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Vegetables and fruit consumption profile: conscious choices or contributions to waste?

Perfil de consumo de hortaliças e frutas: escolhas conscientes ou contribuições ao desperdício?

Perfil de consumo de hortalizas y frutas: ¿elección consciente o contribución al despilfarro?

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Abstract

Consumption habits that give preference to aesthetic standards exclude "imperfect" food from the chain, contributing to its waste and generating social, economic, and environmental consequences. In Brazil, tons of food good for consumption are wasted every day. The aim was, therefore, to formulate a socio-economic profile to ascertain how habits affect food waste, by applying a quantitative online form. The target audience was consumers in the region of Ponta Grossa, Paraná. The data showed that individuals aged between 46 and 60 wasted less and that higher monthly income was significant for higher percentages of waste, with the participant's level of education inversely proportional. Agroecological food influenced more than 30% of consumers at the time of purchase. Discarding, on the other hand, was more expressive when dysfunctions were found in the colour, followed by the size, and little influenced by the shape of the food.
Keywords: Eating habits, horticulture, aesthetic standard.

Resumo

Hábitos de consumo que dão preferência a padrões estéticos, excluem da cadeia alimentos "imperfeitos", contribuindo para o seu desperdício e gerando consequências sociais, econômicas e ambientais. No Brasil, toneladas de alimentos próprios para o consumo são desperdiçados diariamente. Portanto, objetivou-se formular um perfil socioeconômico a fim de verificar como hábitos afetam o desperdício de alimentos, por intermédio de aplicação de formulário quantitativo *on-line*. Tendo os consumidores da região de Ponta Grossa, no Paraná como público-alvo. Os dados demonstraram que indivíduos com idades entre 46 e 60 anos de idade desperdiçam menos, a maior renda mensal se mostrou significativa a maiores porcentagens de desperdício, com o grau de instrução dos participantes sendo inversamente proporcional. Alimentos agroecológicos influenciaram mais de 30% dos consumidores na hora da compra. Já o descarte, se mostrou mais expressivo quando encontradas disfunções na cor, seguidos do tamanho e pouco influenciados pelo formato do alimento.
Palavras-chave: Hábito alimentar, horticultura, padrão estético.

Resumen

Los hábitos de consumo que favorecen los estándares estéticos excluyen los alimentos «imperfectos» de la cadena, contribuyendo a su desperdicio y generando consecuencias sociales, económicas y medioambientales. En Brasil, cada día se desperdician toneladas de alimentos aptos para el consumo. Por lo tanto, el objetivo era formular un perfil socioeconómico para determinar cómo afectan los hábitos al desperdicio de alimentos, aplicando un formulario cuantitativo en línea. El público objetivo fueron los consumidores de la región de Ponta Grossa, en Paraná. Los datos mostraron que los individuos con edades comprendidas entre los 46 y los 60 años desperdiciaban menos, una renta mensual más alta era significativa para porcentajes más altos de desperdicio, y el nivel de educación de los participantes era inversamente proporcional. Los alimentos agroecológicos influyeron en más del 30% de los consumidores a la hora de comprarlos. El descarte, por su parte, era más significativo cuando se encontraban defectos de color, seguido del tamaño y poco influido por la forma del alimento.
Palabras-clave: Hábitos alimentarios, horticultura, estándar estético.

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INTRODUCTION

In the context of economic development and urbanization, it is estimated that there will be food shortages to meet the needs of a growing population by the year 2050, further perpetuated by climate change, according to the Food and Agriculture Organization of the United Nations (FAO, 2011). In the world, 783 million people are already experiencing severe food insecurity, characterized by a state of hunger (FAO, 2023), where one in ten people is considered undernourished (FAO, 2021).

It is known that 1/3 of the food produced is lost and wasted along the production chain (FAO, 2013). Of this, 61% comes from households, 26% comes from food services, such as restaurants and shopping malls, and 13% from the retail sector. These values suggest that action on food waste is equally relevant in high, upper-middle, and lower-middle-income countries, according to the United Nations Environment Program (PNUMA, 2021).

The terms loss and waste, although used synonymously, have different definitions. Food loss refers to a reduction in the volume or nutritional value of food, while food waste is the rejection of food fit for consumption at the end of the production chain (FAO, 2013). Losses are mainly caused by climatic conditions and inefficiencies in supply chains, such as failures in infrastructure, logistics, and management. Waste, on the other hand, is the consequence of oversupply or consumption habits (FAO, 2013).

The later food is lost in the production chain, the higher its economic, social, and environmental impacts (FAO, 2013). This waste is exacerbated when food ends up being selected according to its physical standard. The consumer market has a habit of buying food aesthetically, rejecting food that is considered “imperfect” in terms of color, shape, and size, often labeled as unsuitable, even though it is nutritionally equivalent to the rest.

Therefore, identifying the causes of food waste is fundamental to determining actions and strategies to reduce it, as exemplified by the High-Level Panel of Experts on Food Security and Nutrition (HLPE, 2014). However, few countries have reliable and regular

information on food loss and waste (FLW), which could help formulate public policies aimed at mitigating it.

Consequences such as market inefficiencies, social inequalities, and environmental liabilities, generally threaten the sustainability of life on the planet (Cantaragiu, 2019). Around 8-10% of global greenhouse gas (GHG) emissions are associated with food production and food waste that is neither consumed nor used (Smith *et al.,* 2020). This scenario inevitably means that a large amount of resources used in the production of this food, such as the use of soil, water, and inputs, are wasted.

In Brazil, between 30 and 35% of agricultural production is lost or wasted along the production chain, according to research carried out by the Institute for Applied Economic Research (Carvalho, 2009). As a result, the country ranks 10th among the countries that waste the most and among the ten with the highest number of undernourished people (FAO, 2015).

