Article

Household Food Waste Awareness in Relation to Motivations

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Abstract: The current study investigates which motivations to reduce food waste influence respondents' likelihood to accurately self-assess food waste quantities. Some studies suggest that motivations to prevent household food waste influence respondents' behaviors, but others highlight that routine and daily life often represent an obstacle to acting consistently. To this end, this study observed if a certain set of motivations actually influences the perceived quantity of food waste produced; in other words, if the motivation to reduce food waste is a driver of coherent behavior and awareness. The results were drawn from weekly food diaries and then compared with online questionnaires run on a sample of 388 households. A random forest has been performed to identify the relevant variables, able to predict the food waste self-assessment. The results show that no specific motivation is related to a better awareness of food waste quantities, nor to the actual waste average.

Keywords: household food waste; awareness; quantities; attitude; motivation; diary

1. Introduction

Household food waste (HFW) has been identified as the main contributor to food waste along the food supply chain [1]. Unlike other stages in the chain, its recoverability for human consumption is low due to health and safety reasons, leaving prevention through behavioral change and recycling as the main mitigation measures [2,3]. For these reasons, the existing scientific literature on food waste (FW) focuses mostly on waste assessment and valorization at the consumer stage [4–10].

According to [1], it is expected that HFW will increase mainly in emerging countries, with a larger environmental and economic impact. Thus, identifying the determinants and motivations behind this phenomenon is of paramount importance for reducing HFW, achieving sustainable development and tackling relevant ethical and moral issues [11].

Two flows of literature have elaborated on the role that motivations play in reducing food waste. One states that a higher willingness to reduce food waste corresponds to less actual waste [8]. For instance, Ref. [12] (p. 645) report that "personal norms that are feelings of personal duty to behave in a particular way, have proven to be significant predictors of food waste, meaning that if households have strong personal norms against food waste, they tend to avoid or reduce food wastage".

Literature on the topic has identified several motivation categories as drivers or barriers to food waste reduction [13–15]. These categories include general attitudes toward food waste (such as guilt toward wasting food), environmental awareness (such as consciousness of the environmental impact of food waste), financial considerations (concerns due to over-purchasing or waste of money for food purchase), and exemption from responsibility.

Another flow of literature is skeptical about the role of motivations in reducing food waste, elaborating on the influence that the attitude–behavior gap may play [16]. This gap is common in many other pro-environmental behaviors [17]. In the food waste field, several scholars have demonstrated a discrepancy between food wasting habits and awareness of the issue [4,5,18–25]. Routine and daily life might represent an obstacle to acting coherently with a pro-food waste reduction attitude [26], as it happens for other behaviors [27].

Strictly connected to the mentioned attitude–behavior gap, there is also a methodological issue, namely the widespread use of questionnaires. Most of the existing studies (in both flows of literature) are based on the use of questionnaires only: it is consolidated in the literature that questionnaires tend to reflect frequency, availability, and/or anchoring biases [28], rather than actual food waste [29–33]. Indeed, Ref. [34] (p. 526) reported that "When a person responds to a self-report form, there is often substantial inconsistency between questionnaire responses and actual past behavior. Also, self-reports are frequently found to be poor predictors of future behavior". This is also reflected in the literature on cognitive dissonance from [35], whose theory, applied to the case of food waste and our hypothesis, may suggest that subjects could consciously or subconsciously underestimate their food waste quantities to cope with any uncomfortable feelings raised by inconsistencies between their attitudes ("wasting food is wrong") and their behavior ("I waste food"). Thus, it might be likely that people declaring to be committed to the issue of food waste reduction are more likely to deny, consciously or subconsciously, their actual food waste quantities, thus reflecting a lower degree of awareness of food waste quantities. This gains importance as the debate on how much individuals' attitudes and awareness influence actual behavior concerning HFW is still open [31].

