Food waste among Dutch students: motivations and barriers to behave conscientiously towards food waste

Running head: Food waste behaviour among Dutch students

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Abstract

The alarming numbers of food waste internationally have severe negative consequences, for example, environmentally and economically, making it crucial to study what causes and affects food-wasting behaviour. This study investigated food waste behaviour among students, taking their living situation into consideration. Food waste behaviour was studied by an extensive questionnaire, largely based on the factors of the Theory of Planned Behaviour. The survey measured several psychological constructs, such as perceived behavioural control and financial attitudes, and two knowledge constructs to gain insights on how educated students are on food waste-related topics. Ultimately, distributing the questionnaire online led to a sample of 184 students, leading to several main results. The outcomes of this study were that, among students, i) a high intention to avoid food waste leads to lower amounts of food waste, making intention a key factor in food-wasting behaviour; ii) perceived behavioural control appeared to be both a direct as an indirect predictor of food-wasting behaviour; iii) personal attitudes had a strong positive relationship with the intention to avoid food waste. Lastly, no outstanding results were found when differentiating between students' living situations. However, it did appear that students living with parents wasted significantly more vegetables than students living alone or students living with their partner. Therefore, additional research on the possible effects of the living situation of students is promising and should be considered in future food waste behaviour studies.

Introduction

Every year, an estimated amount of 1.3 billion tons of food is wasted worldwide (Cornelissen, 2015; FAO, 2011). This indicates that, worldwide, a third of all produced or farmed products are thrown away, which, according to the Food and Agriculture Organization of the United Nations (FAO), ultimately is accountable for an economic loss of 740 billion euros (FAO, 2019). Next to financial losses due to food waste, producing food also requires numerous resources, such as water, land, and energy, while also significantly contributing to the amount of greenhouse gas (GHG) emissions caused by households (Tukker & Jansen, 2006; Hertwich, 2010). Not consuming but discarding food, leads to more GHG emissions, more use of recourses, and an unnecessary change in biodiversity (FAO, 2011).

According to the FAO (2019), in Northern America and Europe around 16 % food is discarded yearly, from the post-harvest to distribution process. After Central and Southern Asia, who discard approximately 21 % of the food yearly, Northern America and Europe are the second-largest food waste regions. In addition, a difference has been established between higher and lower-income countries; in higher-income countries (e.g. in Europe), the most food is wasted during the distribution and consumption stages, whereas in lower-income countries (e.g. in Sub-Saharan Africa) the postharvest and agricultural stages account for the biggest proportion of food loss (Stancu, Haugaard & Lähteenmäki, 2016). This claim is substantiated by Maes and Bastiaansens (2014), who claim that, when looking at the total amount of food waste in Europe, consumers are responsible for 41 % of the food waste, while food producers can be held accountable for 34 % of the total amount of food waste. This study focuses on avoidable food waste, which represents foods and drinks that are lost, although they were edible, therefore mainly referring to the consumption stages (FAO, 2011; Kummu et al., 2012; WRAP, 2007).

These large numbers of food waste have severe negative impacts, and have, like stated before, both environmental and monetary effects. Additionally, in the last decade, the global population has increased significantly and is expected to increase even more the next years, placing higher constraints on the food industry. Reducing food waste is identified as an important indirect manner to increase the food supply (Godfray, Beddington, Crute, Haddad, Lawrence, Muir et al., 2010; Godfray, Crute, Haddad, Lawrence, Muir, Nisbett et al., 2010), since throwing away less food eventually leads to lower amounts of food production while also being able to continue feeding the increasing global population. The FAO (2019) also recognizes the reduction of food loss as crucial to advance food security and nutrition, reduce production costs, improving the efficiency of the food organization, and contribute to

environmental sustainability. However, implementing strategies and interventions contributing to food waste does not appear to be as desirable and clear as it seems; implementation is not easy and completely eliminating food waste is not a realistic goal (FAO, 2019).

As research shows that households, and therefore consumers, consume the biggest amount of food, various studies focus upon investigating perceptions and behaviours among consumers related to food waste (e.g. Quested, Marsh, Stunell & Parry, 2013; Stancu et al., 2016; Abeliotis, Lasaridi & Chroni, 2014; Graham-Rowe, Jessop & Sparks, 2014). Nevertheless, little research focuses directly on why food is wasted, more specifically, the motivators and barriers related to food waste behaviour, especially among young people. Studies that explicitly focused on household food waste did, for example, focus on perceptions towards food waste (Doron, 2012), identifying what food is thrown away most (WRAP, 2009, Lyndhurst, 2010), and on who is most likely to throw food away (Doron, 2012; WRAP, 2009; Koivupuro et al., 2012). Although these studies are doubtlessly important, they lack a deeper understanding of the nature of household waste behaviour, and therefore minimising these behaviours.

Students, who are generally between the age of 18 and 26 years old, are mostly in their young adolescent development phase. Since research shows that habits developed during young adolescence are quite persistent and difficult to adjust in later life stages (Warde, 1997; Wills, Backett-Milburn, Gregory & Lawton, 2005), this makes them an important target group. Additionally, age seems to be a predictive factor regarding food waste; young people tend to waste more food than older people (Thyberg & Tonjes, 2016; WRAP, 2007; Quested et al., 2013) with young adults even being one of the highest food-wasting groups (Ellison & Lusk, 2018; Thyberg & Tonjes, 2016; Secondi, Principato & Laureti, 2015; Quested et al., 2013). Finally, focussing on students provides homogeneity, presumably leading to less variance in the target group. All of this makes that students are an appropriate target for this study.

Finally, this study aims to consider the type of residence of students, since their living situation influences food-wasting behaviour and decisions (Nikolaus, Nickols-Richardson & Ellison, 2018). Literature so far has unfortunately emphasized this factor in the context of food-wasting behaviour too little. Therefore, this study aims to fill this gap since it is essential to gain insight into the role that living situation has in this context since this can create starting points to influence their behaviour towards more food waste-conscious behaviour.

This study aims to investigate food waste behaviour among students towards food waste, taking their living situation into consideration. Gaining knowledge about student's food waste behaviour, their motivations to minimise food waste, as well as their perceived barriers to food waste practices is essential when designing effective interventions to ultimately reduce food waste behaviour. Since the Theory of Planned Behaviour (TPB) (Ajzen, 1991) seems to be the most appropriate model to explain human behaviour, the constructs of this model will be used throughout this study to explain food waste behaviour among students.

Conceptualising food waste Although often interchangeably used, food loss and food waste are different concepts. Despite that there are several definitions of both terms given in the literature, there is no common definition for each. For the purpose of this study, we draw upon the Food and Agriculture Organization of the United Nations report (2019) and Parfitt, Barthel and MacNaughton (2010) to conceptualise both food loss and food waste. Food loss is defined as available food that is not eaten, thus including parts that could not be eaten such as bones and fruit peels. Additionally, food loss concerns all phases of the food supply chain, except stages that concerns interaction with the final consumers, thus excluding food service providers, retail, and consumers. Food waste, however, refers to throwing out food that could have been eaten at some point. In conclusion, food waste results from decisions made by consumers, or even decisions from foodservice providers or retailers that could affect the behaviour of consumers. Since the focus of this study is examining food waste behaviour of consumers, in this case, students, the emphasis will lay on food waste and not food loss.