In 2022, there were 33.1 million people in Brazil without guarantees of what to eat, with 14 million Brazilians in a situation of extreme hunger (Rede PENSSAN, 2021). On the other hand, it is estimated that a Brazilian family spends around US$ 300.00 a month on food and that approximately US$ 100.00 goes to waste (Rodrigues, 2018).

Concerning losses, 54% of them occur in production and post-harvest handling (FAO, 2013). In Brazil, these figures exceed 50% throughout the production chain (Gustavsson *et al.,* 2016). The time between harvesting fruit and vegetables and receiving them in the packing and storage sheds is often excessive, contributing to this outlook (Kader, 2005).

In storage, losses reach 46% (FAO, 2013). In general, this is due to failures in refrigeration systems, which play a fundamental role as one of the most important factors in extending the shelf life of food. Inadequate temperatures and mixing foods, such as tropical fruits stored together with temperate fruits, act as precursors to food losses at this stage (Zaro, 2018). In addition, the lack of infrastructure, combined with

scarce resources during the transportation and storage process, contributes to a large proportion of food not reaching its destination fit for consumption (HLPE, 2014).

Transportation is the main cause of mechanical damage to fruit and vegetable products and the intensity is proportional to the distance traveled, the quality of the roads, the speed used, the packaging used, and the product being transported (Kummu *et al.,* 2012). Transport costs and inherent GHG emissions must also be considered, in line with the distances between the production center and the distribution center.

Thus, the quality of fruit and vegetables received by retail chains is directly related to post-harvest losses (Freire; Soares, 2014). In addition, according to the 24th Evaluation of Losses in Brazilian Supermarket Retailing carried out by the Brazilian Supermarket Association, in 2024 Brazilian supermarkets alone discarded 5.83% of fruit, vegetables, and legumes (FVL) due to operational inefficiencies, with 88% coming from known losses and 12% from unknown losses (Abras, 2024).

As a result, consumers often discard the food after purchase because it does not meet their specific quality requirements, playing a fundamental role in terms of waste. Studies report that consumers associate abnormal shapes and aesthetic damage to food with poor quality (Bunn *et al.,* 1990; Loebnitz *et al.,* 2015). Retailers then assume that consumers are unwilling to buy products that deviate from a standard physical appearance in color, shape, and size (Helmert *et al.,* 2017).

These foods considered abnormal fall into one of the main criteria used for food selection (Loebnitz et al, 2015; Hooge *et al.,* 2017). They fit into the category of suboptimal, *i.e.* those that deviate from normal products, without deviations in intrinsic quality or safety (Halloran *et al.,* 2014; Teunissen, 2017).

Products that are selected and classified are better accepted by consumers than products with an “imperfect” physical appearance. Therefore, informing people about the economic, social, and environmental implications of food waste resulting from their choices can alter perceptions and attitudes, generating behavioral changes (FAO, 2016).

Some initiatives aim to raise awareness of the issue. One example is the Food Banks, such as Mesa Brasil Sesc, which aims to use food that is still fit for consumption (Belik; Silva; Takagi, 2001), acting as a national distribution network for social institutions that serve people in vulnerable situations, against hunger and waste (Sesc, 2024).

Contrary to the action cited, it is known that the current model for disposing of food waste is not based on economically sustainable practices (Roy *et al.,* 2023). According to the United Nations (UN, 2021), food losses and waste cost the world economy around 1 trillion dollars. In addition to the economic loss, it is estimated that the damage generated by food waste is in the order of US$ 900 billion in the social dimension and US$700 billion from an environmental point of view (FAO, 2013).

For a long time, hunger was linked to food shortages, but this is no longer true. The world produces enough food to sustain societies, but poor distribution, waste, and, above all, social inequality are variables that still directly affect hunger in the world (Prim, 2003).

However, reducing the amount of food wasted by consumers in developed countries does not necessarily mean that there will be more food available for poor families in distant countries (FAO, 2020). Poverty still deprives a large part of the world's population of access to food, leading to consequences such as poor physical, psychological, and social development (Rosaneli *et al.,* 2015).

With food and nutrition insecurity being one of the latent problems in most countries, which fail to guarantee the supply of and access to food in the present without compromising future production capacity (Maluf, 2007). To achieve food security, four conditions must be met simultaneously: the physical availability of food; physical and economic access to food; food utilization, and food stability (Webb *et al.,* 2006; FAO, 2008; Barrett, 2010).

This complex scenario becomes especially risky when related to the scarcity of resources, such as water and access to energy, which are considered essential for the

well-being of human societies and important for reducing socio-economic inequalities and achieving sustainable development (Flammini *et al.,* 2014; Simpson; Jewitt, 2019).

Also, Article 6 of the 1988 Brazilian Constitution states that food is a fundamental right, essential, and inseparable from other basic rights (Rodrigues, 2007). Complemented by the legislation that deals with food security in Brazil, with Law No.11.346 of September 15th, 2006 (Brasil, 2006). And more recently by Law No.14,016, June 23th, 2020, which allows the donation of surplus food *in natura*, industrialized, and processed foods, which are within the expiration date, and which are not compromised to sanitary safety (Brasil, 2020).

On the other hand, while waiting for operational legislation, development programs are being carried out by society itself in cooperation with international and/or religious organizations and some private initiatives to mitigate the problem. One example is the Save Food Brasil program, which has the support of the FAO, the World Resource Institute (WRI), and the Brazilian Agricultural Research Corporation (Embrapa), and which seeks ways to raise public awareness about waste, with engagement between society, farmers and governments (Cruz, 2016).

Given the above, this work focused on contributing to public policies regarding Sustainable Development Goal (SDG) 2: Zero Hunger, which aims to halve food waste, guarantee access to food for all inhabitants by 2030, and encourage sustainable agriculture (UN, 2015). This study aimed to establish a relationship between the habit of buying and consuming fruit and vegetables and how preferences affect food waste. Based on the available literature on the subject, we sought to understand and correlate the main causes and possible consequences of this practice.

