



Antecedents of the intention to reduce food waste: A meta-analytic study

Antecedentes da intenção de reduzir o desperdício de alimentos: Um estudo meta-analítico

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Abstract

Purpose: In view of the contradictory results found in the extant literature, this study aims to analyse the overall effect of attitude, perceived behavioural control, and subjective norms on the intention to reduce food waste. **Method:** A meta-analytic study was carried out. 25 empirical articles were examined, with a total of 67 effect sizes and a cumulative sample of 30,960 consumers. **Findings:** The key findings reveal a consistent positive relationship between attitude, perceived behavioural control, subjective norms, and the intention to reduce food waste. Moreover, the effect size tends to be larger in the relationship between subjective norms and the intention to reduce food waste in samples composed of non-students. **Theoretical contributions:** This study reveals the general effect of the attitude, perceived behavioural control, and subjective norms on the intention to reduce food waste. The main contribution of this work was to analyse contradictory results from previous research and reveal generalizable global effects of the antecedents of the intention to reduce food waste. **Practical contributions:** In short, public and private educational institutions, in partnership with state or federal government agencies, could propose workshops and design online educational booklets to encourage food waste reduction. Moreover, advertisements including precise instructions on reducing waste can make the respective tasks more tangible for consumers, making them easier to perform. Marketing practitioners should also delineate strategies to reduce food waste, such as selling ugly food that is still suitable for human consumption and employing influencer marketing. Such strategies should be segmented according to the consumers' profiles. For instance, those more sensitized to environmental causes (e.g., environmental activists) may be more willing to reduce food waste.

Keywords: Food waste; theory of planned behaviour; meta-analysis.

Resumo

Objetivo: Tendo em vista os resultados contraditórios encontrados na literatura existente, este estudo tem como objetivo analisar o efeito global da atitude, controle comportamental percebido e normas subjetivas na intenção de reduzir o desperdício de alimentos. **Método:** Foi realizado um estudo meta-analítico. Foram examinados 25 artigos empíricos, com um total de 67 tamanhos de efeito e uma amostra cumulativa de 30.960 consumidores. **Resultados:** Os principais resultados revelam uma relação positiva consistente entre atitude, controle comportamental percebido, normas subjetivas e a intenção de reduzir o desperdício de alimentos. Além disso, o tamanho de efeito tende a ser maior na relação entre as normas subjetivas e a intenção de reduzir o desperdício de alimentos em amostras compostas por não estudantes. **Contribuições teóricas:** Este estudo revela o efeito global da atitude, controle comportamental percebido e normas subjetivas na intenção de reduzir o desperdício de alimentos. A principal contribuição deste trabalho foi analisar resultados contraditórios de pesquisas anteriores e revelar efeitos globais generalizáveis dos antecedentes da intenção de reduzir o desperdício de alimentos. **Contribuições práticas:** Em resumo, instituições de ensino públicas e privadas, em parceria com órgãos governamentais estaduais ou federais, poderiam propor oficinas e elaborar cartilhas educativas on-line para estimular a redução do desperdício de alimentos. Além

disso, a divulgação de instruções precisas sobre como reduzir o desperdício pode tornar as respectivas tarefas mais tangíveis para os consumidores, facilitando a sua execução. Profissionais de marketing também podem delinear estratégias para reduzir o desperdício de alimentos, como vender alimentos feios que ainda são adequados para consumo humano. Tais estratégias devem ser segmentadas de acordo com o perfil dos consumidores. Por exemplo, aqueles mais sensíveis às causas ambientais (por exemplo, ativistas ambientais) podem estar mais dispostos a reduzir o desperdício de alimentos.

Palavras-chave: Desperdício de alimentos; teoria do comportamento planejado; meta-análise.

1. Introduction

Food waste can be defined as the disposal resulting from the misuse and mismanagement of food that was once fit for human consumption (Costa et al., 2021). According to the authors, waste is a global issue that negatively impacts nations environmentally, socially, and economically. For example, they cite the degradation of the biosphere, greenhouse gas emissions, and natural, financial, and labour resource expenditure (Stancu et al., 2016). According to the Food and Agriculture Organization of the United Nations (FAO, 2013), more than 30% of all that is produced, including the initial stage of the production process until the final stage — that is, the actual consumption — ends up being discarded due to endogenous and/or exogenous aspects affecting the actors in the production chain, such as production inefficiency, ineffective management, as well as social, demographic, ethical, and psychological factors.

