

## HOW DO BRAZILIANS PERCEIVE FOOD WASTE?

### COMO OS BRASILEIROS PERCEBEM O DESPERDÍCIO DE ALIMENTOS?

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#### ABSTRACT

This research aims to identify the profile and factors associated with the perception of Brazilian consumers regarding food waste. The chosen technique was survey research, with the application of a structured online and self-administered questionnaire with 664 Brazilian consumers. Descriptive statistics were calculated and multivariate statistical techniques, such as factor analysis and multiple linear regression. Five factors have different affirmations on assessing and dealing with the food, besides the behavior concerning food and its respective waste. The factor regarding education was included in the survey, adapted from Richter (2017), which generated this factor. This is an additional result when applied to the Brazilian context. The waste is associated with behavioral factors. One of the main contributions was to present the use of metrics, which provide comparisons between different themes of food waste, providing proposals for the public policies and guidelines for minimizing this problem. The study helps with discussions based on a relevant topic for humanity and contemplating the UN SDGs through a national diagnosis. Academics, public, private, and non-profit organizations have increasingly brought the spotlight onto food waste. Implications of this study point to the need for effective policies turned to mitigate food waste.

**Keywords:** Food consumption. Supply chain. Food waste. Sustainability.

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## RESUMO

Esta pesquisa busca identificar o perfil e os fatores associados à percepção dos consumidores brasileiros sobre o desperdício de alimentos. A técnica escolhida foi a *survey*, com aplicação de um questionário estruturado on-line e autoaplicável com 664 consumidores brasileiros. Estatísticas descritivas e técnicas multivariadas (análise fatorial e regressão linear múltipla) foram calculadas. Cinco fatores têm resultados diferentes sobre como lidar com os alimentos, além do comportamento em relação aos alimentos e seus respectivos resíduos. A educação foi incluída nesta pesquisa, quando adaptada de Richter (2017), que gerou um novo fator. Esse é um resultado adicional quando aplicado ao contexto brasileiro. Apontou-se que o desperdício está associado ao fator comportamental. Uma das principais contribuições consistiram na apresentação de métricas, que proporcionam comparações entre diferentes temas do desperdício de alimentos, oportunizando propostas de políticas públicas e diretrizes para a minimizar esse problema. Também auxilia nas discussões a partir de um tema crucial para a humanidade, além de contemplar os ODSs da ONU por meio de um diagnóstico nacional. Academia, organizações públicas e privadas e organizações sem fins lucrativos têm cada vez mais destacado o desperdício de alimentos. As implicações deste estudo apontam para a necessidade de políticas eficazes de combate ao desperdício de alimentos.

**Palavras-chave:** Consumo de alimentos. Cadeia de suprimentos. Desperdício de alimentos. Sustentabilidade.

## 1 INTRODUCTION

When it comes to food consumption and waste, society must go through systemic changes in consumption patterns. The transition to sustainability encompasses a transformation towards the answer to many restrictions from modern society (BILALI, 2019), either in sectorial, political, cultural, economic terms, in favor of agrifood systems. The food supply chain can be observed in a multidisciplinary way, considering the complexity of its actions resides in the flows of interactions, with a distancing of relationships between producers and consumers (NAYAK; WATERSON, 2019).

In this context, it is important to consider the growing discussions about sustainability worldwide. Academics, public, private, and non-profit organizations have increasingly highlighted food waste. It is estimated that 30% of global food production is lost or wasted along the supply chain (GUSTAVSSON et al., 2011; KUMMU et al., 2012; FAO, 2013). Limited resources, such as land, water, and energy, are necessary for food production. Besides, the food system contributes to the greenhouse gases emissions (GARNETT, 2011).

Therefore, the effects of food waste have direct and indirect economic, social, and environmental impacts. At least two billion people do not consume the minimum necessary nutrients per day (FAO, 2013). Reducing food waste can be an effective way of reducing hunger, misery, and malnutrition (FAO, 2013). This is a major concern when it comes to global food waste rates. The food production sector will increase its demand due to the population growth in the coming decades, which will demand more food (GODFRAY et al., 2010).

