents estimate they throw 5 and 10 kg (smaller restaurants), and 30% of them state they waste between 10 and 20 kg of food. Kitchen leftovers and plate waste is thrown away in 85% of the restaurants, while the rest is recycled. Only one restaurant has a person in charge of food recycling.

The respondents were further asked to state what kind of food they buy in greater amounts and then have to throw away because they could not plan the expenditure. As many as 80% of them said there is a problem with the planning of fruit and vegetable expenditure since it can easily go rotten, especially if not stored properly.

When recycling is being analysed, the restaurants in question pointed out that they sometimes throw their food waste in specified garbage containers. Only one restaurant has recycling containers for bio waste, paper, glass and mixed municipal waste, while others plan to purchase them soon.

The respondents were further asked to scale their level of agreement or disagreement with the statements related to the food recycling obstacles (for example, '*insufficient number of recycling options*', '*spatial limitations*', '*transportation limitations*', '*taking care of collecting and storing concerning food safety*', '*unclear legislation*'). The scale from 1 to 5 reads as follows: 1 = do not agree at all, 2 = do not agree, 3 = do not agree and do not disagree, 4 = agree, 5 = agree completely.

**Figure 6.** Food waste recycling obstacles in restaurants in Zagreb



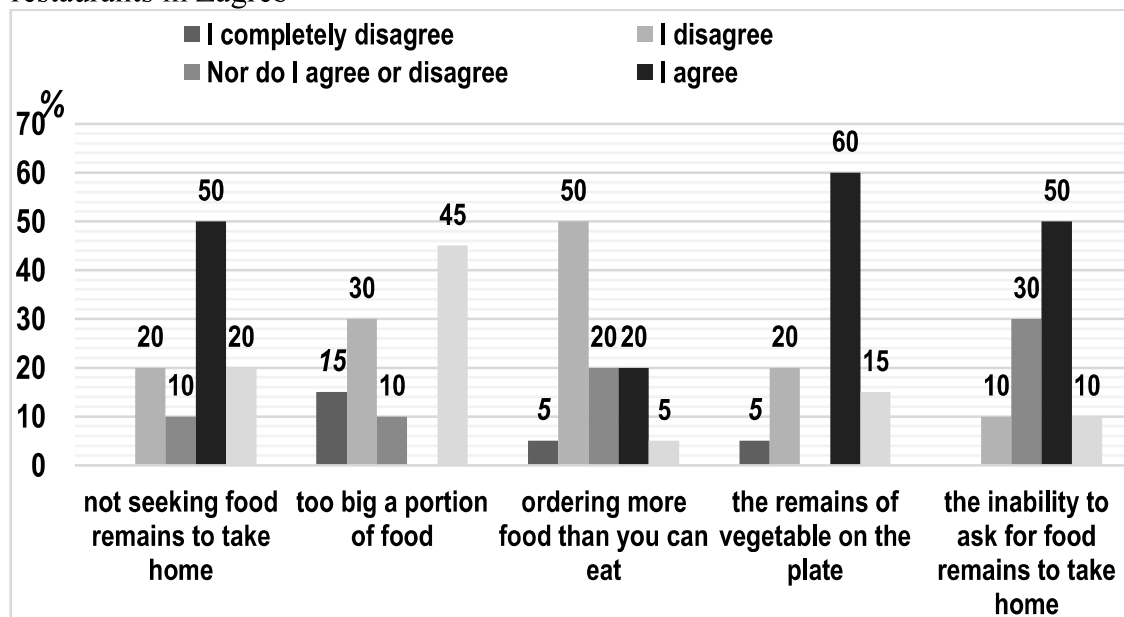
Source: empirical research

As many as 20% of the respondents agree with the statement that '*there are limited recycling options*'. The restaurants in question are situated in the centre of Zagreb, where there are no recycling options in suitable locations and it is therefore

easier to throw everything together in the same container. As many as 45% of the respondents agree that *'there is not enough space in the restaurant for storing waste'*. 65% of them agree with the statement that *'transportation limitations are an obstacle to recycling'*. Namely, the respondents agree that the waste is collected at inappropriate times, for example every other night, when the restaurants are busiest, instead of being collected in the morning. Likewise, restaurant owners do not have the appropriate vehicles to transport waste. Furthermore, as many as 40% of the restaurants completely disagree that *'taking care of collecting and storage concerning food safety'* is an obstacle to recycling because food safety is a must. As many as 60% of them are indecisive about *'unclear legislation'* being a food waste recycling obstacle.