In particular, such aspects are investigated in the scope of consumer behaviour, a field in which research has focused on the analysis of the actors in the production chain from its very beginning (e.g., Richards et al., 2021) to the end-consumer (e.g., Amato et al., 2021). It is worth mentioning that the notion that end-consumers are one of the primary parties responsible for waste has been a consensus (Stancu et al., 2016). For instance, van Geffen et al. (2020) found that when consumers have several prioritized goals related to food handling, they can focus on those with higher priority, such as freshness and healthiness, using such aspects as a justification to discard foods. Moreover, when it comes to food quality metrics, consumer expectations have been adopted as a parameter (Helmert et al., 2017). Indeed, food that fails to meet such expectations, even if suitable for human consumption, ends up being wasted (Aschemann-Witzel et al., 2020).

By focusing on end-consumers, several researchers have endeavoured to identify the antecedents of food waste behaviour (e.g., Sharp et al., 2010; Porpino et al., 2016; Di Talia et al., 2019) and, above all, the intention to reduce such waste (e.g., Graham-Rowe et al., 2015). Such efforts have focused particularly on using the Theory of Planned Behaviour (TPB, Ajzen, 1991), contributing to the literature by expanding its explanatory factors (e.g., Visschers et al., 2016; Elhoushy & Jang, 2021).

TPB was proposed to explain why individuals engage in certain behaviours (Ajzen, 1991). According to the author, attitudes, subjective norms, and perceived behavioural control shape individual intentions, thus directing human behaviour. Since it is a generic model, the TPB is used as a framework, especially in the consumer behaviour field. Within this field, TPB is applied to explain specific behaviours, which is not different regarding food waste behaviour (Chun T'ing et al., 2021). However, although some studies have stressed the relevance of the TPB model in the context of food waste (e.g., Graham-Rowe et al., 2015; Abadi et al., 2021), doubts remain as to the real effect of its theoretical assumptions. For instance, Lourenco et al. (2022) claim that TPB only partially explains household food waste as it is more suitable when it comes to frequent and low-volume episodes.

Accordingly, the influence of attitude, subjective norms, and perceived behavioural control on the intention to reduce food waste has been presented discrepantly in the literature (see Table 1). Indeed, in some studies, attitude is a strong predictor of intention (e.g., Aktas et al., 2018; Barone et al., 2019), whereas, in others, it has a negligible effect (e.g., Schmidt, 2019) or even showed no influence at all (e.g., Elhoushy & Jang, 2021). Likewise, subjective norms are sometimes a determining factor (e.g., Soorani & Ahmadvand, 2019; Schmidt, 2019) but sometimes have no influence (e.g., Mondéjar-Jiménez et al., 2016; Cantaragiu & Ghinea, 2020). Some of these latter results are from journals with less scientific rigour, requiring a parsimonious interpretation. And finally, so is perceived behavioural control, which was sometimes found to be a strong determining factor (e.g., Tsai et al., 2020; Cammarelle et al., 2021), whereas other studies claimed it has no effect (e.g., Bell & Ulhas, 2020; Heidari et al., 2020).

Table 1 - Summary of the relationships between the constructs of the theory of planned behaviour and the intention to reduce food waste

| Relationship | Finding | Authors |
|--------------|---------|---------|
|--------------|---------|---------|

| | | |
|--|---------------|---|
| Attitude → Intention to reduce food waste | Significant | Graham-Rowe et al. (2015); Visschers et al. (2016); Stancu et al. (2016); Mondéjar-Jiménez et al. (2016); Lorenz et al. (2017); Aktas et al. (2018); Soorani and Ahmadvand (2019); Barone et al. (2019); Van der Werf et al. (2019); Bhatti et al. (2019); Neubig et al. (2020); Cantaragiu and Ghinea (2020); Tsai et al. (2020); Cammarelle et al. (2021); Abadi et al. (2021); Nair (2021). |
| | Insignificant | Russell et al. (2017); Schmidt (2019); Elhoushy and Jang (2021). |
| Subjective norms → Intention to reduce food waste | Significant | Graham-Rowe et al. (2015); Russell et al. (2017); Aktas et al. (2018); Soorani and Ahmadvand (2019); Schmidt (2019); Barone et al. (2019); Neubig et al. (2020); Abadi et al. (2021). |
| | Insignificant | Visschers et al. (2016); Mondéjar-Jiménez et al. (2016); Lorenz et al. (2017); Van der Werf et al. (2019); Van der Werf et al. (2020); Heidari et al. (2020); Cantaragiu and Ghinea (2020); Tsai et al. (2020); Cammarelle et al. (2021); Nair (2021); Chun T'ing et al. (2021). |
| Perceived behavioural control → Intention to reduce food waste | Significant | Graham-Rowe et al. (2015); Visschers et al. (2016); Mondéjar-Jiménez et al. (2016); Russell et al. (2017); Soorani and Ahmadvand (2019); Schmidt (2019); Van der Werf et al. (2019); Van der Werf et al. (2020); Cantaragiu and Ghinea (2020); Tsai et al. (2020); Cammarelle et al. (2021); Abadi et al. (2021); Elhoushy and Jang (2021); Nair (2021); Amato et al. (2021); Chun T'ing et al. (2021). |
| | Insignificant | Stancu et al. (2016); Lorenz et al. (2017); Aktas et al. (2018); Barone et al. (2019); Bhatti et al. (2019); Neubig et al. (2020); Heidari et al. (2020); Bell and Ulhas (2020). |

