Food Waste Knowledge in Austria: A Consumer Perspective

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ABSTRACT

In times of increasing environmental awareness, the topic of food waste receives high attention from practitioners and scholars alike. In this study we analyze how well-informed Austrian consumers are regarding food waste and what factors might influence this knowledge. In a consumer survey (n = 470), we examined consumer food and food handling knowledge, cooking skills, place of living, personal ties to agriculture, engagement in initiatives against food waste, and their effect on food waste knowledge. To understand what effect social desirability might have on participants' answers, we administered the survey both in an online and a face to face setting. Amongst others, our findings suggest a positive relationship between knowledge about food and food handling and knowledge about food waste prevention as well as a social desirability bias in reporting one's own knowledge about food waste prevention. We could not find a statistically significant relationship between food and food handling knowledge, and food waste knowledge. Furthermore, we did not find evidence that a personal connection to agriculture or a rural place of living leads to a higher food waste knowledge. Finally, the unexpected influence of cooking skills is at least surprising to a certain extent. We conclude this study by outlining potential areas for future research as well as managerial implications.

Keywords: food waste, food waste knowledge, consumer behavior, social desirability bias, consumer survey

1   Introduction

Over the last decades, the topic of food waste has gained substantial traction in both, political debate and academic literature. Around one third of food for human consumption is wasted unconsumed (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011). This food waste, defined by Thyberg and Tonjes (2016) as food "which was originally produced for human consumption but then was discarded or was not consumed by humans" (p. 112), stems from a number of reasons: From a consumer perspective, food waste may be a

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result of shopping behavior, such as over-provisioning, bulk purchases (Pearson, Minehan, & Wakefield-Rann, 2013; Priefer & Jörissen, 2012), or oversized packages (Williams, Wikström, Otterbring, Löfgren, & Gustafsson, 2012), and consumption behavior, such as inadequate cooking skills (Koivupuro et al., 2012), or erroneous food safety concerns over food that is perceived to be expired given its expiration date (Thyberg & Tonjes, 2016). Additionally, decreasing household size – smaller households generate more food waste per person (Parizeau, von Massow, & Martin, 2015), cultural and economic factors (Thyberg & Tonjes, 2016), as well as increased urbanization (Parfitt, Barthel, & Macnaughton, 2010) may have impacts on food waste.

The implications of food waste are affecting both, humans and the environment, negatively. As food production can be highly resource-intense, in some cases to the extent of environmental harm (e.g. beef, coffee), wasted food, i.e. an overproduction of food in some markets, may be viewed as an amplification of the environmental strain or poorly allocated resources in the fight against world hunger (Thyberg & Tonjes, 2016). We thus raise the question *if consumers are aware of the impact their food consumption choices can have*, in other words, what their food waste knowledge is, and what factors may influence this awareness and knowledge.

While there is a large number of studies in the food waste field, only few have so far examined consumer food waste knowledge as a specific topic (Neff, Spiker, & Truant, 2015; Visschers, Wickli, & Siegrist, 2016). Neff et al. (2015), for instance, found that US consumer awareness of food waste is growing. Building on this, we aim to understand what factors can drive consumer food waste knowledge and how this might help practitioners, researchers, and consumers going forward. This study is structured into four distinct sections: It commences by outlining the hypotheses developed for this study. Next, the methodology employed is detailed and the experimental design discussed. Thereafter, the results are presented before the study is concluded with a discussion of said results, potential future research avenues, managerial implications, and limitations.

2   Hypotheses development

In order to examine the drivers for waste knowledge, a common understanding of this term (i.e. a working definition) is required for this study. We thus propose the following definition: food waste knowledge is the information consumers consciously possess of the adverse effects of food waste to the environment and society, which leads them to engage in sustainable (i.e. less wasteful) shopping and consumption behavior. Based on a comprehensive literature research (see below), this study examines four potential drivers of food waste knowledge: (1) food and food handling knowledge, (2) cooking skills, (3) place of living and personal ties to agriculture, and (4) engagement in initiatives against food waste.