The 12th Sustainable Development Goal (SDG), defined by the 2030 United Nations Agenda, establishes sustainable production and consumption as one of the main pillars for sustainability. This Goal is to reduce consumption, production, and the losses regarding food production, which is increasing in developing countries (LEMAIRE; LIMBOURG, 2019). Based on this, there is an aspect that is part of our problem research, which includes the behavior of

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individuals about responsible consumption and food waste. Although a consumer profile is focused on these, scientific research and practical initiatives are needed to minimize waste and strengthen a more citizen culture.

Considering studies carried out in many countries, a gap in the literature is identified: the lack of research that emphasizes the profile who waste food, considering social, economic, and behavioral factors. Researchers have examined the demographics of individuals who waste, as well as their social and environmental behaviors (COX; DOWNING, 2007; KOIVUPURO et al., 2012; GRAHAM-ROWE et al., 2014; KLEIN; MENTAD, 2016). Besides, consumers need information regarding the impacts and consequences of food waste (REFSGAARD; MAGNUSSEN, 2009). Richter (2017) investigates the awareness, attitudes, and perceptions of German consumers regarding food waste. Three consumer clusters have been identified: guilty food wasters, unwitting food wasters, and careless food wasters.

It is important to highlight the concern about food waste in the countries that are part of the BRICS (Brazil, Russia, India, China, and South Africa), and the need to carry out quantitative analyzes in these countries about their food supply chains (PARFITT et al., 2010). Brazil has played an important role in the global production and trade of food. Its expansion in agribusiness, in recent decades, led to a growing insertion in the national and international markets. The expansion of production is relevant but reducing food waste is necessary to produce more food, and consumers have a key role in this aspect. Given that, this research aims to identify the profile and factors associated with the perception of Brazilian consumers regarding food waste.

Our results can contribute to scientific knowledge, management, and public policy practices. Each country has a different diagnosis, which considers the unique factors of each nation and consumers. Specificities should be mentioned as cultural aspects, education, and knowledge about responsible production and consumption. The study helps with discussions based on a relevant topic for humanity and contemplating the UN SDGs through a national diagnosis as a scientific theoretical contribution.

There is a perspective of population growth and the consequent need to increase food production, which would lead to an increase in waste. Based on this, the contribution of this study was to present the use of metrics, which provide comparisons between different themes of food waste, providing proposals for public policies and guidelines for minimizing this problem.

## **2 THEORETICAL BACKGROUND**

There is a concern that consumers recognize the need to change their lifestyle to assist sustainable consumption. The consumption behavior of society concerning food and other products refers to the fact that of being inserted in a system that seeks, through numerous strategies, to maximize profit and potentiate the economic pillar (SOUZA et al., 2019).

Another critical factor is the food waste from the production processes to final consumption. In the Food Supply Chain (FSC), food losses regard the stages of agricultural production, postharvest handling, and storage, processing, and packaging. On the other hand, food waste encompasses FSC distribution and consumption (GUSTAVSSON et al., 2011; RICHTER, 2017).

Losses are greatest in the early stages of FSC in developing countries, such as in the postharvest stage, and greatest for perishable foods in industrialized economies, in the final stages of FSC (PARFITT et al., 2010; GUSTAVSSON et al., 2011). In this study, we consider the concept that food waste includes all leftovers of food and beverages throughout the FSC,

which is partially avoidable (RICHTER, 2017). Waste happens in the food supply chain due to peculiarities. The higher the complexity, the longer the time of learning each of the stages that generate these interactions (ÖZBÜK; COŞKUN, 2020). One fact that must be considered is the perishability of the food, which often requires proper storage temperature. It shows that reducing food waste is not standardized, but each classification has its particularities.