Given the divergent results observed in several papers in the food waste literature, it becomes necessary to investigate the real effects of attitude, subjective norms, and perceived behavioural control on the intention to reduce food waste. After all, although the model is used as a starting point for several research studies, its real relevance to the context of food waste remains unclear. Therefore, this research is based on meta-analysis, which will allow the calculation of the overall effect of attitude, subjective norms, and perceived behavioural control on the intention to reduce food waste. Thus, it will be possible to generalize the intention to reduce waste from such assumptions.

It is worth noting that besides allowing the integration of divergent effects and calculating their real magnitude, meta-analysis allows the effects to be corrected for the scales used and sample size, as well as testing methodological moderators that may be influencing the results (Farley et al., 1995). For this reason, a general standard answer can be obtained (Brei et al., 2014). Therefore, we hope this study will contribute to the theory of food waste as it analyses the observed discrepancies and highlights conclusive findings.

2. Theoretical background and hypotheses development

The intention is the main antecedent of actual behaviour, which, in turn, reveals the degree of an

individual's willingness to behave in a certain way (Ajzen, 1991). Given that behaviour is a difficult construct to modify (Loria & Marconi, 2021), researchers have sought to understand the various phenomena that can guide behavioural intention (e.g., De Canio & Martinelli, 2021; Alexa et al., 2021) based on the fact that, as previously discussed by Ajzen (1991), a favourable intention makes it more feasible to perform a given behaviour. From this perspective, the analysis of behavioural intention has also been incorporated into discussions about food waste.

The intention not to waste was first analysed by Stefan et al. (2013). Based on the TPB model, the authors observed that moral attitude and lack of concern explained the intention not to waste. However, their investigations also revealed that the other components of the theory, i.e., subjective norms and perceived behavioural control, had no influence. This may be explained by the fact that this study did not access other cognitive-behavioural variables that could influence and even change the results. Later, extensive models of TPB came to be developed by adding new constructs.

Among them, Graham-Rowe et al. (2015) stand out as an example of research that has expanded the predictors of TPB. In that particular study, the authors added self-identity and anticipated regret to the model, which explains the intention not to waste. They also found that, unlike the findings of Stefan et al. (2013), attitude, subjective norms, and perceived behavioural control have statistical significance in predicting the intention to reduce waste. Therefore, the two studies are discrepant in theoretical terms. This can be attributed to several reasons, such as the sample size and type and the research context.

Not only this study shows divergent results, but also do several others that have incorporated the TPB model and have become, in some respects, contradictory (e.g., Visschers et al., 2016; Stancu et al., 2016; Elhoushy & Jang, 2021). The following section will analyse the base model used by the authors in order to outline its particularities and then outline hypotheses to be tested through meta-analysis. Initially, we discuss the origins of the TPB before proceeding to analyse its three core variables.

2.1. Theory of Planned Behaviour

The TPB can be understood as an extension of the Theory of Reasoned Action (TRA). The latter assumes that behaviour results from intention, which, in turn, is conditioned by attitudes towards specific actions and subjective norms (Fishbein & Ajzen, 1975). According to this perspective, besides incorporating these aspects, TPB establishes that perceived behavioural control is a variable that also guides one's intentions and, therefore, behaviour (Hoppe et al., 2012). It is worth mentioning that the importance of attitude, subjective norm, and perceived behavioural control in predicting intention may vary according to the behaviours and situations in question (Ajzen & Fishbein, 1980).

According to the seminal study by Ajzen and Fishbein (1980), to understand the factors that can affect behaviour, one must consider the determinants of normative and attitude components. The normative components are the individual beliefs that consumers have about themselves and the world in which they live. Therefore, they are observed as determinants of subjective attitudes and norms and mostly determine individual intentions and behaviour. Along these lines, the TPB assumes that individual actions are preceded by conscious decisions to act in a certain way (Osorio, 2015). According to the author, attitudes are consequences of life experiences, personal characteristics, and the perceptions built by the individual from past experiences.