When asked which communication channels they use to receive information on food waste, the respondents' answers included magazines, television and the word of mouth. Certain amount of food in the restaurants is being wasted by guests. Most often guests order more they can eat and then leave the plate waste instead of asking to take it home, and their leftovers have to be thrown away for health reasons. The respondents were asked to express their level of agreement or disagreement with the statements regarding food waste made by guests.

**Figure 7.** Respondents' perception of the reasons why guests create food waste in restaurants in Zagreb



Source: empirical research

Vegetables are wasted at higher rates than other food and are most often left on plates by guests. Furthermore, as many as 45% of researched restaurants agree with the statement that *'the guests complain about portions being too big'* and think they need to cut their size. Most of the restaurants in question think that guests feel uncomfortable asking for leftovers, and at the same time, most of them think that guests do not order more than they can eat. Only 30% of the respondents disagree with the statement that *'the portions are too big'*. In order to avoid unnecessary food waste,

it is crucial that the employees who are in contact with guests explain the size of the portion and what it consists of, if not already stated on the menu. It is also important to ask the guests if they want the leftovers to be packed to go, instead of waiting for them to ask first.

#### **4.3. Discussion**

According to the research results, it can be concluded that the employees in the restaurants in question are already familiar with the issue of food waste and its consequences, but restaurants still don't have a specific method for food waste prevention.

Most food in Zagreb restaurants is wasted in the phases before the food is being served, and it includes waste such as, for example, vegetable and fruit leftovers, bones, egg shells, or accidental spillage of food and drink, a dish gone wrong, etc. The food waste reduction at this stage leads to lower costs and has positive influence on the environment. The restaurants are careful with the daily or weekly grocery purchase planning and food is rarely stored in excessive amounts. If more is ordered than needed by mistake, or if the delivered food is rotten or not fresh, the food is returned and replaced due to the agreement obligations. Everyday menu planning is crucial for restaurants, as well as providing portions that should not be too big.

The restaurants should cut side dish portion sizes, since they are most often left on the plate and thrown away in the end (for example, fried potatoes, salads and sauces, etc.). It can be concluded that the researched restaurants are not exactly sure what amount of food is being wasted, because there is no kitchen management system or a person in charge of it. The communication between employees is crucial in restaurants, especially between chefs and waiters, so that the actual dish is prepared as ordered. Also, restaurant employees should be educated to take orders as precisely as possible and to communicate them with the kitchen staff more efficiently to prevent mistakes and avoid the food being returned by guests. Although there are numerous guidelines and handbooks, as well as hospitality facility legislation, the food waste issue is still understated and not a priority. For this reason, very few restaurants recycle and none of them has recycling containers at their facilities. It is necessary for the state to pass legislation to reduce food waste all restaurants should abide by and in that respect, mitigate unnecessary waste, or at least entice restaurants with certain incentives to take care of food waste and begin recycling it.

#### **4.4. Limitations and recommendations for future research**

The research on food waste in Zagreb restaurants was carried out on a sample of 20 restaurants, which is a relatively small sample compared to the total number of restaurants in Zagreb. The sample represents a certain limitation in forming general conclusions, and future researches should therefore include more restaurants in the Zagreb area and wider. A more structured analysis with performance indicators related to food waste would contribute to the internal validity of the study. The results of this research largely depend on the type of hospitality facility, its location and its offer, which are additional variables to be considered in the future. Furthermore, the



research collected the data from the restaurants' employees (mainly the owners), which can imply possible subjectivity and selectivity while answering the questions and covering the facts that could consequently undermine the reputation of their restaurant. Nevertheless, if the research included more respondents, the possibility of making more generalised conclusions would be greater. As far as the consumers, i.e. the guests of the restaurants are concerned; it is preferable to include them in the research as well.