METHODOLOGY

The study's theoretical basis was formulated using a literature review as an exploratory and descriptive methodology, relying on data or theoretical categories already worked on by other researchers and properly recorded (Severino, 2007). It is based on online

research platforms such as Web of Science, Google Scholar, and the Capes Journal Portal.

After the literature review, a semi-structured survey questionnaire with a quantitative approach was applied. The questionnaire consisted of 30 questions, organized into two parts: (1) socio-economic profile, comprising 8 questions; and (2) consumption profile, containing 22 questions.

To avoid social bias and a lack of representativeness in the sample, anonymity and confidentiality of answers were guaranteed, allowing participants to respond more sincerely. The questions were formulated in a neutral way to avoid inducements and biased responses, including a variety of formats, such as open-ended questions, to reduce distorted responses.

For validation and adjustments, a test application was carried out. This involved the participation of four individuals selected from contrasting age groups and levels of formal education. The questionnaire was made available on the Google Forms® digital platform, with consumers in the Ponta Grossa region of Paraná as the target audience. The decision to take data from a specific region was made due to the occurrence of the Covid-19 pandemic.

The city of Ponta Grossa had a school enrollment rate between the ages of 6 and 14, exceeding 98% in 2010. Its GDP (Gross Domestic Product) reached R$ 54,316.58 in 2021, according to the census of the Brazilian Institute of Geography and Statistics, with a Municipal Human Development Index (MHDI) of 0.763 (IBGE, 2010, 2021).

The questionnaire was shared via WhatsApp® groups, social networks, e-mails, and the author's contacts. Available from August 25th, 2021, until September 1st, 2021.

The information collected was systematized and analyzed descriptively, summarizing the objective answers. For subjective questions, the response patterns were analyzed and weighed. Systematization and calculations were carried out using Excel® software.

RESULTS AND DISCUSSION

Eating habits are influenced by various factors, including demographic, economic, social, epidemiological, and nutritional factors (Radaelli, 2003). They are associated with aspects such as age, purchasing power, level of education, and the health of a population (Sampaio, 2002).

Considering the geographical delimitation limited to the region of Ponta Grossa (PR), 380 valid responses were obtained. According to the survey questionnaire, there was greater participation from people aged between 18 and 30 (54.5%), followed by people aged between 31 and 45 (28.2%). The lowest turnout, however, was among people under the age of 18, corresponding to 1.3% of all respondents.

According to the responses of people aged between 46 and 60, they reported wasting less, approximately 10% of what they buy in fruit and vegetables compared to people aged between 18 and 45, who assume they waste 30% of the total they buy.

These results corroborate with Baptista's *et al.* (2012) studies, which show that there is a negative correlation between age and waste. This association is interpreted as the result of better eating habits, contrary to the modern dietary pattern, known for its high levels of fat, salt, sugar, and ultra-processed foods (Jaime *et al.,* 2003).

In terms of gender, women made up 68.7% of the survey, with a total of 261 individuals, accompanied by 31.3% of men, with options for different genders on the form, but with no results for this classification.

The association between food consumption and gender has been observed in several studies, where women are less likely to waste food compared to men (Barr 2007; Secondi, Principato, Laureti, 2015; Visschers *et al.,* 2016). When it comes to attitudes towards food acquisition, preparation, consumption, and disposal, gender appears to be a significant factor, mainly due to gender segregation and divisions of household responsibilities (Cantaragiu, 2019).

In terms of family income, the group with the highest number of interviewees had a monthly income of more than R$5,000.00 (37.1%), being the group that reported the highest participation in fruit and vegetable waste, exceeding 50%. The majority of people earning up to R$1,500.00 a month reported wasting around 10% of the food they buy. It has been observed that the higher the family budget spent on food, the greater the waste (Parizeau *et al.,* 2015).

Monthly income may also be correlated with the participant's level of education. More than 50% had higher education (complete or incomplete), and 34.1% were postgraduates, such as Master's (8.9%), Doctorate (6.3%), and Specialization (18.9%).

The majority of participants declared that they were students as their main occupation, accounting for 37.4% of the total, followed by civil servants (24.2%), those working in private companies (16.1%), the self-employed (15%), retired and unemployed accounted for 3.7%.

The results showed that individuals with a higher level of education end up wasting less, around 20% of the total amount of fruit and vegetables they buy, compared to individuals with a high school education, who claim to waste up to 30% of the total amount of food they buy.

Education is a factor that directly influences food waste, where individuals with higher levels of education have lower tendencies to waste (Mattar *et al.,* 2018). However, individuals with higher education (complete or incomplete) had the highest rates, reaching over 50% waste of the total food they buy.

The composition of households, such as the number of people living together, is also important when it comes to the amount of food that is bought and consumed, along with the standard of living and lifestyle.

The survey found that more than 37% of participants live in households with up to three people and a minority of 8.10% live alone.

These values portray a new arrangement, where independence, much sought after in the past decade, is taking on a new configuration and where it is becoming more common for people to live in arrangements with more people.

The second part of the questionnaire, called the consumption profile, aimed to trace the behavior of the participants about their eating habits and preferences, to provide important information, and to open up space for suggestions and questions about waste.

According to the questionnaire, the majority of participants (95.8%) consume both animal and plant-based foods. Vegetarians and vegans accounted for less than 5%. The frequency of daily fruit and vegetable consumption, *i.e.* people who eat fruit and vegetables every day, reached 45.3%.

This frequency of fruit and vegetable consumption increases according to the level of education of consumers, which is reaffirmed by studies that show that individuals with a higher level of education consume more fruit and vegetables daily (Hallyday, 1990; Lima *et al.*, 2003). Only 0.8% of the survey participants classify themselves as non-consumers of fruit and vegetables.