In addition, it is crucial to specify which types of food are wasted the most often among students to conceptualise on which food waste types this study will focus on. According to a report on food waste among households in the Netherlands in 2019 written by Ooijendijk et al., (2019), the top five most wasted foods among the Dutch population are bread, vegetables, dairy, fruits, and potatoes. Another rather remarkable finding of this report is that studying and school-going youths appear to waste considerably more liquids than average (Ooijendijk et al., 2019).

Since research does not indicate that, besides liquids, there are specific types of foods that are more frequently wasted by students in comparison to other age groups, it is not relevant to include any other food types when investigating food waste behaviour among students.

Determinants of food waste from the Theory of Planned Behaviour The Theory of Planned Behaviour (TPB) is a frequently used and acknowledged framework aiming to explain human behaviour using four constructs. TPB postulates intention, reflecting on the amount of motivation to perform a particular task, being the most influential factor determining an individual's behaviour (Ajzen, 1991). Intention is hypothesised to be predicted by three variables: attitude, subjective norm, and perceived behavioural control, thus all having an indirect effect on behaviour. Firstly, attitude refers to the degree that an individual has either a positive or negative value related to a particular behaviour. Second, the norms and opinions of others lead to perceived social pressure (i.e. subjective norms), which eventually leads to behaving in a certain manner. Finally, perceived behavioural control reflects on the amount of perceived control and ability an individual has regarding performing certain behaviour. As seen in Figure 1 below, perceived behavioural control also has a direct effect on behaviour; an individual may have the intention to perform a behaviour, but not the ability and/or control to actually carry out the behaviour.

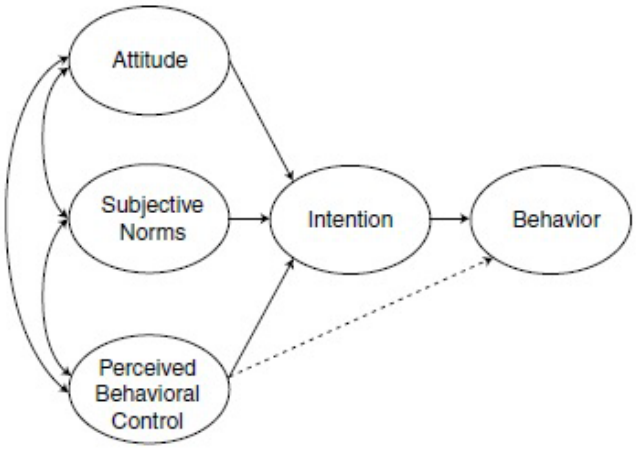

Figure 1. Theory of Planned Behaviour**.**

Since the TPB is designed and used to explain and predict human behaviour in specific situations (Ajzen, 1991), it seems like an appropriate model to provide insights regarding the motivational factors that might affect food waste behaviours. Several studies related to modelling food-wasting behaviour use the TPB (Visschers, Wickly & Siegrist, 2016; Graham-Rowe, Jessop & Sparks, 2015; van der Werf, Seabrook & Gilliland, 2019; Stancu et al., 2016; Stefan, van Herpen, Tudoran & Lähteenmäki, 2013), demonstrating the relevance of using this model in the context of food waste behaviour.

Empirical findings Previous research suggests that consumers have a negative attitude concerning throwing away food, are concerned about this matter, and often feel ‘’bad’’ when engaging in food waste (Abeliotis et al., 2014; Evans, 2011; Watson & Meah, 2012). Personal attitudes are in this context is somewhat intertwined with moral norms, which is also added to the TPB model and used in other food waste studies (e.g. Arvola et al., 2008; Olsen, Sijtsema & Hall 2010). Moral norms refer mainly to feeling responsible and obligated to avoid food waste and conserve resources. Several studies showed that consumers indeed felt guilty after throwing food away (Quested et al., 2013; Parizeau et al., 2015). Considering this overlap, moral norms and attitudes are merged into one construct for this study: *personal attitudes.* Besides having a general attitude towards food waste, other types of attitudes can be identified coming forth of other food waste related studies.

Research designates that *financial attitude* concerns as a consequence of over-purchasing motivate consumers to reduce their food waste (Quested et al., 2013; Graham-Rowe et al., 2014). Studies by Parizeau, von Massow and Martin (2015) and Principato et al., (2015) shows that consumers are generally more concerned about the financial aspects of food waste than *environmental* consequences. Students have, in general, less money to spend than adults and therefore are presumably more consciously engaged with making budged-proof food choices. Additionally, research shows that students are less educated on personal finances (Chen & Volpe, 1998), making it likely that they spend more money on other matters like going out, drinks, shopping etc., leaving less money to be spent on food. In conclusion, it is likely that students, in particular, are more inclined to save up money by trying not to waste any food. This is in line with research from Graham-Rowe et al., (2014), where several students indicated that throwing away food felt like ‘’throwing away their own money’’, ultimately leading to adapting their food waste behaviours and attitudes to become less senseless concerning food waste.

In the context of food waste, *subjective norms* relate to the perceived social pressure to engage in food waste related behaviour and beliefs about what others do and think about food waste. Subjective norms might also imply the belief whether an individual perceives either approval or rejection of certain behaviour from important people or a group (Park & Smith, 2007). However, subjective norms only seem to have a modest influence on the intention to reduce food waste (Graham-Rowe et al., 2014; Stefan et al., 2013). As suggested by Quested et al., (2013) this might be because food-wasting behaviour is only seen by the generator, making it impossible for other people to judge these behaviours.

However, when focussing on students, peer pressure is a recurrent, important theme in their development phase (Sim & Koh, 2003). More specifically, young adolescents' perceptions of other peers' attitudes, beliefs, and behaviours strongly affect their own attitudes, beliefs, and behaviours (Burkey, 2005). The presence of the effects of peer pressure among this target group makes it important to take social norms into account. Furthermore, literature on the influence of social norms, stresses that injunctive norms relate to commonly disapproved or approved behaviour in a certain culture, i.e. how should one behave according to the norms? According to Thøgersen (2006), the construct subjective norms in the TPB model can be interpreted as a form of injunctive norms, since both take perceived social pressure concerning performing behaviour into account. As earlier demonstrated by Graham-Rowe et al., (2014) and Stefan et al., (2013), a review on the TPB model also shows subjective norms having a weak effect when applied to food-waste related behaviour (Armitage & Conner, 2001). Therefore, the decision was made to operationalize subjective norms as *injunctive norms* in the current study.

Perceived behavioural control appears to be a construct of the TPB model that has a large direct influence on food waste reducing intentions, and therefore indirect influence on food waste behaviour (Visschers et al., 2016; Stefan et al., 2013; Graham-Rowe et al., 2014; Stancu et al., 2016). Perceived behavioural control relates to situations where other family members did not want to eat the prepared food because of pickiness, food packaging being too large to be consumed before expiring, and unexpected meals outside the house (Williams, Wikström, Otterbring, Löfgren & Gustafsson, 2012; Evans, 2012).

Finally, previous studies have shown that the *intention* to reduce food waste might motivate people to waste less food (Stancu et al., 2016; Visschers et al., 2016; Stefan et al., 2013; Graham-Rowe et al., 2014).