To this end, the present study explores the extent to which the attitude detected through different motivations for reducing HFW plays a role in individuals' awareness of their own food waste quantities, and then real quantities. Specifically, the question has been formulated as follows: are motivations to reduce HFW good predictors of individuals' awareness about quantities?

To answer the research question, a comparison between the HFW quantities detected through daily filled diaries and questionnaires has been conducted. Furthermore, in order to assess the relationship between motivations and individuals' awareness, a series of independent variables have been addressed as explanatory variables of the food waste self-estimation accuracy, based on [36].

2. Materials and Methods

Data collection was conducted between May and June 2017 on a national scale in Italy. The explorative nature of the research steered the use of a quali-quantitative approach based on diaries and questionnaires. To encourage enrolment among people who were not necessarily interested in the topic (to avoid self-selection bias) and to reward people for their participation in the time- and energy-consuming survey, a shopping voucher of 50,00 euros per family was granted.

2.1. Participants

The diary survey and the CAWI (Computer-Assisted Web Interview) questionnaire were administered to a sample of 388 households. Stratified random sampling was used for the selection of participants. The strata considered were:

- geographical area of residence: north, center, or south of Italy;
- population of the city of residence (above or under 100,000 inhabitants);
- household composition (no children, children aged less than 11 years old, or children aged between 11 and 17 years old).

2.2. Data Collection

2.2.1. Diaries

This study adopts diaries to explore several aspects of household food management. Details on grocery shopping, with the option of either providing the shopping receipt or recording the details in a dedicated box, were requested. The quantity of HFW every day and for each meal was to be recorded for all family members. Leftovers were to be weighed using a scale or, if absent, using kitchen tools as a proxy (e.g., a spoonful, a cupful, etc., as listed in the instructions). Finally, respondents were asked to highlight whether any unusual circumstances had affected their routine habits related to food consumption. The last page of the diary requested details on a final clearing out of the fridge and pantry at the end of the week, for which respondents were to record any food bought during the week that had not been consumed and that was no longer going to be consumed. Information requested about the products thrown away included the type of products, their brand names (where possible), reasons for waste, and quantities wasted (open-ended question).

In addition, respondents were asked to select a single response to multiple-choice questions on the following: manner of disposal (mixed garbage, organic waste, sewer, given to pets, or other) and type of product (frozen, tinned, fresh, takeaway, or home-cooked meal). Meals consumed away from home during the week (e.g., in canteens, restaurants, etc.) were not included in the diary, while meals purchased outside but consumed at home were. The latter included takeout meals consumed at home.

2.2.2. Questionnaires

A CAWI questionnaire was sent to respondents two weeks after the end of the diary survey. The questionnaire was composed of 23 questions. Out of these, questions 15 and 16 (hereafter Q15 and Q16)-which were to be answered on Likert scales 1–5 where 1 corresponded to "fully disagree" and 5 "fully agree" (see Table 1), were designed to investigate motivations, so only these two questions will be analyzed in depth. The results of the general questionnaire have been published in [31].

Table 1. Questions concerning motivations that can encourage or discourage HFW reduction.

Q15: Among the following options, which would encourage you to reduce food waste?
a.   Reducing the environmental impact of my lifestyle b.   Reducing food inequality/insecurity in the world c.   Saving money d.   Managing my home more efficiently e.   Relieving guilt associated with throwing away food f.   Eating healthy
Q16: Among the following motivations, which discourages you from reducing your food waste?
a.   There are more important issues to care about b.   I do not believe that my food waste costs me significantly in economic terms c.   I do not believe that wasting food has a negative impact on the environment d.   I need to buy a lot of food to be sure there is enough of it at home e.   My children do not eat all their food f.   I do not know how to reduce my food waste

The digitalization of the dataset was performed in Limesurvey.