The purchase of fruit and vegetables has a direct correlation with the frequency with which the participants eat at home. In the questionnaire, more than 70% said they ate at home every day of the week. People who eat out most days of the week, such as in restaurants, fast food, at universities, or at work, amounted to 4.5%.

In households, there may be greater control over what is used in meals and how food is disposed of, but unfortunately, this does not suggest lower levels of waste. Buying and preparing surplus food is the main cause of food waste in households.

In restaurants, consumers are often unaware of the destination of food that has not been consumed, and well as not having access to the preparation environment. This leads to a lack of empathy or interest in the food that will be discarded. On the other hand, restaurants can use financial strategies to reduce waste by charging extra fees to consumers who leave a lot of “leftovers” on their plates.

As a means of purchasing fruit and vegetables, general markets (supermarkets, wholesalers, and grocery stores) were the main means of acquisition, accounting for 90% of individuals (**Table 1**). It was also mentioned private and community gardens, food grown by the family, either at home or on rural properties, or purchases made directly by the producer, which together accounted for 10% of the total.

Table 1. Main places where consumers buy fruit and vegetables in Ponta Grossa – PR

Main purchasing locations	Relative number of individuals (%)	Number of individuals
General markets*	90.0	342
Fruit shop or Greengrocer	26.3	100
Producer's market	23.7	90
Home-delivered baskets	6.3	24

Source: Authors, 2021. **Note:** *(supermarkets, wholesalers and grocery stores)

As Table 1 shows, the widespread consumption of fruit and vegetables from chain markets is linked to the ease of access, greater convenience, quantity, and variety offered all year round. Also, the availability of minimally processed foods, in this case, foods that have already been peeled, cut, and packaged in smaller portions, are some of the factors reported by consumers.

This proximity and frequency of shopping in markets reduce the purchase of food considered "imperfect". Food that doesn't meet the standards set by retailers is discarded at the farm and doesn't reach the final stages of separation and selection. These undervalued foods are related to aesthetic requirements that are too restrictive on the part of consumers, which causes them to reject foods that are fit for consumption (Aschemann *et al.,* 2015; Schanes; Dobernig; Gözet, 2018).

The preference for acquiring food via general markets also causes distancing between those who produce and those who consume, making food procurement impersonal, implying less awareness when it comes to disposing of food (Parfitt *et al.,* 2010). In this context, more than 50% of the participants said they didn't care about knowing the farmer who produced their food. Only 10.5% of participants showed an interest in getting to know the farmhand.

This suggests that one of the reasons for food waste is a possible lack of appreciation of the importance of food, knowledge of its origin, and a lack of social and emotional connection with it.

There are also some pricing and merchandising strategies adopted by supermarkets to encourage consumers to buy larger packages or opt for "buy one, take other one for free" promotions (Porpino, 2016). Encouraging impulse buying, excesses, and consequent discarding. Studies carried out in the UK and Romania have shown that the practice of a shopping list has a positive association with a reduction in food waste (Quested, 2011).

In this study, the price of food, reported by 78.9% of the interviewees, was the main factor considered when making a purchase (**Table 2**). Strategies are shaped by consumer culture or end up being shaped by it.

Table 2. Attributes that interfere in the purchasing decision of consumers in Ponta Grossa - PR

Attributes that affect the purchasing decision	Relative number of individuals (%)	Number of individuals
Food price	78.9	300
Food color	66.3	252
Food size	56.1	213
Food format	40.5	154
Organic/ agroecological food	31.1	118
Hydroponic food	6,1	31
Conventional food	4,5%	17

Source: Authors, 2021.

Therefore, understanding the costs of food waste could encourage changes in consumer behavior regarding waste (Quested *et al.,* 2013; Graham *et al.,* 2014; Thyberg; Tonjes, 2016). Factors such as the color (66.3%), size (56.1%), and shape (40.5%) of the food were also considered important at the time of purchase.

The importance given to color, size, and shape when buying fruit and vegetables validates the first non-nutritional classification already carried out on the farm. When asked about the relationship between appearance and discarding food, the majority of

people said that shape was not the main reason for rejection. Color dysfunctions, on the other hand, proved to be more considerable, with up to 50% of the food being wasted.

There was also a lot of rejection when it came to size. They can be too big or too small, depending on consumer preferences. However, when consumers buy what they consider to be the standard size, they report less waste.

When asked if they would be interested in buying fruit and vegetables in smaller or larger sizes than the standard, but at lower prices, 44.2% said "yes", while 7.1% of individuals would not be interested in buying these foods. With the justification that these products don't offer all the necessary nutrients (57.9%) or because the product is ugly and/or non-standard (45.6%). These allegations infer that non-standard food is unsafe, which is the most common reason for discarding food that is fit for consumption (Neff *et al.,* 2015).

Organic/agroecological foods influence more than 30% of consumers at the time of purchase, which precedes the percentage of 98.7% of individuals who are aware of what organic or agroecological foods are, with 75.8% of participants who have already consumed or eventually consume these foods. 24.2% of participants who do not consume organic/agroecological food claimed price (42.6%) as the main factor.

Non-purchase of this type of food was also reported due to indifference to the product being organic/agroecological (32.6%), difficulty of access (13.2%), or distrust of the certification/quality of the product (11.6%) (**Table 3**).

Table 3. Attributes that interfere with the purchase of organic/ agroecological food in Ponta Grossa – PR

Attributes that interfere with the purchase of organic/agroecological food	Relative number of individuals (%)	Number of individuals
Price	42.6	55
Indifference of being organic/agroecological	32.6	42
Difficulty in finding organic/agroecological food	13.2	17
Attested food quality	11.6	15

Source: Authors, 2021.

When buying fruit and vegetables, 54.6% of consumers prefer to buy whole food, either because of the better price, check the quality at the time of purchase, to reduce the use of plastic packaging (*e.g.* Styrofoam and Plastic film), less handling or for hygiene reasons. Only 0.5% prefer to buy minimally processed, frozen, cut, and/or peeled food. Their main arguments are practicality, durability, easier processes, knowledge of origin, product appearance, and the possibility of buying smaller foods, such as halved fruit and vegetables.