In that regard, foods are sent from long distances between the production and consumption points. Its durability is linked to an efficient transportation, packaging, and isolation to temperature changes. Retail, however, being a connecting link between the producer and the final consumer, also demands safe products from the suppliers, which assure higher durability in the points of sale to ensure the food safety until they reach people's homes (GOBEL et al., 2015).

Considering the food logistics and the food quality, the consumption behavior is influenced by visual interactions, tastes, flavors, needs, social interactions, physical environment, affective answers linked to the appreciation of food. Emotion regards a structured adjusting process to coordinate multiple cognitive operations to solve complex adjusting problems (SZNYCER, 2019). It contributes to understanding the consumer behavior as to how they make their choices (GUNARATNE et al., 2019). Corroborating the importance of social values, there is a matter related to the consumption of green and organic foods, contributing to the environmental impact generated by excessive consumption. The choice for these products ranges from behavioral patterns, social, psychological, and institutional factors (WANG et al., 2019).

In this sense, it is worth mentioning that introducing of new technologies in food processing ensures food safety and sensorial and nutritional quality (MARTINS et al., 2019). Some consumers are willing to pay higher prices for products with sensorial quality. One factor contributing to this quality is packaging technology, ensuring the durability and protection of the food throughout the supply chain (KALPANA et al., 2019). One of the most relevant elements in the food supply chain is transparency. It represents the free flow of information about how the foods are produced and delivered. It is one factor that generates more confidence in consumers (ASTILL et al., 2019), such as the traceability of products during the flow that they pass through the FSC (YIANNAS, 2018).

It is also relevant to study consumer behavior and product packaging strategies. In terms of the supply chain, there is the division of information flows and reverse logistics, generating value to consumers, contributing to the circular economy (LEHTOKUNNAS et al., 2020). The efficient information helps determine the flow of demand to limit the impact of seasonality. It is necessary to stimulate sharing best practices among the FSC agents.

To better understand the context, it is necessary to the educational practices for responsible consumption, especially those developed in households, comprehend elements such as purchasing, stocking, and food preparing (KASZA et al., 2019). Food waste can be avoided with deliveries that are more accurate by investing in efficient stocking, logistics, and transportation systems. In this context, there is an effort to ensure the expiration date of the products is not reached, which is similar to the concept of expired product (a product that is no longer appropriate for human consumption) (KHAN et al., 2019). The consumption behavior and food manipulation are led by social norms regarding a certain social group (SCHOLDERER; VEFLÉN, 2019). An example comprises people who underestimate the risks of food contamination.

Although food waste is a global concern and object of many studies, it is unclear how consumers perceive the subject and how aware they are of this practice's problems (RICHTER,

2017). Richter (2017) shows that German consumers are not entirely informed about the subject, which are differences in information and perceptions among consumer groups. It was presented that guilty food wasters are already well informed, but could be provided with further information to bring more awareness to the subject. In contrast, unwitting and careless food wasters should be better informed about the issue.

### 3 METHOD

The chosen technique was a survey, which consisted of applying a structured online and self-administered questionnaire with 664 Brazilian respondents. In addition to social and demographic data, there were questions about food purchases and daily behaviors related to food waste. The answers were registered using the five-point Likert scale, from completely disagree (1) to completely agree (5). The research developed by Richter (2017) served as the basis for the survey constructs, and adjustments to the Brazilian context were made.

The basis survey had 18 statements, and they were adapted into 23 ones. It was intended to understand additional concerns: perceptions on food waste and greenhouse gases emissions; food availability; waste effects on finance; food handling carefully; and information about food waste at school, home, work, or government programs. We performed the back translation of the data collection instrument. Two subject-matter experts analyzed final statements, and a pre-test was performed with 15 respondents. Data collection included 664 questionnaires using convenience sampling. There were no discarded answers due to filling errors. The Qualtrics platform was used for hosting and data collection.