(1) Food and food handling knowledge: Several studies have found that poor food handling knowledge may result in an increase of food waste. From inadequate food storage (Terpstra, Steenbekkers, De Maertelaere, & Nijhuis, 2005; Wayne, 2014) to misconceptions about food safety, predominantly stemming from expiration dates. Limited knowledge thereof may lead consumers to throw out food past its expiration date despite it being still edible (Thyberg & Tonjes, 2016). As a result, we hypothesize the following relationship:

H_{1a}: *There is a positive relationship between knowledge about food and food handling and knowledge about food waste.*

H_{1b}: *There is a positive relationship between knowledge about food and food handling and knowledge about food waste prevention.*

(2) Cooking skills: Cooking skills or rather the lack thereof can be an influential factor in generating food waste through preparing too much food (Graham-Rowe, Jessop, & Sparks, 2014; Porpino, 2016) or not engaging in preparing meals with leftover ingredients rather than sticking to predefined recipes (Ganglbauer, Fitzpatrick, & Comber, 2013; Graham-Rowe et al., 2014). Additionally, people who tend to consume convenience food tend to also exhibit higher levels of food waste (Mallinson, Russell, & Barker, 2016). We further assume that cooking skills will also have an influence on food waste prevention behavior. However, at this point we are not determining if these skills influence food waste prevention positively or negatively, because both directions are conceivable. Better cooking skills might result in better and comprehensive usage of food (and thus, less food waste) or in more careful, cautious behavior (resulting in more food waste). We thus theorize that

H_{2a}: *There is a positive relationship between cooking skills and knowledge about food waste.*

H_{2b}: *Cooking skills influence the knowledge about food waste prevention behavior.*

(3) Place of living and personal ties to agriculture: Increased urbanization has led to broader food systems and diversified diets (Thyberg & Tonjes, 2016), which may lead to a detachment from food production methods. Some studies report that people living in urban areas generate a larger amount of food waste compared to people living in rural areas (Cecere, Mancinelli, & Mazzanti, 2014; Secondi, Principato, & Laureti, 2015). In a similar vein, it can be argued that people with personal ties to agriculture (e.g. having growing up on a farm), may have a better understanding of the origins of the food they consume; the lack of such ties may render people unfamiliar with food production and thus increase food waste generation (Parfitt et al., 2010; Thyberg & Tonjes, 2016). Thus, we propose that

H_{3a}: *People living in rural areas exhibit a higher degree of food waste knowledge compared to those living in urban areas.*

H_{3b}: *People with personal ties to agriculture exhibit a higher degree of food waste knowledge compared to those without such ties.*

(4) Engagement in initiatives against food waste: As the topic of food waste grows increasingly popular, several initiatives have been launched by non-profit organizations, consumers, and retailers alike. Aschemann-Witzel et al. (2017) categorize these initiatives into three groups given their goals and features: information and capacity building, redistribution, and retail and supply chain alteration. These initiatives can range from raising awareness to donating food to dumpster diving. On a consumer level, we hypothesize that

H₄: People who actively engage in initiatives against food waste exhibit a higher degree of food waste knowledge compared to those without such engagement.

(5) Food waste prevention knowledge and behavior: As human food waste is largely generated on the consumer level (Monier et al., 2010), it can be sensible to examine consumes' knowledge of and behavior regarding the actions that can be undertaken on a personal level to decrease or prevent food waste generation such as cooking leftovers or pickling fruit and vegetables. Thus, we argue that

H₅: There is a positive relationship between food waste prevention knowledge and food waste prevention behavior.

(6) Social desirability bias: On an individual level, consumers' food waste generation is visible only to the members of the same household and difficult to measure in great detail. To address this, researchers often have to rely on self-reported consumer behavior. This can lead to distorted results depending on the mode a consumer survey is administered in. For self-reported behavior consumers can be prone to respond in a socially desirable manner – especially if no anonymity is given (Grimm, 2010). To understand the extent of this social desirability bias, we opted for a two-fold study administration – online and face to face (F2F). To contrast this, consumers' knowledge of general food waste facts (e.g. quantities, initiatives, origins) is tested as this does not provide an opportunity for respondents to display themselves in a favorable light. Therefore, we hypothesize that

H₆ₐ: Respondents who participated in the survey F2F exhibit a higher degree of self-reported food waste prevention knowledge compared to respondents who participated in the survey online.

H₆ᵦ: Respondents who participated in the survey F2F exhibit a higher degree of self-reported food waste prevention behavior compared to respondents who participated in the survey online.

H₆c: There is no significant difference in food waste knowledge between respondents who participated in the survey F2F and respondents who participated in the survey online.

Altogether, the assumptions of this study can be summarized according to Figure 1. Consequently, the research model will be tested by means of adequate analytical methods.