However, there is a lot of debate about the real need to sell food, mostly fruit and vegetables, previously peeled, cut, and sold in plastic packaging. The problem is not only the waste of edible parts but also the increased generation of plastic waste. However, another way of thinking is centered on the practicality that these products offer, for example, to people with motor disabilities and the elderly.

The habit of consuming processed foods suggests that a large part of the food is discarded, such as peels, stalks, and leaves, so that the food is not fully utilized. In Portugal, the Project and Study of Reflection on Food Waste (Perda), concluded that around 17% of the edible parts of food are lost or wasted in food processing (Batista *et al.,* 2012).

Waste itself does not only occur with the purchase of processed food since 27% of the participants do not use food fully, 33.4% think that this use depends on either the processes or the food in question and 26.3% reported that they use fruit and vegetables fully (**Table 4**).

Table 4. Percentage of fruit and vegetables that respondents admit to wasting in Ponta Grossa - PR

Percentage of food wasted (%)	Relative number of individuals (%)	Number of individuals
10	24.2	92
20	26.3	100
30	30.5	116
50	12.1	46
>50	6.8	26

Source: Authors, 2021.

According to Table 4, more than 80% of respondents admit to discarding up to 30% of the fruit and vegetables they buy. In addition, approximately 12% of consumers admit to discarding up to 50% of these foods. Meanwhile, 6.8% of respondents throw away more than 50% of everything they buy in terms of vegetables.

In addition, the way food is disposed of has a direct influence on the sustainability of the production chain. It is very striking, perhaps because of the purchasing power and level of education of those interviewed, that 50% dispose of their food in organic waste, and only 13% use ordinary waste.

Along the same lines, as a highly positive aspect, more than 50% of those interviewed dispose of their food in organic waste, with 43.9% disposing of food in their backyard as a simple, homemade means of composting. However, there are no public policies on the selective collection of organic waste in Ponta Grossa and the region.

Most of the domestic solid waste (DSW) generated and sent to landfills in the municipality of Ponta Grossa corresponds to 42% organic matter, which is lower than the national average of 51% (Brasil, 2011) and 48% in Curitiba (State capital) (Melo *et al.,* 2009). This figure indicates a waste of raw materials and energy due to their non-reuse (Gomes *et al.,* 2017). Even with the increase in recycling and composting rates, DSW is still considered a major environmental liability.

The other 27% of waste constitutes rejections, which are the only materials that should be sent to landfill, as they have no viable and/or known alternative other than final disposal (Brasil, 2011). This relative amount of waste produced in the municipality of Ponta Grossa is high compared to the national average, which, according to the Ministry of the Environment (MMA), is 17% (Brasil, 2011).

During the questionnaire, the participants also reported the reuse of this food. They cited uses in animal feed, making cakes and desserts, preparing soups and broths, jams and preserves (10.3%), and also freezing (5.8%) surpluses. Concerning the reasons for discarding, 62.1% of individuals believe that they discard 10% of all fruit and vegetables due to spoilage.

The way food is chosen, prepared, and disposed of has a direct impact on hunger statistics in Brazil. When asked whether or not they contribute to this scenario, 72.4% of the participants said that they do contribute to food waste and 27.6% said that they "do not" contribute to this statistic.

Asked how they could individually contribute to improving the situation, many of the participants mentioned that planned shopping, buying only what is necessary, consuming consciously, choosing "imperfect" fruit and vegetables in shape, color, and size, making the most of every part of the food, storing and disposing of it correctly, freezing, reusing and donating food that is still fit for consumption could be some of the alternatives.

Some of the statements collected may be linked to social bias, which tends to compromise the accuracy of the results by influencing participant's responses to avoid judgment and conform to social norms. This results in socially desirable responses, where individuals report more ethical, sustainable, or engaged behavior than they really practice. To reduce this problem, we ensured the anonymity of responses by using neutral questions and cross-checking data with other sources to validate the results obtained.

The use of the term "setting an example" was also mentioned in some contributions, as a way of highlighting that the following generations need good examples and current, accessible, and impactful information that will positively influence their future consumption habits.

Some participants also reported not knowing how to minimize their waste, and some individuals had never thought about it. In these claims, there is a risk of underestimating or overestimating certain practices, due to the fear of admitting to actions considered negative. Therefore, concern and recognition of food waste are significant factors that play an important role in reducing it (Principato, 2015).

CONCLUSIONS

For the geographical region evaluated, sociodemographic variables such as age, level of education, and monthly income of individuals were shown to be related to food waste. Individuals aged between 46 and 60 showed that they waste less than people aged between 18 and 45. The higher monthly income was also responsible for the higher waste rates. In addition, the participant's level of education was inversely proportional to fruit and vegetable waste.

The classification of food as organic/agroecological influences more than 30% of consumers at the time of purchase, which precedes the percentage of 98.7% of individuals who are aware of what these foods are. Where 75.8% of the participants have already consumed or eventually consumed these foods, demonstrating a highly positive impact on encouraging sustainable production and promoting biodiversity.

The means of disposal or reuse of food reached values of more than 50% for disposal of organic waste and 43.9% who dispose of food in the backyard as a form of composting. Disposal in ordinary waste reached 13.4% and a lower percentage of only 6.6% of people who use portable compost garbage cans.

In addition, the individual participation in best practices for buying, consuming, storing, preparing, and disposing of food reported by the participants, showed a certain awareness on the part of individuals of their real contributions to the scenario of food insecurity and food waste in Brazil. However, there were still reports of individuals who had no interest or knowledge of how to personally contribute to improving this scenario.