In the questionnaire, respondents were asked to select an option that best represented their waste quantities from the following: 0–200 g, 201–500 g, 501–800 g, 801–1000 g (1 kg), and more than 1000 g (1 kg). A respondent's selection, which represented self-assessment by declaration, was compared to his or her average food waste quantities as estimated from the diary survey. In Q15, a first set of motivations to be graded through a Likert 1–5 scale was proposed to the respondent: these motivations ranged from ethical and environmental aspects (environmental, food access, guiltiness) to more individually driven motivations

(savings, healthy diet, home management). Despite analyzing all of them, we focused our attention on Q15a and Q15e (see Table 1), as they are openly mentioning the sense of guilt or environmental impact as motivations to reduce food waste. The sense of guilt might reveal the cognitive dissonance if the respondent assigns a high score to this answer, but his/her average food waste does not differ from the sample or those who assign a lower score (our hypotheses). The environmental impact might drive more conscious behavior, thus a higher awareness of quantities or a reduced waste average compared to those who state that they do not care.

A second set of independent variables (Q16) assessed which motivations could discourage the reduction in food waste. These motivations range from a perceived lack of relevance of the food waste issue in terms of its impact in economic, individual and environmental terms, to practical issues such as the need of buying enough food for self-consumption and lack of knowledge on how to reduce food waste production.

2.3. Data Analysis

As a result of the combined methodology adopted in the present study, the final set of data includes information on the quantity and type of HFW, as well as information on participants' food-related attitudes and shopping behavior.

Data analysis was conducted using the software *R*.

The first step of the data analysis consisted of creating classes of respondents depending on the accuracy in assessing food waste quantities. Three classes were created by comparing the values declared in questionnaires with the specific food waste quantity that emerged from diaries. The three classes were: (i) Respondents who stated that they wasted more than their actual waste, i.e., overestimated their food waste.; (ii) Respondents who stated that they wasted the same as their actual waste, i.e., accurately assessed their food waste; and (iii) Respondents who stated that they wasted less than their actual waste, i.e., underestimated their food waste.

The first part of the analysis focused on the relationship between attitude variables (items in Q15 and Q16) and the waste quantities of the class of respondents who accurately assessed their food waste quantities. Specifically, non-parametric tests (Kruskal–Wallis H test and Mann–Whitney U test) were used to verify whether waste behaviors varied based on different levels of the attitude variables. These tests were used because the hypotheses of normality and homoscedasticity were not satisfied.

The next step was to jointly consider the entire set of motivations to identify which, if any, were relevant in predicting the degree of accuracy of self-perception of food waste (the dependent variable), and to identify the nature of the relationship. For this purpose, we used machine learning techniques (random forest). This non-parametric, inductive-learning technique—in addition to the generation of predictive models—allows us to identify which variables are relevant in predicting the dependent variable in question. The use of predictive accuracy, however, is not appropriate when the data are unbalanced [37], as was the case with our study (the class of respondents who overestimated their waste is much smaller than the class of respondents who underestimated their waste). There are a few solutions to this problem, which include over-/under-sampling or the development of a specific misclassification cost function. In our case, given the structure of the sample, a synthetic minority over-sampling technique (SMOTE) was selected to solve the problem [37]. Using the sample, new data were generated through the SMOTE procedure and used as input for the construction of the random forest. The classification rules produced by the model were tested on the original sample to assess the models' actual predictive capacities, and hence their ability to describe existing relationships between the explanatory variables (attitudes) and dependent variable (self-assessment of waste). Random forest, through the SMOTE, provided an accuracy of 0.98 (with a recall $\geq$ 0.95 for all classes).

3. Results

The three groups identified were compared against the attitude variables in order to assess whether one or more of these variables can predict an accurate perception of one's own food waste. Averages are presented on the per family and per capita levels (Table 2).

Table 2. How much food do you think your family wastes per week? (Awareness of average food waste quantities).