Additional potential determinants of food waste behaviour Although the determinants in the TPB model appear to be very useful and applicable regarding explaining food waste behaviour, there are other potential predictors of food waste behaviour that are relevant for this study. Firstly, *good provider identity* has been identified and suggested as a potential determinant in several previous studies. This factor refers to being prepared for both expected and unexpected situations through purchasing a sufficient amount of foods so that guests are well taken care of (Visschers et al., 2016; Graham-Rowe et al., 2014; Evans, 2011, Evans, 2012). Good provider identity has been found to predict food waste in households (Visschers et al., 2016), but might also contribute to food waste among students. Visschers et al., (2016)

identified being anxious for not having enough food in case of unexpected events and wishing to be seen as a decent host as underlying reasons for the desire to be a good provider. Students might encounter more unexpected events than other age groups because there is usually not as much routine intertwined in their life compared to, for example, adults. This might be even more applicable for students living on-campus; other students may often come by since they all live relatively close to each other. Next to this, young adolescents often highly value the maintenance of friendships and social acceptance (Steinberg & Silk, 2002; Klimes-Dougan & Zeman, 2007), which makes it likely that they are more prone to wanting to make a good impression as a host.

The extent to which people obtain a certain amount of *knowledge* in terms of food-related subjects, such as food storage, can also contribute to food waste behaviour. Studies on food waste behaviour have shown contradictory results on this matter. On the one hand, Comber and Thieme (2013) and Zepeda and Balaine (2017) found an increased awareness among young people regarding both the negative consequences of food waste, as the magnitude of required recycling. On the other hand, research shows that young people (ages 18-24) have less food waste knowledge (Bravi, Francioni, Murmura & Savelli, 2020; Principato et al., 2015; Clark & Manning, 2018). This claim is supported by a study from Sainsbury's (2016), who state that, in the UK, 47 % of the 18-24 year olds admitted lacking knowledge concerning the storage of food and cooking in general. All of this suggests that it is important to establish if and to what extent this younger target group is well-educated on several food-wasting related subjects.

Socio-demographic factors First of all, some socio-demographic factors may influence food waste behaviour among this target group. Studies of Koivupuro et al., (2012) and Secondi et al., (2015) state that, in general, males waste more food than females, making gender a possible determinant of food waste behaviour.

Additionally, age appears to be negatively correlated with the amount of food waste; older people tend to waste considerably less food than young people (Quested et al., 2013; WRAP, 2009; Principato et al., 2015; Thyberg & Tonjes, 2016; Stefan et al., 2013). Having different interests, responsibilities, and habits that are associated with belonging to a specific age group might help explain this difference in food waste behaviour. For example, older people appear to have obtained knowledge of formal and informal food management and food waste behaviour through experience over the years (Quested et al., 2013; van der Werf et al., 2019). This assumption is substantiated by Radzymińska, Jakubowska & Staniewska (2016),

who claim that the difference in the amount of food waste between young and old people results from having limited creativity and experience with food management. It might also be that young people tend to waste more food because of underlying psychological differences in comparison to other age groups (Aschemann-Witzel, de Hooge, Amani, Bech-Larsen & Oostindjer, 2015). According to this paper, younger people may act more spontaneously regarding food waste behaviour, rely more on convenience food decisions, and have limited experience with how trade-offs can be managed (Aschemann-Witzel et al., 2015). Taken all of this into consideration, demonstrates the fact that age might also be an important determinant of food waste behaviour.

Possible influence living situation Another factor that could possibly influence food waste behaviour, especially among this target group, is the type of residence. Available literature on food waste thus far fails to consider the impact that different living situations could have on food waste decision making and behaviour. Only one study by Nikolaus et al., (2018) examines this aspect among young adults on their food waste behaviour, leading to the conclusion that the type of residence brings forth unique food waste behaviours. Being a student is often intertwined with assembling a sense of interdependence, in terms of moving out and making own (food) purchases. For example, one can imagine that living in a dorm, where dinner is a frequently shared moment, means having less direct responsibility over food purchases and management than when living by yourself in an apartment.

Other studies focus solely on investigating one particular living situation. For example, Whitehair, Shanklin and Brannon (2013) studied food waste behaviour among students living on campus. This study concluded that causing awareness regarding food waste among these university students is possibly contributing to the improvement of sustainability and food waste behaviour in their food dining facilities. Another study chose to exclude young individuals living in student dorms, shared apartments etcetera, and focused exclusively on young people living at home while studying marketing and sales strategies related to food (Mondéjar-Jiménez, Ferrari, Secondi & Principato, 2016). This paper concludes that sale and marketing strategies of food have a negative influence on the food-wasting behaviour of young people who live at home, making it important to consider the role of retailers and food companies by the implementation of food waste campaigns to prevent food waste. The results of the example studies above show that the variation in living situations possibly has different effects on food waste behaviour among young individuals. In conclusion, despite their living situation, young individuals are likely to be involved with food

waste to some extent; however, food waste decisions may deviate based upon factors regarding their living situation.

Study rationale and hypotheses This study aims to obtain more knowledge on the motivations and barriers among students regarding food waste since limited research has been undertaken among this target group specifically. Next to this, the study takes the influence of the type of residence into consideration as the living situation could possibly influence food-wasting behaviour and decisions (Nikolaus et al., 2018), especially among students. To meet these objectives, the constructs of the Theory of Planned Behaviour (Ajzen, 1991) were used to model food waste behaviour. Other additional determinants that, according to literature, appear to be relevant for this study were added to the model.

Following the Theory of Planned Behaviour and the relevant literature above, a conceptual model is developed in the context of this study. Figure 2 aims to give an overview of determinants that possibly affect food-wasting intention and behaviour. This led to several hypotheses. Based on both the TPB and the study of Visscher et al., (2016), intention to avoid food waste seemed to be the main predictor of the amount of food waste. Therefore, it is hypothesized that, also among students, intention is the key predictor of the amount of self-reported food waste (**hypothesis 1**). Next, we hypothesise that financial attitude has a positive direct significant impact on the intention to avoid food waste (**hypothesis 2**), since students generally have less money to spend, making it more likely that they are more concerned with the financial consequences of food waste. In line with hypothesis 2, it is also expected that students living with their parents are less concerned about the financial consequences of food waste than the other groups (**hypothesis 3**) because their parents might contribute to their school expenses, but also because their parents, for a large part, provide for their meals and food. Perceived behavioural control already appears to have a large direct and indirect impact on food-wasting behaviour (Visschers et al., 2016; Stefan et al., 2013; Graham-Rowe et al., 2014; Stancu et al., 2016). However, more specifically, we hypothesise that students living together with other students, i.e. in a dorm, have less perceived behavioural control regarding food waste than students living off-campus (**hypothesis 4**) since students living in a dorm experience several circumstances (such as the occurrence of more unexpected, spontaneous events, having food waste unconsciously roommates etc.) possibly making them feel less in control of the amount of food they waste.