It should be noted that the research faced some limitations, such as selection bias and dependence on the author's initial contacts, which compromised the diversity of the sample. Data validation was a challenge since the indications were based on personal relationships, making it difficult to verify the authenticity of the information collected.

To this end, this study can contribute to raising awareness about food waste by highlighting the influence of consumption habits on the rejection of food with aesthetic imperfections. In addition, the data will provide support for educational campaigns and

strategies to encourage more conscious consumption and may strengthen the appreciation of foods outside the conventional standard in promoting more responsible practices from a social, economic, and environmental point of view.

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REFERENCES

ABRAS – Associação Brasileira de Supermercados. **Pesquisa de Eficiência Operacional. [s.l.]:**ABRAS, 2024. Disponível em: https://www.abras.com.br/economia-e-pesquisa/pesquisa-de-eficiencia-operacional/pesquisa-2024. Acesso em: 13 fev. 2025.

ASCHEMANN-WITZEL, Jessica *et al.* Consumer-Related Food Waste: causes and potential for action. **Sustainability**, v. 7, n. 6, p. 6457-6477, 2015. http://dx.doi.org/10.3390/su7066457.

BAPTISTA, Pedro *et al.* **Do Campo ao Garfo:** Desperdício Alimentar em Portugal. Lisboa: CESTRAS. 2012.

BARR, Stewart. Factors Influencing Environmental Attitudes and Behaviors. **Environment And Behavior**, v. 39, n. 4, p. 435-473, 2007. http://dx.doi.org/10.1177/0013916505283421.

BARRETT, Christopher B. Measuring Food Insecurity. **Science**, v. 327, n. 5967, p. 825-828, 2010.. http://dx.doi.org/10.1126/science.1182768.

BELIK, Walter; SILVA, José Graziano da; TAKAGI, Maya. Políticas de combate à fome no Brasil. **São Paulo em Perspectiva**, v. 15, n. 4, p. 119-129, dez. 2001. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s0102-88392001000400013.

BRASIL. **Lei nº 14.016, de 23 de junho de 2020**. Dispõe sobre o combate ao desperdício de alimentos e a doação de excedentes de alimentos para o consumo humano. Diário Oficial da União, 2020.

_____. MMA – Ministério do Meio Ambiente. **Plano Nacional de Resíduos Sólidos: versão preliminar para consulta pública.** Brasília, 2011.

_____. **Lei no 11.346, de 15 de setembro de 2006**. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. Diário Oficial da União, 2006.

BUNN, David *et al.* Consumer Acceptance of Cosmetically Imperfect Produce. **Journal Of Consumer Affairs**, v. 24, n. 2, p. 268-279, dez. 1990. Wiley. http://dx.doi.org/10.1111/j.1745-6606.1990.tb00269.x.

CANTARAGIU, Ramona. The Impact of Gender on Food Waste at the Consumer Level. **Studia Universitatis, Vasile Goldis" Arad – Economics Series**, v. 29, n. 4, p. 41-57, 8 nov. 2019. Walter de Gruyter GmbH. http://dx.doi.org/10.2478/sues-2019-0017.

CARVALHO, Débora. Fome e desperdício de alimentos. **Desafios do desenvolvimento,** ano 6, v. 54, p. 48-53, 2009. Disponível em: http://www.ipea.gov.br/desafios/images/stories/PDFs/desafios054_completa.pdf. Acesso em: 11 set. 2021.

CRUZ, Patrícia Elaine. Brasil desperdiça 41 mil toneladas de alimento por ano. **Agência Brasil**, São Paulo, 30/06/2016. Disponível em: https://agenciabrasil.ebc.com.br/economia/noticia/2016-06/brasil-desperdica-40-mil-toneladas-de-alimento-por-dia-diz-entidade. Acesso em: 20 maio. 2023.

FAO. **The State of Food Security and Nutrition in the World 2023:** Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. Rome: FAO, 2023.

_____. **The State of Food Security and Nutrition in the World 2021.** Rome: FAO. 2021.

_____. **O desperdício alimentar tem consequências ao nível do clima, da água, da terra e da bidiversidade:** novo estudo da FAO. Rome: FAO. 2020. Disponível em: http://www.fao.org/news/story/pt/item/204029/icode/. Acesso em: 28 de ago. 2021.

_____. **Pérdidas alimentos y desperdicios de alimentos en América Latina y El Caribe**. Rome: FAO. 2016.

_____. **Food wastage footprint & climate change**. Rome: FAO. 2015.

_____. **Food Wastage Footprint Impacts on natural resources**. Summary Report. Rome: FAO. 2013. Disponível em: http://www.fao.org. Acesso em: 15 ago. 2021.

_____. **Global food losses and food waste –Extent, causes and prevention**. Rome: FAO; 2011.

_____. **An Introduction to the Basic Concepts of Food Security**. Rome: FAO. 2008. Disponível em: http://www.fao.org/docrep/013/al936e/al936e00.pdf. Acesso em: 27 jul. 2021.

FLAMMINI, Alessandro *et al*. Walking the nexus talk: assessing the water-energy-food nexus in the context of the sustainable energy for all initiative. **Environment and Natural Resources Management.** Working Paper (FAO) eng no. 58. Rome: FAO. 2014.2014.

FREIRE JUNIOR, Murilo.; SOARES, Antônio. Gomes. **Orientações quanto ao manuseio pré e pós-colheita de frutas e hortaliças visando à redução de suas perdas** – comunicado técnico. Rio de Janeiro: Embrapa Agroindústria de Alimentos. 2014.

GOMES, Simone *et al.* Potencial energético de resíduos sólidos domiciliares do município de Ponta Grossa, Paraná, Brasil. **Engenharia Sanitária e Ambiental**, v. 22, n. 6, p. 1197-1202, 2017. http://dx.doi.org/10.1590/s1413-41522017143432.