			Edible Food Waste per Family		Edible Food Waste per Capita	
	Number of Households	Percentage (%)	Mean (g)	St. Dev.	Mean (g)	St. Dev.
Stated more than actual waste (overestimated)	28	7	335.5	253	147	112
Stated the same as actual waste	65	17	419.0	441	179	151
Stated less than actual waste (underestimated)	295	76	1486.0	1089	644	481
Total	388	100	1224.0	1075	530	470

Edible food waste: Kruskal–Wallis chi-squared = 142, df = 2, *p*-value < 2.2×10^{-16}. Edible food waste per capita: Kruskal–Wallis chi-squared = 138.63, df = 2, *p*-value < 2.2×10^{-16}.

As shown in the table, the average food waste for respondents who overestimated their food waste was 335.5 g per week, while the average for respondents who underestimated their waste was 1486 g and the differences are significant (*p*-value < 2.2×10^{-16}). However, only 28 respondents overestimated their waste, compared to the 295 respondents that underestimated their waste.

The three classes of respondents, therefore, represent our dependent variable, while the attitudes define a matrix of explanatory variables.

3.1. Extent to Which Motivations Are Related to an Accurate Awareness of Food Waste Quantities
3.1.1. Motivation to Reduce Food Waste

The overall value assigned by respondents to the question on the motivation to reduce food waste was between 3.7 and 4.5, reflecting positive attitudes of all respondents toward all listed motivations. Of all the listed motivations, statistical significance of any form was detected only for the "manage home efficiently" motivation, to which respondents who overestimated their waste (N = 28) assigned significantly lower values of importance (*p*-value < 0.05).

Based on our hypothesis, we expected a sense of guilt (Q15e) to be a driver of cognitive dissonance. In other words, we expected respondents who assigned a high value of importance to this motivation to deny wasting food more than other respondents. On the contrary, we observed that respondents who underestimated their food waste (N = 295) assigned lower importance to this motivation (average value = 3.4). Another assumption that was tested relates to whether respondents who stated that they were worried about the environmental impact of their lifestyle paid more attention to food waste and thus displayed a higher awareness of their waste quantities (Q15a). The results showed that respondents who underestimated their food waste assigned high importance to this motivation. Indeed, 44% of these respondents assigned the highest level of importance (5) to this motivation, but their average waste was similar (and not significantly different, *p* = 0.8) to those who assigned a lower value. Indeed, in this case, we might assume that environmental motivation is not a driver of less waste for those who underestimate their waste quantity (N = 295).

However, as shown in Table 3, only in the case of respondents who overestimated their food waste (N = 28) there was a significant difference (KW *p*-value = 0.03) in the food waste quantities between those who assigned a "5" to this motivation (186 g on average) and those who assigned a lower value (385 g on average). Namely, the environment can be considered a driver of less waste for those who overestimate their food waste. No significant differences were recorded in the class of respondents who accurately estimated their food waste quantities (*p*-value = 0.06).

Table 3. Wilcoxon test for difference in environmental motivation.

	Average Food Waste (g/Household/Week)			Wilcoxon Test	
	Q15a Recoded				
	<5	**5**	**Total**	**W**	***p* Value**
Overestimated food waste	385	186	335	113	*p* < 0.05 *
Accurately estimated food waste	437	385	419	607	*p* < 0.10
Underestimated food waste	1482	1492	1486	10,534	*p* < 0.10
Total	1186	1280	1224		

Question Q15a: Reduce the environmental impact of my lifestyle was recorded as dichotomous with classes: (<5) for values less than 5; (5) for values equal to 5 since more than 70% of the answers had values of 4 or 5 and were, thus, not discriminating. * This value is statistically significant (KW *p*-value = 0.03).

3.1.2. Motivations Not to Reduce Food Waste

Respondents who overestimated their food waste quantities assigned higher values to all motivations except for Q16f ("I do not know how to reduce my food waste") compared to other respondents. Additionally, they assigned significantly higher values to Q16a ("There are more important issues to care about") (KW *p*-value = 0.00). Respondents who underestimated their food waste quantities, on the other hand, consistently assigned lower values to all motivations except for Q16a and Q16d ("I need to buy a lot of food to be sure there is enough of it at home") (See Figure 1). With reference to the motivation in Q16c ("I do not believe that wasting food has a negative impact on the environment"), the waste difference between respondents who overestimated their food waste and those who underestimated their food waste was statistically significant as well (KW *p*-value = 0.03). No other differences were found to be statistically significant (*p*-value > 0.05).