For the data analysis, descriptive statistics were calculated (average, standard deviation) and multivariate statistical techniques, such as factor analysis and multiple linear regression, using the Statistical Package for Social Sciences software. In this research, factor analysis was used as the extraction method of the main components with Varimax rotation. In order to verify the degree of susceptibility or data fitness, the Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity tests were realized. Cronbach's Alpha test was also performed to measure the reliability of the questionnaire applied. Values can be considered good when above 0.70, despite accepting its reduction close to 0.60 in exploratory research (HAIR JR. et al., 2010). The coefficient is better when higher (CORTINA, 1993), starting at 0.45 is considered acceptable, above 0.71 is good, and above 0.81 is a robust value (TABER, 2016).

Through factor analysis, the expectation is that five main factors would be created (independent variables) to be used in multiple linear regression to explain which factors were related to food waste (dependent variable) and in which intensity. The F Test was used to verify the regression significance, indicating that at least one of the  $\beta$  coefficients were not zero, rejecting the hypothesis that all coefficients are the same and the calculation of  $R^2$ , to verify the model's fitness (GUJARATI, 2009).

The sample is presented in Table 1, and it is representative while corresponds to a statistical sample with an error of 3.8% and a reliability level of 95%. Participants live in different areas of Brazil, mostly males younger than 39 years old. Respondents are located in all states of the Brazilian territory with a diversity of habits and socioeconomic realities.

## How do Brazilians perceive food waste?

**Table 1** – Sample description (n = 664)

Variable	Frequency (%)
Where the respondent eats most meals	
Food away from home	32.7
At home	67.3
Gender	
Male	55.4
Female	45.6
Age	
16 to 29 years	11.1
30 to 39 years	44.7
40 to 49 years	22.9
50 to 59 years	18.1
60 to 69 years	3.0
Over 70 years	0.2
Family income <sup>1</sup>	
Up to four minimum wages (Up to 4180 BRL)	26.1
More than four minimum wages (> 4181 BRL)	73.9
Residence	
Metropolitan region	36.6
Interior	63.4
Number of family members <sup>2</sup>	
One	10.8
Two	24.2
Three or more	65.0
Brazilian region	
North	4.0
Northeast	14.0
Midwest	9.0
Southeast	34.0
South	39.0

Note: <sup>1</sup>the sum of the gross income of the people who live with them plus their income. In 2020, the minimum wage was 1.045 Brazilian Real (BRL); <sup>2</sup>living in the same household.

Source: Elaborated by authors.

Based on this sample (collected online), it can be assumed that the respondents have a high level of schooling, as 83.89% have undergraduate or postgraduate degrees. They mostly reside in their states' interior, and 10.8% live alone, which means that most of them live with one or more persons.

#### 4 RESULTS

A key feature found in the descriptive statistics was feeling guilty about wasting food (average = 4.51, standard deviation = 0.92), and being careful when handling foods (average = 4.39, standard deviation = 0.81), followed by taking care to use the products the best way possible (average = 4.28, standard deviation = 0.89), and being careful not to consume the food after its expiration date (average = 4.20, standard deviation = 1.05). On the other hand, they also acknowledge that they received few information about food waste from government projects and programs (average = 2.30, standard deviation = 1.25). Table 2 shows the results for all variables.