Figure 1: Research model
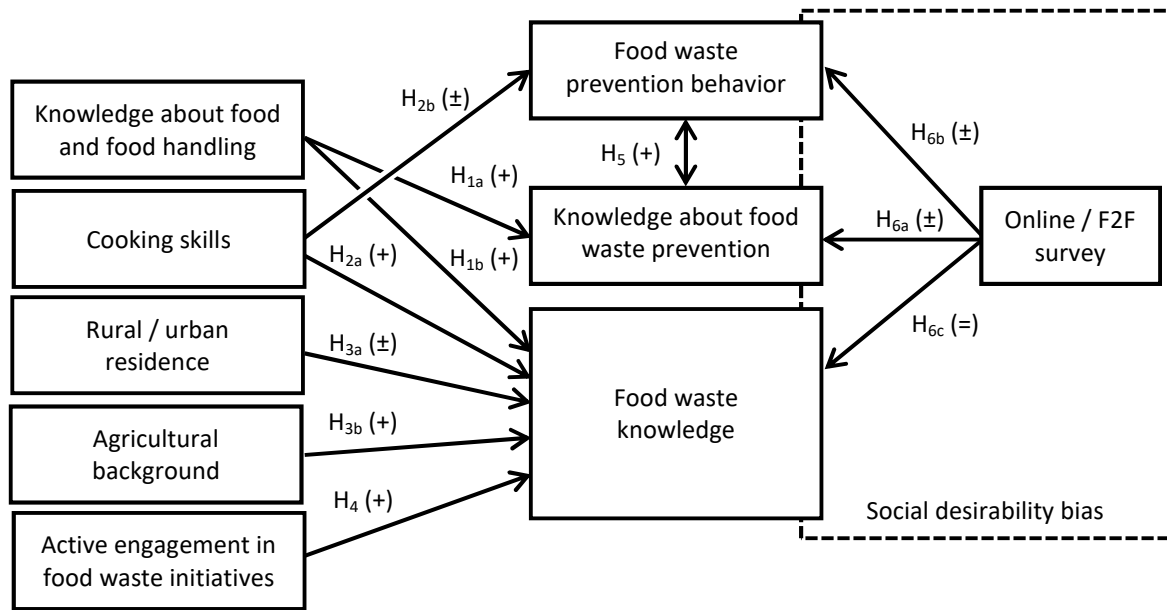
3   Methodology

3.1   Data collection

The data was collected by way of a survey in late 2017, administered online and in person in Upper Austria, yielding a total of 470 valid responses (online n = 368, face to face n = 102). The survey format was pre-tested with ten people before being distributed to our sample. While we attempted to capture a sample representative of the Austrian population, there are some deviations (regarding gender, age, and education).

Table 1: gives an overview of the sample of this study.

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Table 1: Socio-demographic variables of the sample (n = 470)

		n	valid%	Austria (2017) %[a]
Gender	Female	349	74.3	50.8
	Male	121	25.7	49.2
Age	≤ 20	14	3.0	20.8
	21-30	217	46.2	13.2
	31-45	105	22.3	20.2
	46-60	85	18.1	22.6
	61+	49	10.4	23.1
Monthly net income [b]	< € 1'000	138	32.9	n.c.
	€ 1'000-2'000	163	38.8	n.c.
	€ 2'001-3'000	74	17.6	n.c.
	€ 3'001-4'000	31	7.4	n.c.
	> € 4'000	14	3.3	n.c.
Education	Compulsory schooling	17	3.6	18.0
	Vocation/apprenticeship	98	20.9	48.8
	High school diploma	138	29.4	15.6
	University degree	217	46.2	17.5
Place of living	Urban	301	64.0	47.2
	Rural	137	29.1	52.8
	Other	32	6.8	
Household size	1 person	128	27.2	16.8
	2 persons	180	38.3	27.3
	3 persons	64	13.6	20.2
	4 persons	61	13.0	20.7
	5 persons or more	37	7.9	15.0
	Total	470	100.0	100.0

[a] Source: http://www.statistik.at; n.c. ... not comparable; [b] no information n = 50

3.2 Measures

The survey contained a variety of questions to quantify the constructs in this study. Participants were presented with several statements regarding knowledge about food and food handling, cooking skills, food waste prevention knowledge, and food waste prevention behavior. They were asked to rate every statement on a four-point-scale ranging from *fully agree* to *fully disagree*. For each of the four constructs the mean score was calculated and used for subsequent analyses. Food waste knowledge was gauged in several true/false questions where the study participants were asked to choose the correct statement regarding a variety of food waste facts (e.g. quantities, initiatives, origins). Based on the participants' scores a four-point scale rating of their food waste knowledge was computed. Lastly, in addition to commonly extracted socio-demographic data, we asked the participants to report their place of living (rural, urban, or other), their participation in anti-food waste initiatives, and if they had a connection to agriculture.