3.2. Random Forest

The model built with the random forest technique was able to provide good predictions of the dependent variable. In other words, the model accurately captured relationships between the explanatory variables and the dependent variable (Figure 2).

The variable that most effectively allowed for discrimination across the three classes of the dependent variable was Q16a, followed by, in order of diminishing importance, Q15a, Q16c, and Q16f.

To analyze the relationship between our target variable and the explanatory variables, we used the partial dependence plots (Figure 3). This kind of plot allows for the visualization of the marginal effect that one or two features (the explanatory variables) have on the expected result of the model.
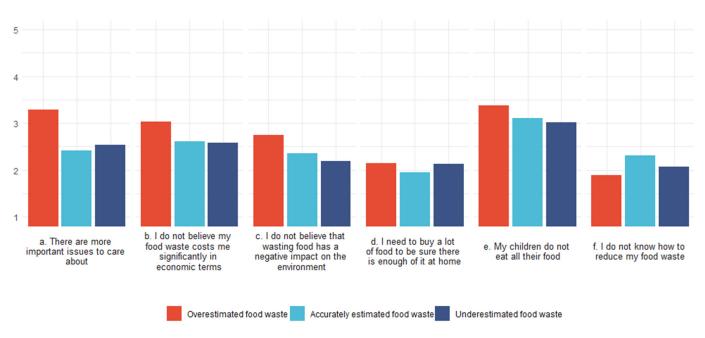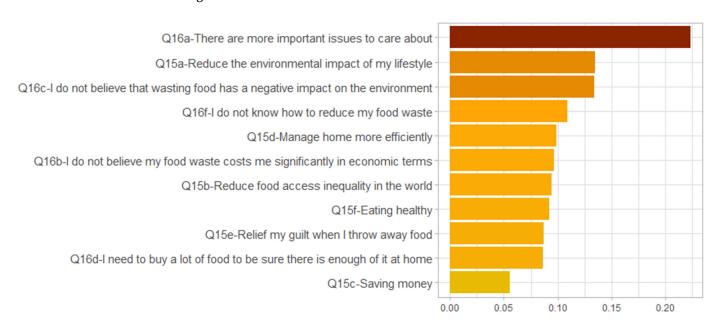
Figure 1. Motivation NOT to reduce food waste.

Figure 2. Variable importance measured via random forest. The variable Q16a (red bar) allows for discrimination more than other variables.

In particular, in Figure 3, we can observe what is the probability of belonging to each of the classes of the dependent variable (class of self-perception of waste) as the explanatory variable varies (Q 16a: there are more important issues to care about). We can highlight that there is a non-linear relationship between the two variables: we can see that as the importance given to the statement "there are more important issues to care about" increases, there is not a constant increase or decrease in the probability of belonging to one of the classes of the dependent variable.
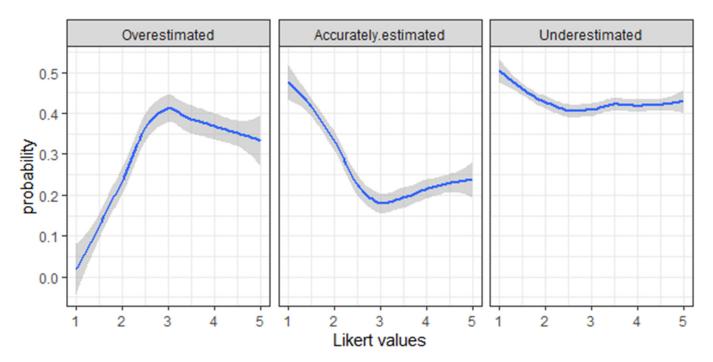
Figure 3. Partial dependence plot. Q 16a: there are more important issues to care about. On the x-axes, Likert values are reported. On the y-axes, the probability of belonging to one class is shown.