**Table 2** – Descriptive statistics

Statements	Average	Standard error	Standard deviation	Sample variance	Kurtosis	Asymmetry
I feel guilty when I waste food	4.51	0.04	0.92	0.85	4.08	-2.11
I do not worry about environmental impacts when I waste food	1.77	0.05	1.21	1.47	1.07	1.51
I do not worry about the effects of food waste with regards to available global resources	1.76	0.05	1.21	1.46	1.29	1.56
Food waste is not an environmental problem because it is natural and can decompose	1.69	0.04	1.09	1.19	2.01	1.67
The food I waste will not help malnourished people	2.16	0.06	1.51	2.29	-0.72	0.92
I believe that food waste increases greenhouse gases emissions*	3.71	0.05	1.35	1.81	-0.69	-0.70
Generally, I consider what I will buy before shopping	4.02	0.04	1.03	1.05	0.45	-0.98
I only buy products that are on my shopping list	2.94	0.04	1.16	1.34	-0.78	-0.11
I plan meals for several days to shop more efficiently	2.92	0.05	1.31	1.72	-1.13	0.01
I have food readily available to buy and consume*	4.16	0.04	0.95	0.89	0.91	-1.12
My food waste affects my finances*	3.53	0.05	1.39	1.94	-1.07	-0.49
During the preparation of food, I am cautious about using products the best way possible	4.28	0.03	0.89	0.79	1.47	-1.28
If something is left after being cooked, I freeze it for later	4.15	0.04	1.03	1.05	1.11	-1.26
I eat leftovers on the next day	4.36	0.04	0.94	0.88	2.49	-1.65
I use food leftovers to prepare other meals	4.09	0.04	1.10	1.21	0.37	-1.10
I handle foods carefully not to spoil it*	4.39	0.03	0.81	0.66	1.97	-1.42
I am careful not to consume food after it expires	4.20	0.04	1.05	1.11	0.73	-1.24
I try to buy foods with long expiration dates	4.04	0.04	1.09	1.19	0.65	-1.11
There is a lot of food waste in my house	2.23	0.04	1.09	1.20	-0.17	0.72
I often forget to eat products before they spoil	2.89	0.05	1.20	1.45	-0.91	0.07
I try to avoid food waste, but sometimes I catch myself wasting food	3.39	0.05	1.18	1.40	-0.71	-0.39
I received information about food waste in school, at home or work*	3.12	0.06	1.47	2.17	-1.36	-0.13
I received information about food waste from government projects and programs*	2.30	0.05	1.26	1.58	-0.60	0.66

Note: \*additional statements to Richter (2017).

Source: Elaborated by authors.

When questioned about food waste, based on what they consumed over the previous week, most respondents, 67.8%, stated the percentage would be a maximum of 10%, but for 32.2%, this percentage would be above 10%. The respondents answered the three categories they believed they wasted the most regarding the type of food waste. Table 3 shows the results.

**Table 3** – Perception of waste - a type of food, in percentage

Type of food	Frequency (%)
Horticultural (greens and vegetables)	81.2
Fruits	76.8
Cereal, byproducts, tubercles (corn, rice, wheat, rye, barley, potato, cassava)	47.1
Dairy	39.2
Fats, oils	21.1
Leguminous plants (beans, chickpeas, lentils, peas, soy)	20.8
Meat, fish, eggs	16.9

Source: Elaborated by authors.

## How do Brazilians perceive food waste?

The perception is that the greens and vegetable categories, followed by fruits, are the foods the respondents believe in having wasted in their daily lives. As a complement to the data analysis, the exploratory factor analysis was performed to reduce the number of variables in factors. Five factors were identified, which explain 61.04% of the total variance. The Varimax factor rotation was used for a better interpretation of the factors. The Kaiser-Meyer-Olkin (0.752) can be considered satisfactory, as well as Bartlett's sphericity test. The results of the exploratory factor analysis indicate that five factors explain the food waste, presented with their reliability degree (Table 4).

**Table 4** – Factor analysis results

Factors and items	Factor loading
<b>Handling with food (Cronbach's Alpha = 0.81)</b>	
I use food leftovers to prepare other meals	0.849
I eat leftovers on the next day	0.848
If something is left after being cooked, I freeze it for later	0.774
I handle foods carefully not to spoil it	0.593
During the preparation of food, I am cautious about using products the best way possible	0.543
<b>Emotions (individual and exogenous) (Cronbach's Alpha = 0.75)</b>	
I do not worry about the effects of food waste with regards to available global resources	0.801
I do not worry about environmental impacts when I waste food	0.780
Food waste is not an environmental problem because it is natural and can decompose	0.690
The food I waste will not help malnourished people	0.534
<b>Food waste in the household (Cronbach's Alpha = 0.71)</b>	
I often forget to eat products before they spoil	0.831
I try to avoid food waste, but sometimes I catch myself wasting food	0.740
There is a lot of food waste in my house	0.732
<b>Expiration date (Cronbach's Alpha = 0.69)</b>	
I am careful not to consume food after it expires	0.799
I try to buy foods with long expiration dates	0.757
<b>Education (Cronbach's Alpha = 0.67)</b>	
I received information about food waste from government projects and programs	0.831
I received information about food waste in school, at home, or at work	0.785