3.3 Hypothesis testing

The statistical analysis was conducted using the software solution SPSS (Statistical Package for Social Sciences, version 26). For hypotheses H_{1a}, H_{1b}, H_{2a}, H_{2b}, and H_5, each theorizing relationships, we use Pearson's correlation analysis between the different constructs. For hypotheses H_{3a}, H_{3b}, H_4, H_{6a}, H_{6b}, H_{6c}, we employed

Mann-Whitney-U tests to assess differences between the groups in question, a convenient method in cases where normal distribution of data cannot be guaranteed.

4   Results

The first part of our analysis consisted of examining the hypothesized correlations. The general distribution of the five relevant indicators can be taken from Figure 2 for food waste knowledge and behavior, as well as from Figure 3 for food knowledge and cooking skills. As we can see from these figures, the variables measuring the constructs were aggregated to an index with a maximum value of 1 (highest knowledge, skills, etc.) and a minimum of 0 (no knowledge, skills, etc.).

Figure 2: Food waste knowledge and behavior (n = 470)
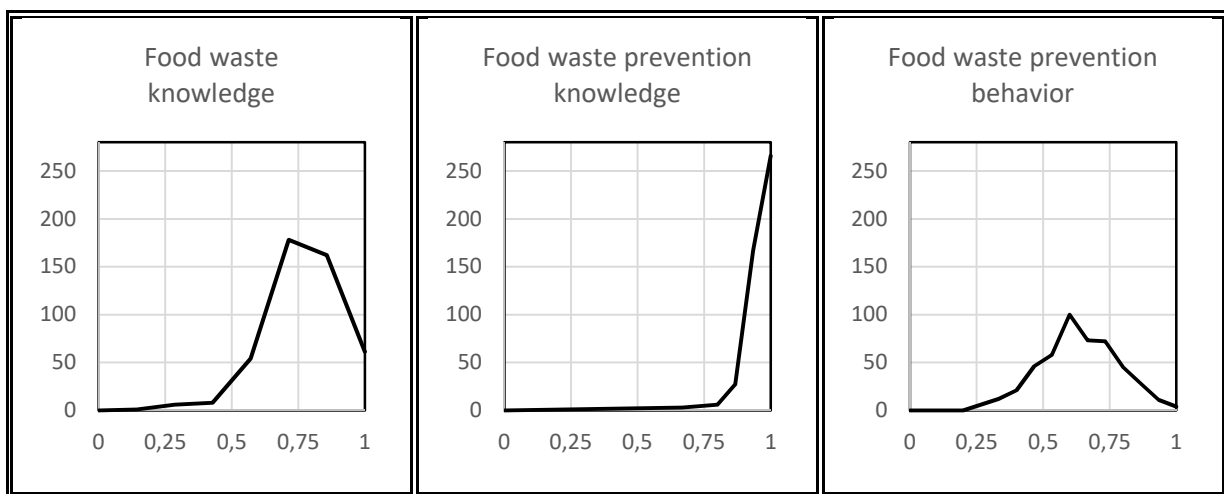
Figure 3: Food knowledge and cooking skills (n = 470)

We did not find a significant positive relationship between *knowledge about food and food handling* and *knowledge about food waste*. H_{1a} is not supported. We did, however, find a positive relationship between

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knowledge about food and food handling and *knowledge about food waste prevention* ($r = 0.220$, $p \leq 0.001$), H_{1b} is supported; however, the effects are rather low and should not be overrated.

We also hypothesized a positive relationship between cooking skills and knowledge about food waste but could not find a significant correlation, too; as a result, H_{2a} is not supported. In contrast to that, there seems to be a *negative, rather strong* relationship between the variables "Cooking skills" and "Food waste prevention behavior" (-0.551, $p \leq 0.001$). H_{2b} is therefore clearly supported: Cooking skills influence food prevention behavior negatively. Thus, in our sample better *cooking skills might result in lower food waste prevention behavior*. Further, we found a significant relationship between food waste prevention knowledge and food waste prevention behavior, the relationship was negative in nature ($r = -0.384$, $p \leq 0.001$). H_5 is not supported, the alternative hypothesis H5' would, however, be supported: There is a *negative* (moderate) relationship between food waste prevention knowledge and food waste prevention behavior, which is, of course, surprising and has to be discussed.