GRAHAM-ROWE, Ella; JESSOP, Donna C.; SPARKS, Paul. Identifying motivations and barriers to minimising household food waste. **Resources, Conservation And Recycling**, v. 84, p. 15-23, 2014. http://dx.doi.org/10.1016/j.resconrec.2013.12.005.

GUSTAVSSON, Jenny *et al*. **Global food losses and food waste:** Extent, causes and prevention. Rome: FAO, p. 17-21, 2016.

HALLIDAY, Anne. The Dietary and Nutritional Survey of British Adults. **Nutrition Bulletin**, v. 15, n. 3, p. 150-153, 1990. http://dx.doi.org/10.1111/j.1467-3010.1990.tb00084.x.

HALLORAN, Afton *et al.* Addressing food waste reduction in Denmark. **Food Policy**, v. 49, p. 294-301, 2014. Elsevier BV. http://dx.doi.org/10.1016/j.foodpol.2014.09.005.

HELMERT, Jens R. *et al*. Have an eye on the buckled cucumber: an eye tracking study on visually suboptimal foods. **Food Quality And Preference**, v. 60, p. 40-47, set. 2017. http://dx.doi.org/10.1016/j.foodqual.2017.03.009.

HLPE, HIGH LEVEL PANEL OF EXPERTS ON FOOD SECURITY AND NUTRITION. **Food losses and waste in the context of sustainable food systems**. Rome: FAO. 2014.

HOOGE, Ilona E. de *et al*. This apple is too ugly for me! **Food Quality And Preference**, v. 56, p. 80-92, 2017. http://dx.doi.org/10.1016/j.foodqual.2016.09.012.

IBGE. **Ponta Grossa**. IBGE – Cidades [página de internet]. Rio de Janeiro: IBGE. Disponível em: https://cidades.ibge.gov.br/brasil/pr/ponta-grossa/panorama. Acesso em: 10 jan. 2024.

JAIME, Patrícia Constante; MONTEIRO, Carlos Augusto. Fruit and vegetable intake by Brazilian adults, 2003. **Cadernos de Saúde Pública**, v. 21, n. 1, p. 19-24, 2005. http://dx.doi.org/10.1590/s0102-311x2005000700003.

KADER, Adel. Increasing food availability by reducing postharvest losses of fresh produce. **Acta Horticulturae**, n. 682, p. 2169-2176, 2005. http://dx.doi.org/10.17660/actahortic.2005.682.296.

KUMMU, Mattia *et al*. Lost food, wasted resources: global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. **Science Of The Total Environment**, v. 438, p. 477-489, 2012. http://dx.doi.org/10.1016/j.scitotenv.2012.08.092.

LIMA, Eronides da Silva; OLIVEIRA, Celina Szuchmacher; GOMES, Maria do Carmo Rebello. Educação nutricional: da ignorância alimentar à representação social na pós-graduação do rio de janeiro (1980-98). **História, Ciências, Saúde-Manguinhos**, v. 10, n. 2, p. 602-635, 2003. http://dx.doi.org/10.1590/s0104-59702003000200006.

LOEBNITZ, Natascha; SCHUITEMA, Geertje; GRUNERT, Klaus G. Who Buys Oddly Shaped Food and Why? Impacts of Food Shape Abnormality and Organic Labeling on Purchase Intentions. **Psychology & Marketing**, v. 32, n. 4, p. 408-421, 2015. http://dx.doi.org/10.1002/mar.20788.

MALUF, Renato S. **Segurança alimentar e desenvolvimento econômico na América Latina:** o caso do Brasil. Petrópolis: Vozes. 2007.

MATTAR, Lama *et al*. Attitudes and behaviors shaping household food waste generation: lessons from lebanon. **Journal Of Cleaner Production**, v. 198, p. 1219-1223, 2018. http://dx.doi.org/10.1016/j.jclepro.2018.07.085.

MELO, Lucas A.; SAUTTER, Klaus D.; JANISSEK, Paulo Roberto. Estudo de cenários para o gerenciamento dos resíduos sólidos urbanos de Curitiba. **Engenharia Sanitaria e Ambiental**, v. 14, n. 4, p. 551-558, 2009. http://dx.doi.org/10.1590/s1413-41522009000400015.

NEFF, Roni A.; SPIKER, Marie L.; TRUANT, Patricia L. Wasted Food: u.s. consumers' reported awareness, attitudes, and behaviors. **Plos One**, v. 10, n. 6, p. 0127881, 2015. http://dx.doi.org/10.1371/journal.pone.0127881.

PARFITT, Julian; BARTHEL, Mark; MACNAUGHTON, Sarah. Food waste within food supply chains: quantification and potential for change to 2050. **Philosophical Transactions Of The Royal Society B**: Biological Sciences, v. 365, n. 1554, p. 3065-3081, 2010. http://dx.doi.org/10.1098/rstb.2010.0126.

PARIZEAU, Kate; VON MASSOW, Mike; MARTIN, Ralph. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. **Waste Management**, v. 35, p. 207-217, 2015. http://dx.doi.org/10.1016/j.wasman.2014.09.019.

PNUMA - Programa das Nações Unidas para o Ambiente (UN Environment Programme). **Relatório do Índice de Desperdício Alimentar, 2021**. Nairobi: UNEP. 2021.

PORPINO, Gustavo. Household Food Waste Behavior: avenues for future research. **Journal Of The Association For Consumer Research**, v. 1, n. 1, p. 41-51, 2016. http://dx.doi.org/10.1086/684528.

PRIM, Maria. **Análise do Desperdício de partes vegetais consumíveis**. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal de Santa Catarina, Florianópolis, 2003. Disponível em: http://repositorio.ufsc.br/xmlui/handle/123456789/86591. Acesso em: 22 mar. 2021.

PRINCIPATO, Ludovica; SECONDI, Luca; PRATESI, Carlo Alberto. Reducing food waste: an investigation on the behaviour of italian youths. **British Food Journal**, v. 117, n. 2, p. 731-748, 2015. http://dx.doi.org/10.1108/bfj-10-2013-0314.