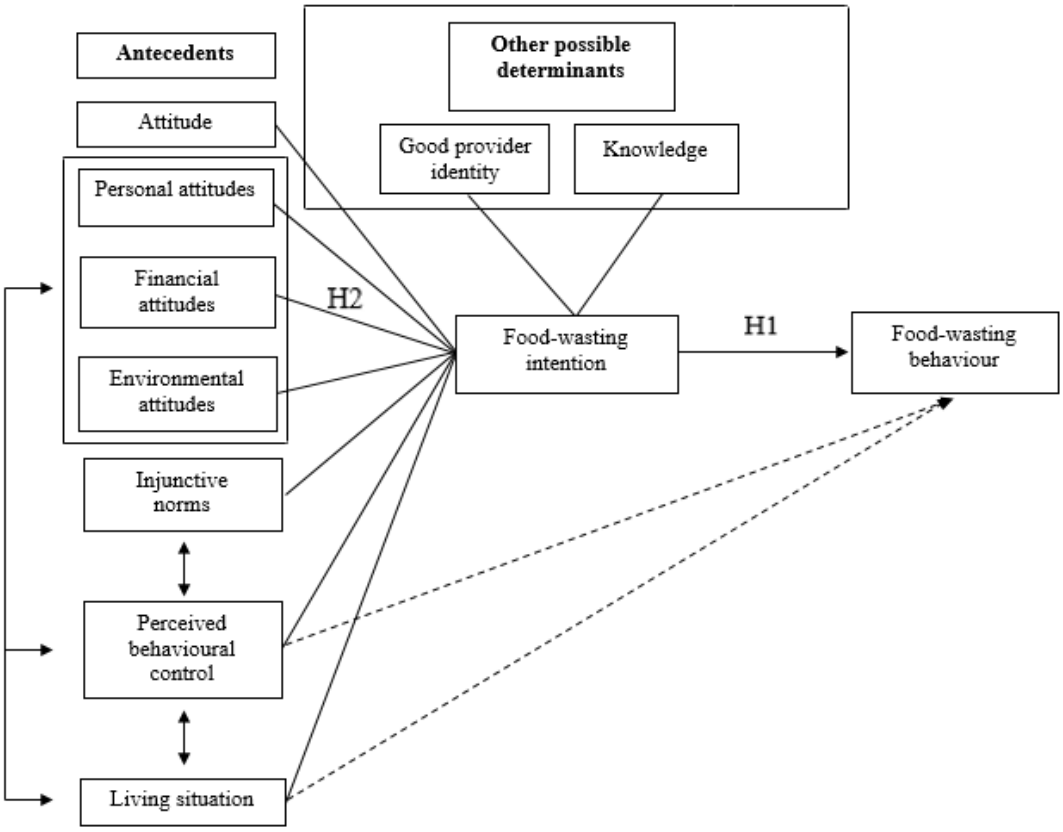

Figure 2. Conceptual model based on the Theory of Planned Behaviour.

Method

Procedure and participants Participants were recruited between December 2020 and January 2021 using the software Qualtrics. There was made use of the snowball sampling strategy, sending out the questionnaire on several online platforms, such as Facebook, LinkedIn, and WhatsApp. Since social media platforms are often widely used among students, this strategy aimed to acquire as many responses from students within the target group as possible. Within the invitation to participate, a short explanation regarding the study and questionnaire, and a direct link to the survey were provided. This invitation also stated that, specifically, students between the age of 18 and 26 years were to contribute to the study.

There were two central criteria to be included in this study's sample: being between the age of 18 and 26 years and being currently residing in the Netherlands. Participants filling in an age not fitting within the age range were excluded from the study. This also applies to participants indicating that they are not currently living in the Netherlands; these individuals were not incorporated into the study's sample. This finally led to a total of 310 individuals

participating in the study through clicking on the link to the online questionnaire, of which 184 finished the survey (60 % response rate). Hence, a considerable amount of respondents were excluded from the sample, since they did not fill in the questionnaire in its entirety. Before starting with the data collection, the study and its research methods were approved by the Ethics Committee BMS of the University of Twente.

The sample consisted of a considerably larger proportion of females (n = 150, 81 %) in comparison to men (n = 34, 19 %). The mean age of the sample is 22.8 years (SD = 1.88), which is close to the midpoint given the age range of a minimum of 18 and a maximum of 26 years old. Most participants in the sample indicated that their highest completed education level was higher vocational education or university degree (n = 106, 58 %), followed by general secondary education (n = 45, 24 %), and intermediate vocational education (n = 33, 18 %). The prevalence of participants in the sample falling into the higher vocational education or university degree education category is slightly overrepresented compared to the population (i.e. 27 %). This does not apply to the other educational levels, the prevalence of these categories in the sample is similar to those of the population (CBS, 2020). Regarding the living situation, the majority of the sample indicated to be living at their parents' house (n = 72, 39 %). Next to this, 50 participants were living together with other students (27 %), followed by participants living by themselves (n = 34, 19 %), and participants living together with their partner (n = 28, 15 %). A few participants filled in the 'other, namely…' option (n = 10). These answer options were analysed, whereafter these participants were excluded from the data set.

Questionnaire The questionnaire consisted of an introduction, an informed consent page, and 42 questions regarding food waste, primarily based on the TPB constructs. The questions used in the survey are primarily derived from questionnaires of Visschers et al., (2016), Stancu et al., (2016) and WRAP (2007), all validated and frequently used food waste questionnaires. The questionnaire consisted of the following constructs: self-reported amount of food waste, intention to avoid food waste, personal attitudes, financial attitudes, environmental attitudes, injunctive norms, perceived behavioural control, good provider identity, use-by knowledge, and food storage knowledge. Since all items were originally written in English, all questions were translated to Dutch before distributing the survey. The survey started by collecting demographic information about the participants (e.g. age, gender, level of education, living situation), whereafter a definition of food waste in the context of this survey was given.

Self-reported amount of food waste Food waste was defined as the disposal of food, purchased or home-grown food, in the trash/garburator (i.e. avoidable food waste (WRAP, 2009)). Furthermore, it was stated explicitly that, in the context of this study, the disposal of inedible food (scraps), such as banana peels and bones, was not seen as food waste. After this, following a similar approach as Visschers et al., (2016), participants were asked to indicate how often food belonging to a certain category ends up being thrown away. These six food types were: bread, vegetables, dairy, fruit, potatoes, and liquids. Participants had six response options: 6-7 times per week [1], 3-5 times per week [2], 1-2 times per week [3], 2-3 times per month [4], about once per month [5], and less often or never [6]. A follow-up question asked participants to indicate how many portions of these same food categories they throw away on average, where they had five response options: more than 3 portions [1], 2-3 portions [2], about 1 portion [3], 0.5 portion [4], and less or nothing [5]. One portion was defined as one handful of food and, in case of liquids, one average glass of liquid. The response options of both these self-reported amount of food waste constructs were later recoded to display the frequency and portion size on a weekly basis.

Psychological constructs The main part of this questionnaire consisted of questions related to the various psychological constructs. All items related to these constructs were measured on a 7-point Likert scale (from completely disagree [1] to completely agree [7]) where higher scores indicate higher agreement with the statements (See Appendix, Table A).

The *intention to avoid food waste* was measured by four items, e.g. ‘’I try to produce only very little food waste’’, $\alpha = .81$. Six items were used to assess *personal attitudes* regarding food waste, e.g. ‘’I have been raised to believe that food should not be wasted and I still live according to this principle, $\alpha = .79$. Four items were used to assess *financial attitudes* regarding food waste, e.g. ‘’I feel like I could save up money by not wasting food’’, $\alpha = .66$. *Environmental attitudes* regarding food waste were also measured by four items, e.g. ‘’I believe that my lifestyle and food waste habits have an environmental impact’’, $\alpha = .64$. Six items assessed *injunctive norms*, e.g. ‘’one should recycle the food waste generated (e.g. composting)’’, $\alpha = .57$. *Perceived behavioural control* was measured by five items, which were all reverse coded, e.g. ‘’my other household member(s) make it impossible for me to reduce the amount of food waste in my household’’, $\alpha = .77$. Lastly, five items assessed *good provider identity*, e.g. ‘’it would be embarrassing to me if my guests ate all the food I have prepared for them. They would probably have liked to eat more’’, $\alpha = .70$.