Moreover, TPB understands that individual behaviour may present three types of beliefs as characteristics: (a) behavioural beliefs, which incorporate the possible consequences of behaviour; (b) normative beliefs, which embrace social and peer pressure, i.e., perceived behaviour expectations referring to other people, such as family and friends; and finally, (c) beliefs about control (Ajzen, 1991; Ajzen & Cote, 2008), which refers to the factors that can facilitate or impede the performance of a given behaviour (Hoppe et al., 2012). Indeed, Ajzen (2002) states that the power exerted by attitude, subjective norm, and perceived control determines behaviour intention. For this reason, these variables will be further discussed below.

2.1.1. Attitude

Attitude refers to the favourable or unfavourable evaluation of the behaviour of interest (Ajzen, 1991). According to this notion, individuals have the intention to engage in a given behaviour when they evaluate it positively and believe that people who are important to them think they should do so (Ajzen, 1985). This is because a favourable attitude may not be effectively executed due to social pressure (derived from interactions with relatives, friends, colleagues and other social relationships), thus preventing engagement in a given behaviour (Webb & Sheeran, 2006). Moreover, there is also the influence of the beliefs and opinions that the individual has about a certain behaviour in a social

context, which revolve around what they believe will happen as a result of the behaviour and their assessment of the potential consequences (Osorio, 2015).

According to the TPB, the first variable of an individual's intention is the attitude, which is the positive or negative actions involved in performing a given behaviour (Fishbein & Ajzen, 1975). Attitude is referred to as a determinant of behavioural intention (Neubig et al., 2020). That is, attitude toward a behaviour is an extension of an individual's favourable or unfavourable conditions to engage in a behaviour (Ajzen, 1991). Indeed, a more favourable intention to reduce food waste is associated with a higher probability of engaging in food waste reduction behaviour (Neubig et al., 2020), with a considerable influence of attitude (Tsai et al., 2020).

Beyond the scope of this discussion, attitude is a cognitive and affective opinion of the object of environmental protection (Bamberg, 2003). For this reason, some studies (e.g., Rex & Baumann, 2007; Wang et al., 2014) argue that consumers more concerned about environmental issues are more likely to engage in responsible consumption behaviour. As the intention to reduce food waste fits in the scope of responsible consumption (Ang et al., 2021), it is likely, therefore, that a favourable attitude toward this dimension will also influence it positively. Given the above, it is assumed that:

H1. Attitude toward food waste is positively related to the intention to reduce food waste.

2.1.2. Subjective norms

According to Ajzen (2002), subjective norms are established from the total set of opinions accessible to the expectations of the important references for the individual, such as relatives, friends, and colleagues. According to the author, subjective norms refer to people's perception of the social pressure exerted on them to engage or not in the intended behaviour (Ajzen & Fishbein, 1980). Therefore, subjective norms correspond to the influences triggered by the social pressure of human interaction, culture, and common sense on the behaviour of individuals. Accordingly, the more people perceive that those with whom they have emotional ties believe that they should perform a given behaviour, the greater will be their intention to engage in it.

Subjective norms also relate to the degree to which the behaviour to be adopted corresponds to the wishes of those who are important to the subject, such as the expectations of relatives about food waste, for example (Osorio, 2015). Furthermore, Biswas and Roy (2015) claim that the norms are effective in pro-environmental consumer behaviour. According to the authors, the influence of peers and the quest for recognition in social life has a positive significance. This corroborates Perkins (2003), who found that norms are used to shape the most "desirable" behaviour in the social sphere.

Given the social pressure for the performance of sustainable behaviours, particularly food waste reduction behaviour (Abadi et al., 2021), it is feasible to suppose that subjective norms impact the intention to reduce waste positively. Therefore, it is postulated that:

H2. Subjective norms are positively related to the intention to reduce food waste.

2.1.3. Perceived behavioural control

Perceived behavioural control evinces the possibility of achieving a desired behaviour (Klößner & Oppedal, 2011). For Ajzen (1991), this variable is defined as the resources and opportunities available to the subject, which facilitates the adoption of a given behaviour with a high probability of success when the intended behavioural action is performed. Along these lines, individual views can hinder or benefit one's behaviour in the face of the information and opportunities occurring in the process of executing the behaviour of interest. Furthermore, it relates to the concept of self-efficacy (Ajzen, 1987) developed by Bandura (1986), which refers to the perceptual factors that are specific to the achievement of a given behaviour or goal.

It is worth noting that the more resources (information) individuals believe they possess, the fewer obstacles they will perceive and the greater their perceived behavioural control will be (Li et al., 2017). According to the authors, perceived behavioural control is a direct factor of behavioural intention, which reflects people's confidence and has repercussions in a higher degree of involvement to adopt the behaviour of interest (Aboelimged, 2021).