Notes: Kaiser-Meyer-Olkin (0.752); explained variance = 61.4; Bartlett's test of sphericity = 2559.211; significance = 0.000; N = 664.

Source: Elaborated by authors.

The five factors have different affirmations on assessing and dealing with the food, besides the behavior concerning food and its respective waste. The first factor, handling food, is related to using and handling leftovers. The second factor relates to negative emotions associated with waste, such as concern and guilt. It associates it to the exogenous effect, which is based on environmental and ethical commitment. The third factor regards family behavior when it comes to food. The fourth factor considers the influence of the foods' expiration dates. The fifth factor regards education, information, or knowledge received about food waste.

Complementarily, multiple linear regression was performed, aiming to confirm what factors were more relevant to explain the perception of food waste among respondents, based on what they consumed the previous week and how much food they considered to have wasted in percent. The waste is associated with the behavioral factor ( $\beta=0,421$ ,  $t=12,775$ ,  $p=0,000$ ) more than how food is handled, that is, the preparation and use of leftovers. The expiration factor presents a negative relation with the increase of food waste, but in a lower intensity to the factors previously described (Table 5).



**Table 5** – Multiple linear regression

Factors	Coefficients - $\beta$	t	Sig = $p$
Handling with food	-,295	-8,948	,000
Emotions	,108	3,272	,001
Food waste in household	,421	12,775	,000
Expiration date	-,098	-2,973	,003
Education	-,017	-,528	,598

Notes: Durbin-Watson = 2.091; Std. error of the estimate = 0.665.

Source: Elaborated by authors.

In addition to the results, significant differences were tested between social and demographic characteristics, aiming to explain the level of food waste. It was presented that the variable associated with the number of family members ( $\beta=-0.066$ ,  $\rho=0.04$ ), when people do not live alone, tends to waste less food when compared to those who live alone. Other social and demographic variables did not present significant differences concerning food waste.

## 5 DISCUSSION

Food waste is associated with social, ecological, and economic factors. The lack of knowledge about solutions to understand and identify the main waste issues affects the search for effective solutions to this problem (GAO et al., 2020). It was evidenced by the results when a third part (above 30%) of the respondents' waste above 10% of their food; when sought to understand which type of food is more wasted horticultural, fruits and cereals appeared with higher frequencies.

It is necessary to guide and promote development and interventions on the topic (BOULET; HOEK; RAVEN, 2021). Concerning the first four factors found in the results, the adoption of different technologies can represent a driver for reducing food waste in different supply chains and in the stages that compose those (CICCULLO et al., 2021). These factors corroborate Richter's (2017) findings.

The research showed that different losses are depending on the type of food, which corroborates FAO (2013): 30% of cereals; 40%-50% of roots, tubercles, fruits, greens, and oilseeds; 20% of meat and dairy products; 35% of fish produced are wasted at the consumption stage. However, meat, fish, and eggs had a 16.9% waste frequency. Despite the lowest frequency, this is higher-priced products, and bovine meat waste has a dominating part in food waste-associated greenhouse gases emissions in Latin America (GUO et al., 2020). For a better understanding of the context, it can be considered systemic processes to reduce food waste and aim at prevention, transparent monitoring, dissemination of waste, and reducing it throughout the supply chain (MESSNER; JOHNSON; RICHARDS, 2021).