The last section of the questionnaire consisted of the knowledge constructs, where respondents had three answer options: true [1], false [2], and I don't know [3]. *Use-by date knowledge* was assessed by three items, e.g. ''the 'best before' date indicates how long a product will retain its specific characteristics (e.g. yoghurt should remain creamy) when stored properly. Products can still be consumed for a longer time after this date''. *Food storage knowledge* was also measured by three items, e.g. ''leftovers from warm meals should be cooled down before they are put in the refrigerator or freezer''.

Statistical analyses Data for this study was analysed using IBM SPSS Statistics version 24. All psychological constructs used in the questionnaire were averaged into one single index (see Appendix, Table A). To measure the internal reliability of the intention to avoid food waste, personal, environmental, and financial attitudes, injunctive norms, perceived behavioural control, and good provider identity scales, Cronbach's Alpha was used. In human dimension research, a Cronbach's alpha between .65 and .80 is considered as ''sufficient'' for a scale (Spector, 1992; Vaske, Beaman & Sponarski, 2016). If a reasonable degree of internal reliability was obtained, the mean of the belonging items was calculated and used in further analyses. Concerning the knowledge constructs, the incorrect items were reverse coded and the ''don't know'' answers were recoded to incorrect answers. This resulted in each respondent having a dichotomous value for each item (correct or incorrect) so that a distinction could be made between participants who knew the right answer and those who did not. For each item, the mean and standard deviation was calculated (see Appendix, Table B).

To calculate the mean, standard deviation, median, and interquartile range (IQR) of the self-reported frequency and portion sizes of food waste, the response options of these items were recoded to display the amount of food waste on a weekly basis. The data is distinguished by displaying the six different food categories: bread, vegetables, dairy products, fruit, potatoes, and liquids. Next, another table was created to display the differentiation concerning the amount of food waste on a weekly basis between the different living situations questioned in this survey. To determine whether there were any significant differences within the living situations of the students regarding the amount of food waste in the different food categories, a one-way ANOVA test was performed.

A bivariate Pearson was used to evaluate the bivariate strength and direction between the psychological constructs and the food-wasting frequency. In the research field of psychology, an often used interpretation of the strengths of the *r* values is those of Dancey and Reidy (2007). According to this review, strengths of the correlations between the

constructs are considered small (<0.3), moderate (<0,.4), or strong (>0.6) (Dancey & Reidy, 2007).

To test hypotheses 1 and 2, linear regression models on the self-reported amount of food waste and intention to avoid food waste were created. At Step 1, several socio-demographic factors were added (gender, age, education level, and living situation) to assess the strengths of these factors and effects on the relevant variable of the linear regression. Several variables were converted to dichotomous variables, i.e. dummy variables. For example, for the variable living situation, dummys were created to compare students living with their parents to students not living with their parents. At Step 2, all other psychological constructs (personal, financial, and environmental attitudes, injunctive norms, perceived behavioural control, and good provider identity) and both of the knowledge constructs (use-by date and food storage knowledge) were added. This was done to see whether adding these constructs would improve the model's fit and examine if significant relations would hold when controlling for other variables.

Lastly, an independent t-test was performed on both financial attitudes and perceived behavioural control towards food waste to study if there were any significant differences between living situations of students. Conducting these independent t-tests led to the testing of hypotheses 3 and 4. The independent t-test on financial attitudes compared students living with their parents to students not living with their parents, whereas the t-test on perceived behavioural control distinguished students living with other students to students who did not live with other students.

Results

Descriptive results As illustrated in Table 1, participants reported they averagely throw away food 2.61 times a week (SD = 2.21), with a mean portion size of 3.40 (SD = 2.23). The most commonly wasted foods, both in general as when comparing the different living situations, were vegetables and fruits, followed by bread and dairy products. The least thrown away types of food were potatoes and liquids.

Table 2 was created to display if the amount of food waste, both in general as per category, differed when looking at the living situations of students. As depicted below, no striking differences were found when comparing the different living situations to the amounts of food waste in the categories. As stated before, generally, the most wasted foods among all student groups were vegetables and fruits. Only one significant difference between the groups was determined by the one-way ANOVA test ($F(3,180) = 3.85$, $p < .05$) in the category

vegetables. A Tukey post hoc test showed that students living alone (0.49 ± 0.51, $p = .03$) and students living with their partner (0.47 ± 0.75, $p = .04$) wasted significantly less vegetables in comparison to students living with their parents (1.04 ± 1.29).

Rated on a 7-point Likert scale, respondents had a relatively high intention to avoid food waste (M = 5.63, SD = 0.97). Likewise, respondents indicated to have rather high negative attitudes towards food waste from an environmental perspective (M = 5.51, SD = 0.97). However, their personal and financial attitudes towards food waste did not appear to be that high (M = 5.02, SD = 1.02 and M = 4.78, SD = 1.10), whereas the same holds for their injunctive norms opposed to food waste (M= 4.91, SD = 0.78). Respondents perceived to have a moderate amount of control over the amount of food wasted at their homes (M = 4.54, SD = 1.23). Finally, respondents in our sample seem to have not that many concerns about being prepared for unexpected events and/or guests (M = 3.95, SD = 1.17). Concerning the two knowledge constructs that were included in the survey, students appeared to be more informed on food storage than on use-by food dates (see Appendix, Table A).

Results of the Pearson correlation showed several significant correlations ($p < .05$ or $p < .01$); the amount of food waste per individual and intention to avoid food waste was significantly correlated to all psychological constructs, expect good provider identity and both knowledge constructs (Table 3). More specifically, the amount of food waste is moderately negatively correlated to the intention to avoid food waste ($r = -.48$) and perceived behavioural control ($r = -.45$). Next to this, intention has a high positive correlation to personal attitudes ($r = .62$), and a moderate positive correlation to injunctive norms ($r = .47$) and perceived behavioural control ($r = .40$). Besides, personal attitudes also appeared to have a moderate positive association with injunctive norms ($r = .58$). Finally, use-by date knowledge had no significant correlations to any of the psychological constructs, whereas food storage knowledge was only correlated to perceived behavioural control ($r = -.15$)

Table 1
Self-reported frequency and portions of food waste weekly, per food category and in total (n = 184).

	Frequency food waste/weekly				Portions food waste/weekly			
	M	**SD**	**Mdn**	**IQR**	**M**	**SD**	**Mdn**	**IQR**
Bread	0.43	0.62	0.25	0.53	1.00	0.63	1.00	0.50
Vegetables	0.78	0.99	0.64	0.59	1.19	0.98	1.00	0.50
Dairy products	0.39	0.54	0.25	0.53	1.00	0.77	0.50	0.50
Fruit	0.50	0.62	0.25	0.53	1.25	0.95	1.00	0.38
Potatoes	0.23	0.40	0.10	0.04	0.78	0.52	0.50	0.50
Liquids	0.28	0.63	0.10	0.15	0.94	0.66	0.75	0.50
Total of food waste	**2.61**	**2.21**	**1.95**	**2.50**	**3.40**	**2.23**	**3.00**	**2.50**

Table 2
Self-reported frequency of food waste weekly, per food category and in total, differentiated by living situation, including one-way ANOVA test (n = 184).