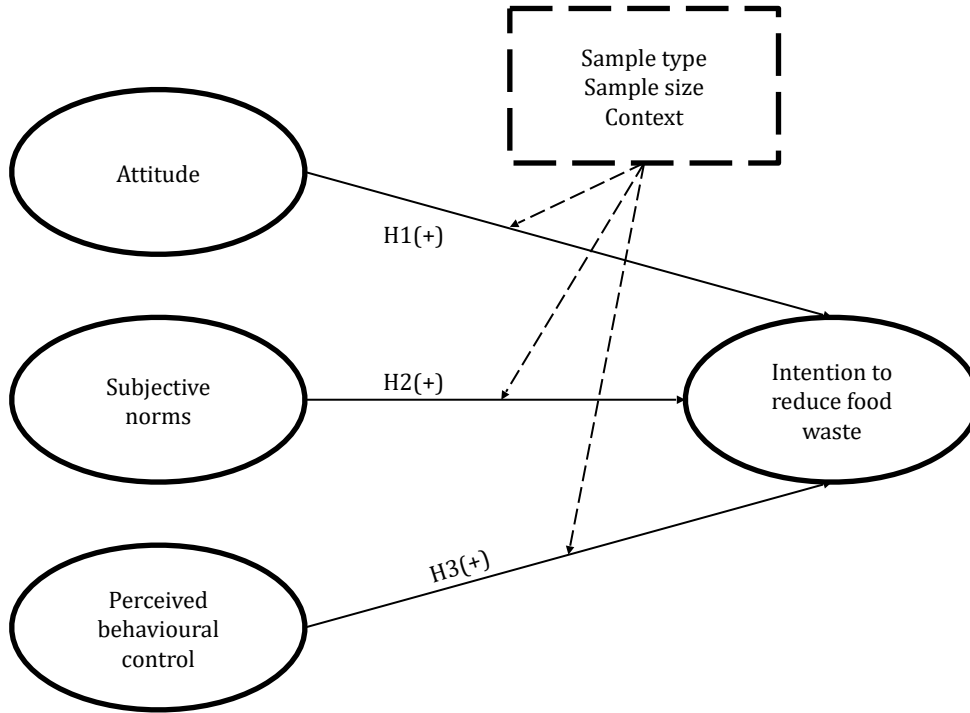
In addition, perceived control refers to the degree of ease or difficulty in performing the behaviour of interest (Ajzen, 1991). Therefore, it reflects the individual's perception of the intended behaviour as easy or difficult to accomplish (Iwaya & Steil, 2019). From this perspective, we posit that this construct can play a vital role as a predictor of intention and behaviour in the food waste context. This is because previous studies have pointed out that the ease of performing a task contributes greatly to engagement in food control activities (Costa et al., 2021). Thus, it is possible that the greater

the perceived behavioural control over food waste, the greater the intention to reduce it, given the perceived ease of the behaviour in question. Thus, it is proposed that:

H3. Perceived behavioural control is positively related to the intention to reduce food waste.

The theoretical model to be assessed in this research is represented in Figure 1.

Figure 1 – Theoretical model



3. Methods

To accomplish the goal proposed in this research, we proceeded to perform the eight steps recommended by Brei et al. (2014). After defining the research goal, we selected reliable articles for analysis. To do so, we collected papers from the Scopus database, which includes the largest number of indexed journals and published articles (Schotten et al., 2017). The following search string was used according to the present study goal: “Food waste” AND “theory of planned behaviour”. A total of 49 eligible articles were found.

The eligibility followed previously defined inclusion and exclusion criteria. Firstly, we considered the inclusion of scientific articles published in journals that directly addressed food waste and adopted the TPB as a theoretical framework. Secondly, the articles should have a quantitative approach (experimental and/or surveys). This is because articles of another nature would not provide the necessary data to conduct the meta-analysis. Finally, the dependent variable to be analysed should be the intention to reduce food waste, and one of the independent variables should be, in particular, the negative attitude toward food waste.

Then, we summarized the 49 articles, which allowed an examination of the method, the scales, the constructs, and the key findings. That said, some of the studies did not fit the defined eligibility criteria, i.e., they did not deal with the variables that are the focus of this research and/or failed to provide quantitative data. Therefore, 24 articles were excluded from the final sample. After filtering, a total of 25 valid articles remained, which resulted in 67 effect sizes between the intention to reduce waste and the TPB antecedents. They were arranged over the 2015-2021 timeframe.