In addition to the assumed relationships we found other, minor and positive correlations between cooking skills and knowledge about food waste prevention ($r = 0.175$, $p \leq 0.001$), and between knowledge about food waste and about food waste prevention. The latter is, although significant, very low with $r = 0.098$ ($p = 0.035$). Table 2 gives an overview over the correlations between constructs.

Table 2: Pearson's correlations *r* between constructs (n = 470)

	1.	2.	3.	4.	5.
1. Knowledge about food and food handling	1				
2. Cooking skills	0.175**	1			
Sig.	≤ 0.001				
3. Food waste prevention knowledge	0.163**	0.277**	1		
Sig.	≤ 0.001	≤ 0.001			
4. Food waste prevention behavior	-0.149**	-0.551**	-0.374**	1	
Sig.	≤ 0.001	≤ 0.001	≤ 0.001		
5. Food waste knowledge	0.023	0.074	0.097*	-0.042	1
Sig.	0.616	0.107	0.035	0.364	

Sig. = Significance; **$p \leq 0.01$; * $p \leq 0.05$

Regarding the hypothesized group differences concerning food waste knowledge (H_{2a}, H_{3a}, H_{3b}, H_4), no significant relationships could be identified. There are no significant differences between respondents with and without an active involvement in anti-food waste initiatives (H_4 not supported at the 5% significance level). Connection to agriculture and place of living (rural vs. urban) did not play a role, as well (H_{3a} and H_{3b} not supported, too). And, as mentioned above, also cooking skills are not influencing food waste knowledge (H_{2a} not supported).

Concerning the social desirability bias related hypotheses, H_{6a} is supported at the 1% significance level, i.e. F2F respondents had a significantly different self-reported level of food waste prevention knowledge (F2F respondents report a slightly better knowledge about food waste prevention; however, differences are still very low). H_{6b}, the hypothesized difference between self-reported food waste prevention *behavior* between

the two groups, is not supported. By contrast, H6c is supported, as we assumed no differences between the two groups and did not find significant differences between online and F2F respondents regarding their general food waste knowledge. Altogether, the social desirability seems not to be a big issue in our study; there are almost no differences between online and F2F interviews. Table 3 provides an overview of the Mann-Whitney-U tests conducted.

Table 3: Mann–Whitney-U tests for select variables

	Group	n	Mean Rank	Sig.
Food waste prevention knowledge	online	368	247.94	≤ 0.001
	F2F	102	190.60	
Food waste prevention behavior	online	368	231.51	0.222
	F2F	102	249.88	
Food waste knowledge	online	368	230.87	0.139
	F2F	102	252.20	
Food waste knowledge	rural	137	211.97	0.375
	urban	301	222.93	
Food waste knowledge	connection to agriculture	280	240.07	0.351
	no connection to agriculture	190	228.77	
Food waste knowledge	active in anti-FW initiatives	183	245.87	0.164
	not active in anti-FW initiatives	287	228.89	

Sig. = Significance

5   Discussion and conclusion

This study set out to offer some explanations for consumers' food waste knowledge and led to intriguing findings. While we found little evidence for social desirability bias in reporting one's own food waste prevention knowledge, we were surprised not to find any explanatory variables for food waste knowledge. This might be a signal, that food waste knowledge is depending on other variables not investigated herein. However, it is probably more realistic to question measurement of food waste knowledge how it was done within this study.

We also did not identify a significant difference for online and F2F respondents regarding their *food waste prevention behavior*. One explanation might be that there may be limited social backlash regarding generating average amounts of food waste, thus resulting in a limited need to present oneself in a more favorable light. Similarly, it was interesting to find that neither a personal connection to agriculture nor living in a rural region led to a significantly higher knowledge about food waste.

Even more surprising is the fact, that cooking skills obviously influence food waste behavior negatively (and again has, besides that, no influence on food waste knowledge). This is a clear contradiction to findings from literature (Graham-Rowe, Jessop, & Sparks, 2014; Porpino, 2016). At least in our sample, food trends like convenience food connected with less cooking skills and higher levels of food waste (Mallinson, Russell, & Barker, 2016) might rather not be valid. Probably, better cooking skills lead to a behavior where food is thrown away even earlier to guarantee high quality cooking. Or, respondents with higher interest in cooking (or in food and food waste) are reporting food waste more truthfully. This would correspond to Neff et al. (2015),

assuming a higher awareness of food waste. However, these are only assumptions and would have to be further investigated.