	Living with parents (n = 72)		Living with partner (n = 28)		Living alone (n = 34)		Living with others students (n = 50)		One-way ANOVA test	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**	***p***
Bread	0.47	0.75	0.47	0.79	0.42	0.40	0.38	0.40	0.25	.861
Vegetables	1.05	1.29	0.46	0.75	0.49	0.51	0.78	0.73	3.85	.011*
Dairy products	0.31	0.35	0.27	0.31	0.43	0.72	0.55	0.68	2.55	.057
Fruit	0.56	0.72	0.43	0.43	0.38	0.40	0.52	0.67	0.76	.521
Potatoes	0.32	0.58	0.19	0.27	0.19	0.27	0.13	0.09	2.63	.052
Liquids	0.33	0.82	0.19	0.17	0.22	0.34	0.31	0.61	0.46	.714
Total of food waste	**3.04**	**2.57**	**2.01**	**1.54**	**2.14**	**1.59**	**2.61**	**2.21**	**0.38**	**.771**

* $p < 0.05$.

Table 3
Pearson correlations between psychological constructs and food waste (n = 184).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Amount of food waste per person	1.00									
2. Intention to avoid food waste	-.48**	1.00								
3. Personal attitudes	-.29**	.62**	1.00							
4. Financial attitudes	-.16*	.16**	.17*	1.00						
5. Environmental attitudes	-.15*	.28**	.38**	.19**	1.00					
6. Injunctive norms	-.22**	.47**	.58**	.10	.48**	1.00				
7. Perceived behavioural control	-.45**	.40**	.20**	.13	.22**	.25**	1.00			
8. Good provider identity	.06	-.10	-.03	-.16*	-.27**	-.14	-.30**	1.00		
9. Use-by date knowledge	.17*	-.05	-.10	.08	-.10	-.15	-.09	-.02	1.00	
10. Food storage knowledge	.14	-.06	.11	.08	.10	-.01	-.15*	-.03	.14	1.00

* $p < .05$, **$p < .01$.

Multiple linear regression self-reported amount of food waste The first model of the linear regression on the self-reported amount of food waste showed several factors being significantly related to the amount of food wasted and overall resulted in moderate model fit (R^2 = .28) (Table 4, Step 1). Intention to avoid food waste was a significant, negative predictor of the amount of food wasted while living with parents was a significantly positive predictor. Adding non-TPB as well as TPB constructs in Model 2 improved model fit (R^2 = .39) (Table 4, Step 2). More specifically, intention to avoid food waste still appeared to result in a decrease in food waste while living with parents no longer seemed to be significantly related. Next to this, the amount of perceived behavioural control had a significant relation to less food waste while use-by date knowledge was positively and significantly related.

Multiple linear regression intention to avoid food waste The results of Model 1 on the hierarchical regression analysis on the intention to avoid food waste showed a low model fit and only one significant relation; financial attitudes appeared to have a mild positive and significant impact on the intention to avoid food waste (Table 5, Step 1). As with the self-reported amount of food waste adding in the other non-TPB and TPB constructs as Model 2 significantly improved the model's fit and explained variances considerably (R^2 = .08 vs. R^2 = .48) (Table 5, Step 2). Adding in the constructs resulted in financial attitudes being no longer significantly associated with intention. However, both personal attitudes and perceived behavioural control seem to have a positive and significant impact on the intention to avoid food waste.

Table 4
Hierarchical linear regression analysis on **self-reported frequency of food waste.**

	Step 1			Step 2		
	B	*SE*	β	*B*	*SE*	β
(Constant)	3.469	0.544	***	3.595	0.744	***
Gender [1]	0.51	0.100	.034	0.049	0.098	.032
Age	0.005	0.022	.015	0.003	0.024	.009
Intention to avoid food waste	-0.313	0.040	-.513***	-0.227	0.051	-.372***
Lower education [2]	0.072	0.127	.047	-0.111	0.125	-.081
Higher education [2]	0.296	0.107	.249	0.182	0.101	.153
Living situation [3]	0.083	0.083	.069**	0.044	0.082	.037
Personal attitudes				-0.012	0.052	-.021
Financial attitudes				-0.055	0.034	-.102
Environmental attitudes				0.003	0.046	.005
Injunctive norms				0.024	0.062	.031
Perceived behavioural control				-0.151	0.035	-.321***
Good provider identity				-0.043	0.034	-.086
Use-by date knowledge				0.274	0.132	.134*
Food storage knowledge				0.085	0.140	.040
Model statistics	R^2 = .28, F (6,177) = 11.48 p = .001			R^2 = .39, F (14, 167) = 7.53 p = .001		

Notes. 1 Dummy variable: 1 = man, 0 = female. 2 Dummy variable with different education levels as reference groups: lower education refers to general secondary education, medium education to intermediate vocational education, and higher education to higher vocational education or university degree. 3 Dummy variable: 1 = living with parents, 0 = not living with parents. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 5
Hierarchical linear regression on **intention to avoid food waste.**

	Step 1			Step 2		
	B	*SE*	B	*B*	*SE*	β
(Constant)	2.963	1.092	***	0.993	1.116	***
Gender [1]	0.121	0.187	.048	0.161	0.147	.064
Age	0.085	0.045	.167	0.017	0.037	.032
Financial attitudes	0.124	0.064	.141*	0.033	0.051	.037
Lower education [2]	0.162	0.236	.072	0.150	0.187	.066
Higher education [2]	0.240	0.190	.123	0.139	0.151	.071
Living situation [3]	-0.170	0.152	-.086	0.012	0.124	.006
Personal attitudes				0.471	0.070	.492***
Environmental attitudes				-0.010	0.069	-.010
Injunctive norms				0.149	0.093	.120
Perceived behavioural control				0.213	0.049	.268***
Good provider identity				0.015	0.051	.019
Use-by date knowledge				0.202	0.198	.060
Food storage knowledge				-0.282	0.210	-.081
Model statistics	R^2 = .084 F (6,176) = 2.69 p = .05			R^2 = .48 F (13,168) = 11.95 p = .001		

Notes. 1 Dummy variable: 1 = man, 0 = female. 2 Dummy variable with different education levels as reference groups: lower education refers to general secondary education, medium education to intermediate vocational education, and higher education to higher vocational education or university degree. 3 Dummy variable: 1 = living with parents, 0 = not living with parents. * p < 0.05, ** p < 0.01, *** p < 0.001.

Independent samples t-tests The results of the independent t-test on financial attitudes towards food waste showed no significant differences between students living with their parents compared to the other living situation groups (Table 6). Students living with their parents do have slightly lower financial attitudes in comparison to students that do not live with their parents, however, this difference is minimal and not significant.

The results of the independent t-test on perceived behavioural control towards food waste, again, showed no significant differences between students living with other students compared to students who do not live with other students (Table 7). On the contrary, students living with other students seem to experience slightly more control over the amount of food wasted compared to the other living situations. However, the effect is again minimal and insignificant.

Table 6
Independent T-Test on **financial attitudes towards food waste,** differentiated by students living with their parents vs. other living situations.