Following the meta-analysis steps, a coding sheet with information on the articles was prepared, which included the authors’ names, journals, year of publication, country of application, type of sample, sample size, statistical results, reliability indices, method, and the name of the scales adopted. The overall effect size was calculated using the correlations found in the articles as metric variables. However, some of the papers found did not report the correlations. Therefore, we collected beta values that were later transformed into correlations, as recommended by Vieira (2017). Moreover, based on

the reliability of the scales, the correlations were checked to correct measurement errors (Vieira, 2017). Following the coding of effects and database preparation, the meta-analytic tests were performed.

It is worth mentioning that due to the identification of heterogeneity of the effect sizes ($Q_{test} = 3181.72, p < 0.001$), the possible influence of moderating variables was evaluated, and mean difference tests (ANOVA) of the effects between groups were conducted, as oriented by Brei et al. (2014). In this regard, the possible influence of sample type (students vs non-students), sample size (small vs large), and context (West vs East) were evaluated.

4. Results and discussion

We identified that the surveys were carried out with a sample size ranging from 156 to 2,248 respondents. The cumulative sample totalled 30,960 individuals. The reliability of the intention to reduce food waste scale ranged from 0.556 to 0.971, with a mean value of 0.808. The meta-analysis results are shown in Table 2.

Table 2 – Meta-analysis results

| | k | N | ES | ES _{range} | ρ | z | CI | CR | Q_{test} | I^2 | T^2 |
|-----|----|-------|-----|---------------------|--------|------|--------|---------|------------|--------|-------|
| ATT | 24 | 11134 | .42 | - .63 to | .51*** | 4.26 | .28 to | -.55 to | 3181.72*** | 99.28% | .31 |
| | | | | .99 | | | .68 | .94 | | | |
| PBC | 24 | 11134 | .31 | - .36 to | .48*** | 4.98 | .30 to | -.40 to | 2081.28*** | 98.89% | .20 |
| | | | | .69 | | | .63 | .90 | | | |
| SN | 19 | 8692 | .21 | - .14 to | .31*** | 4.93 | .18 to | -.15 to | 373.84*** | 95.19% | .05 |
| | | | | .50 | | | .42 | .66 | | | |

Note(s). k = Number of studies; N = Cumulative number of samples; ES = Average effect size; ES_{range} = Minimum (LB) and maximum effect size (UB); ρ = Effect size corrected for reliability; CI = Confidence interval; CR = Critical rate; Q_{test} = Heterogeneity at the individual and aggregate levels; I^2 = Percent variance of effect sizes; *** $p < 0,001$; ATT = Attitude; PBC = Perceived Behavioural Control; SN = Subjective Norms

4.1. Antecedents

The results support hypothesis H1 ($\rho = 0.51, p < 0.001$). Therefore, the relationship between attitude and intention to reduce food waste is positive and significant. It is noteworthy that 190 surveys are required to reject this result based on Rosenthal's fail-safe number. This result corroborates the seminal findings of Ajzen (1991) because a favourable evaluation of a given behaviour has a significant impact on behavioural intention. Thus, we show that the more positive waste reduction is for an individual, the greater his/her inclination to engage in it. More importantly, this may apply to individuals who have a high degree of environmental concern since the pro-environment affective attitude can shape behavioural intentions (Bamberg, 2003). Therefore, an analysis that the behaviour of reducing food waste reverberates in benefits not only for the individual – but also for the environment and future generations – may trigger an increased propensity to effective reduction. It is also important to note that a favourable attitude has the largest effect size on the intention to reduce food waste.

Such a result can be explained based on the assumption that a person's beliefs underlie attitude (Lourenco et al., 2022). Therefore, the unfavourable attitude towards food waste can stem from beliefs related to saving money (Principato et al., 2015), environmental benefits (Diaz-Ruiz et al., 2018) and symbolic value derived from the effort and resources employed in the purchase and food preparation (Ilyuk, 2018). Consumers sensitive to those matters are more likely to intend to reduce food waste (Rex & Baumann, 2007; Wang et al., 2014). Therefore, this relation is in line with the value-belief-norm theory (Stern et al., 1999). According to these authors, if people believe their actions can restore certain values, a predisposition to provide support is created. Thus, it is likely that the belief that food waste causes harm and violates a value increases the propensity to reduce it. Although previous studies claim a gap between attitude-intention (e.g., Wang et al., 2021), our findings add that attitude figures as a relevant element in shaping behavioural intention.