**5.1   Future research areas and managerial implications**

Our research offers some insights into the topic of food waste knowledge. As a first step beyond this study, we can envision researcher employing more complex methodologies (e.g. structural equation models) to shed more light on food waste knowledge to further our understanding of if and how consumers educate themselves regarding food waste. More generally, regarding consumer food waste as a larger research topic, we can envision several topics of interest such as linking food waste behavior to other consumer characteristics such as organic food purchases and price consciousness. In a similar vein, Porpino (2016) offers an extensive suggestion for future research avenues in the field of consumer food waste.

Additionally, our findings hold implications for legislators, producers, and retailers alike. We would argue that food waste knowledge or the lack thereof is primarily an awareness issue. In order to heighten consumer knowledge, we propose several options:

- Raise awareness on the societal and environmental impact of food waste

- Educate consumers regarding the difference between expiry dates and food spoilage

- Empower people to engage in preventive behavior – from the planning stage (e.g. writing shopping lists) to the cooking stage (e.g. cooking leftovers, pickling food)

Regarding food waste reduction in general, Priefer, Jörissen, and Bräutigam (2016) suggest numerous measures for all societal stakeholders that could result in decrease in food waste. However, as we saw from our model, food waste knowledge is not an easy to explain variable. From our initial research model, only few relations left (and some new were discovered; Figure 4), and even those are surprising to some extent (in particular, the negative correlation between cooking skills and food waste prevention behavior cannot easily be explained and needs further attention), which leads to some important limitations of our approach.

Figure 4: Evaluated research model
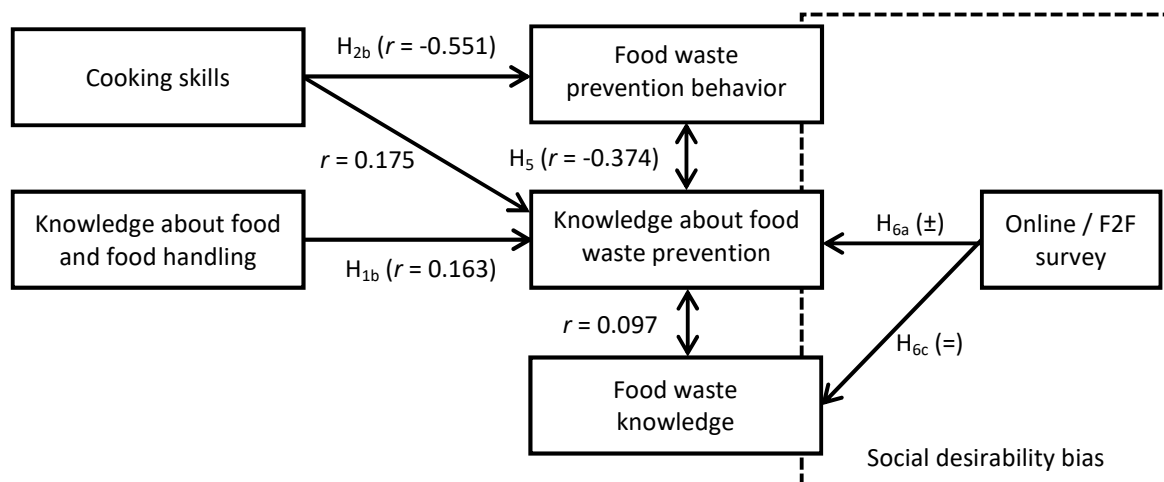
5.2   Limitations

Obviously, there are some important limitations of our study. Several questionnaire items in our survey measured self-reported knowledge and behavior. While extracting self-reported behavior is a useful tool in attempting to assess the role social desirability bias play, different modes to gauge consumer knowledge or behavior can be more appropriate to gain a more accurate representation of consumers' actual knowledge and behavior. Similarly, food waste knowledge was tested largely by administering binary (correct / incorrect) questions as it is not the intention of this study to offer a fully-fledged representative state of consumer food waste knowledge in Austria but rather to allow for a rudimentary categorization of individuals' knowledge to test it against other constructs. To accurately measure the state of consumer food waste knowledge in a way that is precise, detailed, and representative of the Austrian population, a more rigorous and thorough questionnaire design would be advisable. To overcome the self-reporting bias in research topics which can to be seen to be highly relevant for consumers (for instance, there might be high awareness because of public climate change discussion), other methods like scientific observation, dairy methods, experimental designs, might deliver more robust findings.

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