Living situation	n	M	SD	T	df	*p*
Living with parents	72	4.72	1.17	.48	181	.63
Not living with parents	112	4.80	1.05			

Table 7
Independent T-Test on **perceived behavioural control towards food waste,** differentiated by students living with other students vs. other living situations.

Living situation	n	M	SD	T	df	*p*
Living with other students	50	4.57	1.23	.59	181	.56
Not living with other students	134	4.45	1.23			

Discussion

This study aimed to explore if and what factors explain food waste behaviour among, in particular, students currently living in the Netherlands. In this way, we hoped to obtain more insight into what motivates and impedes this group to behave consciously towards food waste. Next to this, this study considers the living situation of students while analysing their food waste behaviour. This was done mainly by relying on TPB constructs, whereby other apparent relevant psychological constructs were added to the model.

Food waste predictors Using the outcomes of the hierarchical linear regression analyses and the independent t-tests, all the set-up hypotheses for this study can either be confirmed or rejected. Firstly, the results indicated that intention to avoid food waste has a significant and negative correlation to the amount of food waste among students, confirming hypothesis 1. Since these constructs were measured by various detailed questions, it is an important and meaningful result that intention to avoid food waste leads to a decrease in the amount of food waste among students. Hence, intention to avoid food waste appears to be a key factor in predicting the food-wasting frequency, also among this target group. Intention being the most important predictor of self-reported amount of food waste is in line with different studies done on food waste behaviour (e.g. Visscher et al., 2016; van der Werf et al., 2019; Graham-Rowe et al., 2014). Besides intention having a strong relationship with the self-reported amount of food waste, perceived behavioural control also appeared to be a strong predictor of the amount of food a student wastes. This indicates that students are more inclined to waste less food when they feel they have control over the amount of food that is wasted. Next, being educated on use-by dates and living with their parents also seemed to be significant, but considerably smaller, predictors of the amount of food wasted. However, when controlling for more variables, the relation between the living situation of residing with their parents and the self-reported amount of food waste became non-significant. Knowledge on use-by dates remained a small, but significant, predictor of the amount of food waste.

Looking at the results of the linear regression on intention to avoid food waste, again showed perceived behavioural control being a key factor towards food-wasting behaviour. Furthermore, personal attitudes appear to have an even bigger influence on the intention to avoid food waste; the more concerned students are about food waste, the higher they intend to not throw away food. Although financial attitudes did show a small positive significant impact on the intention to avoid food waste, this relation did not hold when controlling for other variables, therefore leading to the rejection of hypothesis 2.

Comparing the financial attitudes of students living with their parents to other living situations did not lead to a significant difference, making that hypothesis 3 is not met. Therefore, it seems that the differentiation between these living situations does not have a significant impact on the amount of financial concerns towards food waste. However, in line with the distinguishment between living situations, it did appear that students living with parents wasted significantly more vegetables than students living alone or students living with their partner. A possible explanation for this effect is that students living with their parents feel like they have less control over the amount of vegetables being thrown away in their household in comparison to the other two living situations.

Although perceived behavioural control did appear to have a strong direct as well as indirect effect on the amount of food waste, the results of the independent t-test did not indicate a significant difference regarding perceived behavioural control between students living with other students and students living off-campus, leading to the rejection of hypothesis 4. Thus, it appears that, against our expectations, students living with other students do not feel less in control over the amount of food wasted compared to students in other living situations.

A remarkable finding is that no specific demographic factors seem to affect the amount of food waste among students as well as their intention to not waste food. This is in contrast to other food waste studies, such as those of Stefan et al., (2013), who reported that age correlated negatively whereas household income correlated positively with the amount of food waste in their study. Also the study done by Visschers et al., (2016) found that, for example, being female, having children, and being older resulted in respectively more food waste. A possible explanation for the absence of such a correlation between demographic factors and food waste might be the lack of diversity within the sample. For example, approximately 80 % of the sample was female, which might not be an adequate representation for the population of this study. Additionally, this study focussed on students between the age of 18 and 26, which makes that there is not much variation regarding the characteristic age, making it more plausible to find no links between age and food waste.

Thus, the key finding of this study is that both intention to avoid food waste and perceived behavioural control appear to be strong indicators of the amount of food waste among students. The finding that intention to avoid food waste is the strongest indicator of food waste is substantiated by the linear regression models, in which intention explains slightly more of the variance in comparison with perceived behavioural control. In addition to this, personal attitudes appear to be strongly related to the intention to avoid food waste

among this target group. Finding such a strong relationship between these constructs was not initially expected, making this potentially interesting for future food waste research and interventions. Finally, no outstanding results regarding the differentiation between students' living situation were found, except the finding that students living with their parents appeared to waste significantly more vegetables in comparison to both students living alone and students living with their partner.

Limitations The current study has several limitations. Firstly, a frequently occurring problem with having respondents fill in self-reporting items in a survey is that this may cause challenges, such as observer bias. That is, participants may not be fully aware of their own behaviours regarding, in this case, food waste. This leads to measuring participants' assessment of their food-wasting behaviours rather than measuring their actual behaviour. Another reason why the self-reported amounts of food waste might not be fully adequate is because of the social desirability effect. Other food waste studies already showed that participants might underreport the amount of food because they waste to present themselves more positively towards the experiment leader(s) (Langen, Göbel & Waskow, 2015; Neff, Spiker & Truant, 2015; Høj, 2012; Elimelech, Ayalon & Ert, 2018). However, treating the respondents' data with full anonymity and confidentially might have diminished this social desirability effect. Despite the possible downsides of using self-reporting items, it was the most suitable manner to measure the amount of food waste among students for this study in terms of time, money, and feasibility. A strength of this study is that the used questionnaire in this study was very comprehensive, seeking to measure all psychological and knowledge constructs as accurate as possible. All constructs consisted out of various detailed questions, making it likely that the found effects can be seen as reliable.

Another possible limitation is the sample collection method that was used for this study. Due to the current corona pandemic, it was not appropriate and partly impossible to collect data in public areas such as universities, shopping malls etcetera. Therefore, the respondents were mainly collected using social media channels such as Facebook, LinkedIn, and Instagram. This led to the sample consisting of students using some form of social media, which might not be an accurate representation of this target group. In other words, our sample was not a randomly selected subgroup of the population, possibly leading to less diversity among the students. However, nowadays, the vast majority of the students within the used age range uses social media, probably causing that the amount of diversity of the sample is not endangered to an alarming extent.

Next, our sample is not fully representative of students currently living in the Netherlands. It consisted of considerably more females, while also the number of students being highly educated was overrepresented compared to the population. Yet, since women are often more inclined to fill in questionnaires and are also more often in charge of cooking and food shopping, it is not surprising that there are often more women in a sample of food-wasting related studies (Stefan et al., 2013). Like stated before, the study done by Visscher et al., (2016) showed a connection between being female and higher amounts of food waste. However, our sample consists out of students, making it less likely that the females in the sample are necessarily in charge of cooking and food shopping. Hence, the current study had a different target group than, for example, the study of Visschers et al., (2016), making the effect between higher amounts of food waste and being a woman not so likely. Generally, our sample seemingly wasted relatively low amounts of food, which might be connected to being higher educated. Other studies with more representative samples (e.g. van der Werf et al., 2019) showed similar results regarding the influence of, for example, the constructs intention to avoid food waste and perceived behavioural control on food waste, so similar results are expected when having a more representative sample.