Another interesting finding is the positive and significant relationship between subjective norms and the intention to reduce food waste (H2: $\rho = 0.31$, $p < 0.001$). 250 studies are required to invalidate this result, according to Rosenthal's fail-safe number. This result is in line with Ajzen's (1985) assumptions, as the author points out that an individual's intention to engage in a behaviour is successful when he/she believes that the members of their social circle think they should engage in it. Contrary to other studies in the field that claim that subjective norms have no effect (e.g., Cammarelle et al., 2021; Chun T'ing et al., 2021), such norms are shown to be important predictors of the intention to reduce food waste. This may occur because people seek to be accepted into social groups, and performing actions that meet the expectations of such groups is a way of being part of them (Biswas & Roy, 2015).

Nowadays, peer influence reaches an even greater dimension since opinions are explicitly exposed on social media platforms. Consumers develop real affective bonds and value the opinion of individuals without necessarily knowing them personally by following their daily lives on social media (Ki et al., 2020). Therefore, consumers create a one-sided friendship and are influenced by the opinions and behaviours of the social media personality (Enke & Borchers, 2019). Of note, our results also reveal that the relationship between subjective norms and the intention to reduce food waste is stronger in non-student samples (see Table 4). A possible explanation for this result is that students, generally belonging to the millennial group, tend to be the most individualistic, disregarding third-party opinions and focusing on the individual benefits of a given action (Grant, 2017).

Finally, as for hypothesis H3, the findings ($\rho = 0.41$, $p < 0.001$) reveal a positive and significant relationship between perceived behavioural control and the intention to reduce food waste. 264 articles (fail-safe number) are required to disprove this result. In this vein, the greater the individual perception of behavioural self-regulation, the greater the intention to reduce food waste. It is known that when an individual is well informed about a given behaviour, their perceived behavioural control increases (Li et al., 2017); therefore, it is likely that in-depth knowledge of waste reduction practices is useful in shaping one's intention to reduce. Although previous studies have found that behavioural control is a spurious variable (e.g., Aktas et al., 2018; Bell & Ulhas, 2020), this study uncovers that it has a strong effect on behavioural intention. Therefore, people's confidence in performing a behaviour makes it more likely to be performed. This is because knowledge increases confidence and reduces obstacles, making the perceived effort smaller (Costa et al., 2021; Aboelmaged, 2021).

Table 3 summarizes the meta-analysis results. Thus, we were able to observe the positive and significant relationships of the constructs, among which attitude stands out as the variable with the strongest effect.

Table 3 – Synthesis of findings

| Hypothesis | Theoretical assumptions | Status |
|------------|--|--------------|
| H1 | Attitude toward food waste is positively related to the intention to reduce food waste. | Not rejected |
| H2 | Subjective norms are positively related to the intention to reduce food waste. | Not rejected |
| H3 | Perceived behavioural control is positively related to the intention to reduce food waste. | Not rejected |

4.2. Moderation analysis

We evaluated moderators based on categorical variables to assess the influence of variables that make effect sizes heterogeneous. To this end, methodological variables that could impact the results were checked, namely sample type (students vs non-students), sample size (small vs large), and context (West vs East). The moderation results (Table 4) indicate that sample type only influences the relationship between subjective norms and the intention to reduce food waste. Furthermore, the effect is stronger on samples composed of non-students ($\rho_{\text{students}} = 0.15$ e $\rho_{\text{non-students}} = 0.35$). Finally, the research context (West vs East) and sample size (small vs large) showed no effect on the analysed relationships.

Table 4 – Moderation results

| | ATT → INT | PBC → INT | SN → INT |
|-------------------|-----------|-----------|----------|
| Moderators | | | |

| <i>Sample type</i> | <i>Students</i> | <i>Non-students</i> | <i>Students</i> | <i>Non-students</i> | <i>Students</i> | <i>Non-students</i> |
|--------------------|------------------------------------|---------------------|------------------------------------|---------------------|--|---------------------|
| N | 4 | 20 | 4 | 20 | 4 | 15 |
| ρ | 0.48 | 0.52 | 0.24 | 0.53 | 0.15 | 0.35 |
| Test | $F(1.22) = 0.106, \eta^2 = 0.48\%$ | | $F(1.22) = 2.433, \eta^2 = 9.96\%$ | | $F(1.17) = 2.912^{**}, \eta^2 = 14.62\%$ | |
| <i>Sample size</i> | <i>Small</i> | <i>Large</i> | <i>Small</i> | <i>Large</i> | <i>Small</i> | <i>Large</i> |
| N | 18 | 6 | 18 | 6 | 15 | 4 |
| ρ | 0.51 | 0.51 | 0.46 | 0.54 | 0.30 | 0.31 |
| Test | $F(1.22) = 0.001, \eta^2 = 0.01\%$ | | $F(1.22) = 0.293, \eta^2 = 1.32\%$ | | $F(1.17) = 0.002, \eta^2 = 0.01\%$ | |
| <i>Context</i> | <i>West</i> | <i>East</i> | <i>West</i> | <i>East</i> | <i>West</i> | <i>East</i> |
| N | 15 | 9 | 14 | 10 | 12 | 7 |
| ρ | 0.54 | 0.46 | 0.45 | 0.53 | 0.35 | 0.23 |
| Test | $F(1.22) = 0.209, \eta^2 = 0.42\%$ | | $F(1.22) = 0.266, \eta^2 = 1.20\%$ | | $F(1.17) = 0.846, \eta^2 = 4.74\%$ | |