## 5. CONCLUSION

Food is wasted in every stage of the supply chain, from the initial agricultural production, through retail and service to the final consumption in households. In developing countries, food is wasted in large amounts, even when still suitable for consumption. Certain amounts of food are wasted and thrown away in the early phases of the food supply chain. In underdeveloped countries food is mostly wasted in the production and processing phases due to poor storage conditions and transportation limitations.

With the aim of presenting possibilities for food waste prevention, an exploratory research has been carried out via a questionnaire on a sample of 20 hospitality facilities, mainly restaurants, all of which are already familiar with the food wasting issue. The analysis of the research results shows that the restaurants mostly waste food in the preparation phase (fruit and vegetable leftovers, egg shells, waste oils and fats, accidental spillage), while slightly less food is wasted after the consumption by the guests. Therefore, the food preparation phase can be seen as critical and needs to be analysed further with the aim of better food management in restaurants. Food that is most often left by the guests includes salads, fried potatoes, sauces and vegetables, and it is therefore necessary to offer smaller portions and charge prices accordingly (e.g. the children's menu) or serve smaller portions with the possibility for the guest to order more. Guests often think they can eat the entire portion so they order different side dishes and almost always overestimate their hunger. It is necessary to ensure good communication between guests and waiters, where the waiter, unless it is already indicated on the menu, will inform the guests on the content and the size of the portion.

The research has found that the restaurants do not have suitable recycling systems. Due to spatial limitations and insufficient recycling options, very few restaurants in question sort out food waste in appropriate recycling containers; paper and cardboard are mostly recycled because there are licensed companies in charge of this type of waste. The Sustainable Waste Management Act (NN 94/13) specifies that the produced waste should be separated on the spot in order not to get it mixed and to properly treat it in the future. It is crucial to raise awareness of restaurant owners and their guests about the fact that throwing food away leads to environmental contamination. Unconsummated food production leads to unnecessary CO<sub>2</sub> emission. In the world with limited resources (land, water, energy), where cost efficient solutions produce enough safe and nutritious food, food waste reduction should not be a priority easily forgotten. *As such, food waste reduction is likely to be receiving*

*more attention over the coming decades as one of many environmental and health campaigns that seek to achieve positive social changes in society. It is timely for the foodservice sector to become more engaged in food waste reduction initiatives (Miroso et al., 2016).*

## 6. REFERENCES

- Agencija za zaštitu okoliša (2015). Izvješće o stanju okoliša Republike Hrvatske 2014., Zagreb, Agencija za zaštitu okoliša [available at: <http://www.azo.hr/Izvjesca29>, access May 5, 2017]
- Blondin, S., Djang, H., Metayer, N., Anzman-Frasca, S. & Economos, C. (2014). It's just so much waste. A qualitative investigation of food waste in a universal free school breakfast program, *Public Health Nutrition*, 18(9), p. 1565–1577.
- Bloom, J. (2011). *American Wasteland: How America Throws Away Nearly Half of It's Food (and What We Can Do About It)*, Boston, Da Capo Lifelong Books.
- Buzby, J.C., Wells, H.F. & Hyman, J. (2014). The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States [available at: [https://www.ers.usda.gov/webdocs/publications/eib121/43680\\_eib121.pdf](https://www.ers.usda.gov/webdocs/publications/eib121/43680_eib121.pdf) , access April 28, 2017]
- Charlebois, S., Creedy, A. & Massow, M. (2015). Back of house – focused study on food waste in the fine dining: the case of Delish restaurants, *International Journal of Culture, Tourism and Hospitality Research*, 9(3), p. 278–291.
- Christ, K.L. & Burritt, R. (2017). Material flow cost accounting for food waste in the restaurant industry, *British Food Journal*, 119(3), p. 600–612.
- Costello, C., Birisci, E. & McGarvey R. (2016). Food waste in campus dining operations: Inventory of pre-and post-consumer mass by food category, and estimation of embodied greenhouse gas emissions, *Renewable Agriculture and Food Systems*, 31(3), p. 191–201.
- FAO (2011). Global food losses and food waste – Extent, causes and prevention [available at: <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf>, access April 28, 2017]
- FAO (2016). Food Loss and Food Waste [available at: <http://www.fao.org/food-loss-and-food-waste/en/>, access April 28, 2017]
- Grandhi, B. & Singh, J.A. (2016). What a Waste! A Study of Food Wastage Behaviour in Singapore, *Journal of Food Products Marketing*, 22(4), p. 471–485.
- Gruber, V., Holweg, C. & Teller, C. (2016). What a Waste! Exploring the Human Reality of Food Waste from the Store Manager's Perspective, *Journal of Public Policy & Marketing*, 35(1), p. 3–25.
- Gustavson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R. & Meybeck, A. (2011) Global Food Losses and Food Waste: Extent Causes and Prevention, Food and

Agriculture Organization, Dusseldorf.