Future implications for food waste interventions Other studies, such as Visschers et al., (2016) and van der Werf et al., (2019), already suggested that future food waste studies and interventions should mainly focus on both the intention to avoid food waste as well as perceived behavioural control. Since this study shows similar results regarding the influence of these psychological constructs, the same suggestion can be made for food waste interventions created for students. However, since we found that personal attitudes had a strong relation to the intention to avoid food waste, we suggest that more emphasis is placed on this link in future research and interventions. This means, for example, creating interventions that aim to bolster student's personal, but also environmental and financial attitudes, that wasting food is not right and should be minimised.

As pointed out in the limitations of this study, using self-reporting items in a survey goes with challenges, such as observer bias and the social desirability effect. Therefore, it is suggested to consider other methods to measure the amount of food waste among individuals. For example, a possibility to measure actual behaviour instead of participants' assessments of their behaviour is to collect food waste samples of individuals and measure and weigh those samples. An obvious con to this method is that collecting, weighing, and measuring food waste on a big scale is very time-consuming.

Another aspect that requires additional research is whether and what effect differentiation between living situations of students have on their food waste behaviour. Our expectations regarding the influence of living situation were not met, despite research suggesting that the type of residence leads to unique food waste behaviours (Nikolaus et al., 2018). As stated before, this might be caused by the relatively low sample size in this study. Therefore, it is important to consider the effects of these factors on food waste behaviour of students in future research.

Next, it appears that students' knowledge of food storage is relatively low. Although no direct effect on the amount of food waste has been found, it might be useful to educate students more on this aspect. This can, for example, be done by giving students tips on how to preserve fruits and vegetables in the refrigerator to keep them fresh as long as possible. Informing them more about storing food more effectively might result in having to throw away food less often. In general, it is important to educate students as much as possible on the economic, environmental, and social impacts that food waste have to attempt to teach them pro-food-conscious habits. Research already suggested that habits developed during adolescence are persistent and difficult to change in later life stages (Warde, 1997; Wills et al., 2005), making it extra important to anticipate now that students are still susceptible to changing food-wasting behaviour and habits.

Conclusion

This current study, conducted among students living in the Netherlands on motivations and barriers regarding food-waste behaviours, identified several important predictors of food waste where future interventions among young adolescents should focus upon. The main finding of this study is that, generally, three food-waste-avoiding motivations among students can be distinguished: intention to avoid food waste, perceived behavioural control, and personal attitudes.

It is promising and necessary to conduct more future research upon the influence of the living situation of students' with respect to their food-wasting behaviour. Future interventions should emphasize increasing knowledge about appropriate food storage, but also the impacts of food waste in general, since students are in a stadium of their lives where persistent habits are developed and created, making it important to make them as competent as possible regarding the minimization of food waste. Finally, future research should consider the downsides of using self-reporting items, and aim to consider other, more objective, estimates of measuring food waste.

Appendix

Table A

Questionnaire items per construct, including mean, standard deviation, corrected item-total correlation (r pbis) per item, as well as the internal reliability (Cronbach's alpha).

Questions per construct	M	SD	Cronbach's Alpha	M	SD	R_{pbis}
Intention to avoid food waste	5.63	0.97	0.81			
I try to waste no food at all				5.66	1.19	.71
I always try to eat all purchased foods				6.09	0.91	.59
I try to produce only very little food waste				5.90	1.07	.68
I am to use all leftovers				4.86	1.61	.59
Personal attitudes	5.02	1.02	0.79			
It is unnecessary to waste food: it can always be used in some way				4.96	1.38	.36
It is immoral to discard foods while other people in the world are starving				4.97	1.51	.52
It upsets me when unused products end up in the waste bin or garburator				5.82	1.25	.59
I feel obliged not to waste any food				4.78	1.53	.72
It is contrary to my principles when I have to discard food				5.03	1.48	.59
I have been raised to believe that food should not be wasted and I still live according to this principle				4.61	1.54	.49
Financial attitudes	4.78	1.10	0.66			
I think that wasting food is a waste of money				5.72	1.11	.48
Saving money does not motivate me to discard less food*				4.29	1.71	.45
I rarely think about money when I throw away food*				4.12	1.77	.57
I feel like I could save up money by not wasting food				4.94	1.47	.40
Environmental attitudes	5.51	0.97	0.64			
Throwing out food does not have an environmental impact*				5.97	1.16	.42
I rarely think about the environment when I throw away food*				4.73	1.80	.43
I think it is beneficial for the environment to not throw away food				6.11	1.10	.47
I believe that my lifestyle and food waste habits have an environmental impact				5.23	1.41	.33
Injunctive norms	4.91	0.78	0.57			
People who are important to me find my attempts to reduce the amount of food waste unnecessary*				4.74	1.58	.31
				5.31	1.36	.34
People who are important to me are greedy when I try to reduce my food waste*				3.96	1.55	.28
One should never waste any food				5.09	1.24	.50
One should reuse leftovers				5.16	1.34	.46
One should recycle the food waste generated (e.g. composting)				5.28	1.21	.47
One should not load the environment with food waste						
Perceived behavioural control	4.54	1.23	0.77			
I find it difficult to prepare a new meal from leftovers*				4.08	1.79	.50
I find it difficult to make sure only small amounts of food are discarded*				4.39	1.71	.61
I find it difficult to plan my food shopping in such a way that all the food I purchase is eaten*				4.30	1.80	.59
I have the feeling that I cannot do anything about the food wasted at home*				4.94	1.59	.47
My other household member(s) make it impossible for me to reduce the amount of food waste in my household*				5.01	1.62	.50
Good provider identity	3.95	1.17	0.70			
It would be embarrassing to me if my guests ate all the food I have prepared for them. They would probably have liked to eat more				3.51	1.87	.31
I regularly but many fresh food although I know that not of all them will be eaten				3.48	1.86	.38
I like to provide a large variety of food at shared mealtimes so that everyone can have something he or she likes				4.49	1.70	.49
I always have fresh products available to be prepared for unexpected guests or events				3.32	1.87	.50
When I am expecting guests, I like to buy more food than is necessary because I am a generous host				4.94	1.48	.57

Note. Item is reverse coded. Items were scored on a 7-point Likert scales; higher values indicate stronger agreement with the statements.

Table B

Items about use-by date knowledge and food storage knowledge, including the mean and standard deviation per item.

Items per index	***M***	***SD***
Use-by date knowledge		
The 'use by' date means that food products can become a health risk from this date on and should therefore no longer be consumed*	0.65	0.48
Many retailers put the 'sell-by' date on easily perishable products so that they can sort them out in time	0.51	0.50
The 'best before' date indicates how long a product will retain its specific characteristics (e.g. yoghurt should remain creamy) when stored properly. Products can still be consumed for a longer time after this date	0.77	0.43
Food storage knowledge		
Fruits excrete a gas during storage, which keeps vegetables fresh longer. Fruits and vegetables should therefore be stored together*	0.43	0.50
Raw potatoes should not be stored in the refrigerator	0.52	0.50
Leftovers from warm meals should be cooled down before they are put in the refrigerator or freezer	0.89	0.31

Note. *Item is incorrect. Responses were recoded to indicate correct and incorrect answers. Items are changed into a response format where 0 is incorrect or don't know and 1 is correct.

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