Note(s). $**p < 0.05$. N = Cumulative number of samples; ρ = Effect size corrected for reliability; η^2 = eta-squared, proportion of variance in Y explained by X. ATT = Attitude; PBC = Perceived Behavioural Control; SN = Subjective Norms; INT = Intention to reduce food waste.

5. Conclusion

So far, research findings in the food waste field have been contradictory regarding the three core variables, i.e., attitude, subjective norms, and perceived behavioural control. Therefore, we emphasize that the proposed goal has been achieved since the meta-analytic research allowed the calculation of the global effects of the constructs based on previous studies. The results found in this study show that the assumptions of the TPB are relevant and significant to the intention to reduce food waste.

They also emphasize the importance of information related to the action of reducing food waste and represent an important foundation for the development of future studies aimed at the influence of TPB on the intention to reduce food waste. This study contributes to the extant literature as it obtained statistical support to confirm the positive relationship between the intention to reduce food waste and the variables of TPB. Moreover, the diverse kinds of empirical evidence contribute to a more comprehensive understanding of the effects investigated here. Finally, the results contribute to the ongoing scientific debate on the TPB and the intention to reduce food waste.

In addition to the results above, we stress the practical contributions of this study by promoting critical reflection on the intention to diminish food waste. As unfavourable attitude toward food waste promotes an expanded intention to reduce waste, promoting the idea that this behaviour causes individual and collective harm, such as financial expenditure and environmental damage, which may trigger this attitude among consumers. Public and private educational institutions should partner with state or federal government agencies, could propose workshops and design online educational booklets to encourage food waste reduction.

The broader the awareness about the disapproval of food waste, the greater will be the intention to reduce waste, considering that subjective norms are also associated with this inclination. Finally, it is worth noting that perceived behavioural control is strongly related to the propensity to reduce waste. The dissemination of precise instructions on how to reduce waste can make the respective tasks more tangible for consumers, making them easier to perform. This could increase perceived behavioural control. Also, companies should develop food labels with clearer and easier-to-view instructions.

Educational organizations, together with health professionals, could develop a guide aiming at reducing food waste. In addition, it would be worthwhile to increase options on how to reuse food that is otherwise discarded for failing to meet common-sense aesthetic standards. Schools could create a

dedicated environmental awareness week and address the issue among students, faculty, staff, and the local community by holding workshops.

From a managerial point of view, we also point out that marketing practitioners and companies should stimulate campaigns aimed at a new pattern of sustainable consumption behaviour. For instance, companies can put into practice strategies to promote aesthetically ugly foods that are still edible, such as making accessible information regarding the benefits of buying such foods and low-price strategies, eliciting a smart shopping feeling (financially and environmentally). The development of media campaigns involving reliable public figures (e.g., opinion leaders and social media influencers) should be employed, considering that they can exert peer pressure, which is a driver of pro-environmental attitudes.

Social media influencers produce content considered authentic and trustworthy, in addition to having a highly engaged and targeted audience (Silva et al., 2022). According to these authors, they can create spreadable content customized to the profile of their audience. Therefore, they can produce persuasive messages encompassing the consequences of food waste and ways to reduce it. As a result, consumers may experience peer pressure and perceived behavioural control can increase. However, companies should consider the profile of the influencer's audience, as there are consumer profiles more sensitive to environmental issues (e.g., environmental activists), which can promote better results. Therefore, influencer engagement is not the only criterion to take into account. Market segmentation is also a process that should be considered by companies in such strategies.

The methodological limitations of this study may affect the generalizability of the results. Firstly, this study was carried out using only a single database. We suggest that future research include other databases to improve the accuracy of the results. Furthermore, it only selected studies containing the search string “food waste” AND “theory of planned behaviour.” Therefore, papers that presented isolated TPB variables were not included in the filter. Future research can incorporate other elements into the string, such as the name of each construct and the Boolean operator OR. Upcoming investigations should incorporate other constructs not addressed in this study, such as impulse buying, hedonic consumption and food aesthetics. Another possibility would be the application of the TPB framework using additional constructs to the context of food waste.

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