Hrvatska agencija za okoliš i prirodu (2015). *Katalog otpada*. Zagreb: Hrvatska agencija za okoliš i prirodu, 90/15, p. 1–27.

Jagau, H.L. & Vyrastekova, J. (2017). Behavioral approach to food waste: an experiment, *British Food Journal*, 119(4), p. 882–894.

Kalambura, S., Černi, S. & Jovičić, I. (2014). Važnost i obveze Republike Hrvatske u uspostavi mjera sprječavanja i smanjenja nastanka otpada od hrane, *Krmiva*, 56(3), p. 137–145.

Knežević, B., Marić, I. & Šućur, Z. (2017). Međusektorska suradnja u području distribucije hrane kao odgovor na probleme siromaštva i materijalne deprivacije, *Revija za socijalnu politiku*, 24 (2), p. 143–167.

Lanfranchi, M., Calabrò, G., De Pascale, A., Fazio, A. & Giannetto, C. (2016). Household food waste and eating behavior: empirical survey, *British Food Journal*, 118 (2), p. 3059–3072.

Lyndhurst (2007). Food behaviour consumer research—findings from the quantitative survey. Briefing Paper UK: WRAP

Maddyck, J. (2015). *Food Foolish: The Hidden Connection Between Food Waste, Hunger and Climate Change*, Carrier Corporation.

Mirosa, M., Munro, H. & Mangan-Walker, E. (2016). Reducing waste of food left on plates Interventions based on means-end chain analysis of customers in foodservice sector, *British Food Journal*, 118(9), p. 2326–2343.

Oden, C. (2009). *Avoiding food wastage in restaurants*. EUREST, Švedska.

Osner, R. (1982). *Food Wastage, Nutrition & Food Science*, 82(4), p. 13–16.

Parfitt, J., Barthel M. & Macnaughton S. (2010). Food waste within food supply chains: quantification and potential for change to 2050, *Philosophical Transactions of the Royal Society B*, Vol. 365, p. 3065–3081.

Principato, L., Secondi, L. & Pastes, C. (2015). Reducing food waste; an investigation on the behaviour of Italian youths, *British Food Journal*, 117(2), p. 731–748.

Royte, E. (2016). Ne bacaj, ne gladuj, *National Geographic Hrvatska*, March, p. 18–39.

Setti, M., Falasconi, L., Segrè, A., Cusano, I. & Vittuari, M. (2016). Italian consumers' income and food waste behaviour, *British Food Journal*, 18(7), p. 1731–1746.

Silvennoinen, K., Katajajuuri, J.-M., Hartikainen, H., Heikkilä, L. & Reinikainen, A. (2014). Food waste volume and composition in Finnish households, *British Food Journal*, 116(6), p. 1058–1068.

Sokolić, D. (2015). *Razumijevanje informacija na hrani i stav potrošača o bacanju hrane te nekoliko korisnih savjeta za potrošače*. Osijek: Hrvatska agencija za hranu.

Tristram, S. (2009). *Waste: Uncovering the Global Food Scandal*. New York: W. W. Norton and Company.

Turkalj, Z., Fosić, I., & Dujak, D. (2010). Motivational compensation - a factor in staff turnover in retail organizations, *Interdisciplinary Management Research*, 6, p. 264-274.

Voća, N. (2014). *Sprječavanje nastanka otpada od hrane prilikom obavljanja turističko-ugostiteljske djelatnosti*. Zagreb: Agencija za okoliš.

Wansik, B. & Cheek, K. (2015). Saving food in restaurants: Half-sized portions outperform persuasion on mitigating waste, *Journal of Nutrition Education and Behavior*, 47(4), p. 46.

The Sustainable Waste Management Act. Zagreb: NN 94/13