QUESTED, Tom E. *et al.* Spaghetti soup: the complex world of food waste behaviours. **Resources, Conservation And Recycling**, v. 79, p. 43-51, 2013. http://dx.doi.org/10.1016/j.resconrec.2013.04.011.

QUESTED, Tom E. *et al.* Food and drink waste from households in the UK. **Nutrition Bulletin**, v. 36, n. 4, p. 460-467, 2011. http://dx.doi.org/10.1111/j.1467-3010.2011.01924.x.

RADAELLI, Patrícia G. **Atitudes da população adulta do Distrito Federal, Brasil, relacionadas com a alimentação saudável**. Dissertação (Mestrado em Nutrição Humana) – Universidade de Brasília, Brasília, 2003.

REDE BRASILEIRA DE PESQUISA EM SOBERANIA E SEGURANÇA ALIMENTAR E NUTRICIONAL (REDE PENSSAN). **Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia da Covid-19 no Brasil.** Rio de janeiro: Rede PENSSAN [página de internet]. 2021. Disponível em: https://pesquisassan.net.br/olheparaafome/. Acesso em: 12 set. 2023.

RODRIGUES, Maria. Os direitos sociais na Constituição. IN: PIOVESAN, Flávia; CONTI, Irio Luiz (Coord.). **Direito humano à alimentação adequada.** Rio de Janeiro: Lumen Juris, 2007. p. 113-122.

RODRIGUES, Paula. Projeto incentiva consumo consciente de hortaliças para evitar o desperdício nas residências. **Hortaliças em Revista**, v. 6, n. 23, p. 6-15, 2018.

ROSANELI, Caroline F. *et al.* A fragilidade humana diante da pobreza e da fome. **Revista Bioética**, v. 23, n. 1, p. 89-97, 2015. http://dx.doi.org/10.1590/1983-80422015231049.

ROY, Poritosh *et al*. A Review on the Challenges and Choices for Food Waste Valorization: environmental and economic impacts. **Acs Environmental Au**, v. 3, n. 2, p. 58-75, 2023. http://dx.doi.org/10.1021/acsenvironau.2c00050.

SAMPAIO, Maria de Fátima A. **Análise comparativa do consumo de alimentos:** América Latina e União Européia. Dissertação (Mestrado em Engenharia Agrícola), Universidade Estadual de Campinas, São Paulo, Campinas, 2002.

SCHANES, Karin; DOBERNIG, Karin; GÖZET, Burcu. Food waste matters: A systematic review of household food waste practices and their policy implications. **Journal Of Cleaner Production**, v. 182, p. 978-991, 2018. http://dx.doi.org/10.1016/j.jclepro.2018.02.030.

SECONDI, Luca; PRINCIPATO, Ludovica; LAURETI, Tiziana. Household food waste behaviour in EU-27 countries: a multilevel analysis. **Food Policy**, v. 56, p. 25-40, 2015. http://dx.doi.org/10.1016/j.foodpol.2015.07.007.

SESC MESA BRASIL **Maior rede privada de bancos de alimentos da América Latina**. [sl]: SESC Disponível em: https://www.sesc.com.br/atuacoes/assistencia/sesc-mesa-brasil/. Acesso 18 jan.2024.

SEVERINO, A. J. **Metodologia do Trabalho Científico.** São Paulo: Cortez, p. 106, 2007.

SIMPSON, Gareth B., JEWITT, Graham P. W. The Development of the Water-Energy-Food Nexus as a Framework for Achieving Resource Security: A Review. **Frontiers in Environmental Science**, v. 7, article 8, 2019. doi.org/10.3389/fenvs.2019.00008 .

SMITH, Pete *et al.* **Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (SR2)**: background report for the scoping meeting. London: IPCC, 2020. 32 p. Disponível em: https://www.ipcc.ch/site/assets/uploads/2018/07/sr2_background_report_final.pdf. Acesso em: 18 jun. 2023.

TEUNISSEN, Nicolien. **Reducing food waste of suboptimal fruits and vegetables**. Tese (Doutorado em Business Studies) - Wageningen University, Wageningen, The Netherlands. 2017.

THYBERG, Krista L.; TONJES, David J. Drivers of food waste and their implications for sustainable policy development. **Resources, Conservation And Recycling**, v. 106, p. 110-123, 2016. http://dx.doi.org/10.1016/j.resconrec.2015.11.016.

UN. Desperdício de comida custa quase US$ 1 trilhão por ano em todo o mundo. **ONU News.** 2/10/2019. Disponível em: https://news.un.org/pt/story/2019/10/1689492 . Acesso em: 13 dez. 2023.

UN. Se o atual ritmo de consumo continuar em 2050 o mundo precisará de 60% mais alimentos e 40 % mais água. **Nações Unidas Brasil.** 21/01/2015. Disponível em: https://brasil.un.org/pt-br/68525-fao-se-o-atual-ritmo-de-consumo-continuar-em-2050-mundo-precisar%C3%A1-de-60-mais-alimentos-e-40 . Acesso em: 06 jun. 2021.

VISSCHERS, Vivianne HM; WICKLI, Nadine; SIEGRIST, Michael. Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. **Journal of Environmental Psychology**, v. 45, p. 66-78, 2016.

WEBB, Patrick *et al.* Measuring household food insecurity: Why it's so important and yet so difficult to do. **Journal of Nutrition**. v. 136, n. 5, p. 1404-1408, 2006.

ZARO, Marcelo. **Desperdício de alimentos**: velhos hábitos, novos desafios. Caxias do Sul: Educs, 2018. 419 p. Disponível em: https://lume.ufrgs.br/bitstream/handle/10183/278287/001076347.pdf?sequence=1 . Acesso em: 14 out. 2023.