Five factors were identified to explain food waste. Concerning the factors, the adoption of different technologies can also represent a driver for reducing food waste in different supply chains and in the stages that compose those (CICCULLO et al., 2021). These factors corroborate Richter's (2017) findings. The latter factor regarding education, information, or knowledge received concerning food waste is an additional result of this research applied to the Brazilian context. It corroborates the country's planned actions to prevent and reduce food losses and waste, using government and society initiatives (MSD, 2018).

Food waste contributes to financial losses and affects the environment throughout the supply chain. A study carried out in Phoenix in the United States demonstrates that an educational intervention was carried out virtually effectively in reducing food waste,

highlighting the contribution of strategic information to this aspect (WHARTON et al., 2021). Studies on Brazilian food losses and waste focus on supply chains, but the values on this are incipient or non-existent (RUVIARO et al., 2020). These results are input to public strategic decisions that can positively affect the supply chains related to the types of food highlighted and better disseminate the consumer market information.

People that live alone showed waste more food compared to those who live with others. However, concerning people responsible for the household food purchases in Brazil, during the Covid-19 pandemic, there was an intention to reduce family food waste (SCHMITT et al., 2021). In addition, the intention to reduce food waste and the implementation of leftover management are comprehended within economic values worry (CEQUEA et al., 2021).

Finally, any measures to reduce food waste will be economically beneficial and environmentally sustainable (RADTKE et al., 2021). Some countries have used the UN SDGs targets as a parameter to reduce food waste (LEMAIRE; LIMBOURG, 2019; ANANNO et al., 2021), a viable alternative for public and private initiatives at the point under discussion.

## 6 FINAL REMARKS

The reduction of food losses and waste can be considered one of the most promising goals to improve food safety in the coming decades. However, we have a contradiction: the challenge of feeding people sustainably at the same time that expressive food waste could feed people in need around the world. The research identified a discrepancy between the estimated numbers about food waste and consumers' perceptions regarding waste. At the same time, more than 30% of the respondents admit wasting above 10% of their food.

The behavioral aspect emerges to explain this problem when people even try to avoid this type of behavior but end up wasting food anyways. In addition, leftovers, handling, and preparation, that is, the food handling factor, with the expiration date and emotions, help to explain food waste, but to a lower extent. Purchasing, packing, deliveries and food preparing, expired products, and emotion contribute to understanding consumers' behavior regarding the way they make their choices. On the other hand, it was found that consumers are less informed about food waste, but this factor was not significant in reducing waste. Another finding is that people who live alone waste more food.

The implications of this study underscore the need for effective policies to mitigate food waste. A set of measures that seek to achieve the individual's behavioral change and its relationship with food. Therefore, a change in education with a wider set of information will be necessary. It is suggested to improve the planning and application of policies focused on this theme, in which there could be segmentations, such as for people who live alone.

The study limitations are the effect estimated through scale and perception measured variables. Despite having a relevant number of respondents, the sample may not have represented extreme poverty because the collection was online. Future research could use other approaches and methods to analyze to obtain substantive results. It is suggested to apply a survey in other countries to subsequently carry out a comparative study on the perception of food waste between developing and developed countries. It is also suggested to apply in crisis contexts, such as those caused by Covid-19.

A practical advance can be found with improved questionnaires and qualitative analysis with the respondents. Future research will be able to use these reflections to achieve deeper findings, especially on different periods and practical relationships between the

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validated statements of this research. In this way, the study can be replicated in other countries, providing private and public organizations guidelines effectively and directly to minimize this problem.

In the Brazilian scope, despite some initiatives, an effective education policy regarding food waste would be necessary, involving all sectors of activities, going from individual behavior to know how to deal with food. The challenge of providing food for people in a sustainable way in the future will be challenging. Issues such as food waste, hunger worldwide, future expectations of greater demand for food due to population growth will be everyone's concerns. Therefore, reducing food losses and waste will be an important step towards sustainability and food security.

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