However, it is also true that those who agree with this statement are more likely to have a correct self-perception of their own waste, while those who even partially agree are more likely to fall into the class of those who waste more than they think. In other words, those who think that there are more important issues to care about than food waste have a correct perception or also overestimate their food waste (boxes 2 and 3 of the partial dependence plot). Those who express more concern about food waste most probably fall into the class of those who underestimate it, partially confirming the initial assumption of this paper: a more stated concern toward food waste corresponds to less awareness about own quantities.

4. Discussion

Consistent with previous studies, most respondents (323) in the sample observed (N = 388) were unable to accurately assess their food waste quantities produced over the course of one week. Out of all respondents, 295 underestimated their food waste, while 28 overestimated it. Interestingly, inaccuracy in assessing actual food waste quantities occurred even though respondents had filled out the diary survey three times a day for an entire week only a fortnight earlier. In the diary survey, respondents had to weigh all the food they wasted; therefore, we assumed that respondents would have absorbed, either consciously or subconsciously, some awareness of their overall waste quantities. Since the results showed that this assumption does not hold, the present paper has been conceived with the aim to investigate the variables influencing respondents' likelihood of accurately self-assessing their food waste quantities and drivers.

We decided to observe if there were differences in attitudes among the three groups of respondents: those who overestimated their food waste (N = 28); those who accurately assessed their food waste (N = 65); and those who underestimated their food waste (N = 295). According to part of the literature on cognitive dissonance [35], we expected those who underestimated their waste to show a higher commitment to altruistic motivations, namely environmental and ethical causes. In this sense, we expected to observe traits alluding to feelings of cognitive dissonance [35], which would push these respondents to, consciously or subconsciously, underestimate their food waste quantities to cope with any uncomfortable feelings raised by inconsistencies between their attitudes ("wasting food is wrong")

and their behavior ("we waste more than 1 kg per week on average"). Instead, we observed that all respondents assigned high importance to all the listed motivations, though those who underestimated their waste assigned lower values of importance to ethical motivations compared to the other two classes of respondents.

With reference to environmental motivations, only respondents who overestimated their food waste (N = 28) displayed a significantly lower food waste average (186 g) when they assigned the maximum value of importance to this motivation ("5") compared to when they assigned lower values. However, all respondents assigned high values of importance to these motivations as well.

With regard to negative motivations, respondents who overestimated their food waste (N = 28) stated that "there are more important issues to care about", and they were significantly more likely to select this option compared to other groups. Respondents who underestimated their food waste (N = 295) showed a greater commitment to the food waste reduction cause. They also tended to respond "none of the options" regarding their motivation to commit to reducing their food waste. However, it could be argued that respondents who overestimated their food waste were not really concerned about food waste reduction and thus had no issues recording higher food waste quantities. We considered the possibility that the provided motivations were not "representative" of all possible motivations and attitudes that could explain the phenomenon; in other words, that the observed discrepancy was rooted in the questionnaire itself. To test this, we ran a random forest model, but the results showed an 87% ability to capture the phenomenon through the items provided, so this hypothesis has been discarded.

As Ref. [38] explained, people's beliefs and intentions are not sufficient to determine behaviors. More precisely, downstream interventions such as providing information or changing beliefs are effective when the behavior to be changed is not or is rarely habitual. Consistent with previous findings in the studies that applied TPB to food waste [39,40]— and contrary to findings reported by [8,12,41]—the results of the current study indicate that a gap exists between motivations toward food waste and awareness of food waste quantities. In other words, if households show strong personal norms against food waste, they will declare it through questionnaires, but their actual food waste, measured through diaries, will be higher than those who show less commitment. Hence, through this result, we partially confirmed our initial hypothesis of observing traits of cognitive dissonance for those who state to care about food waste.

Ref. [42] noted that our attitudes are affected by our beliefs, and that "only beliefs that are readily accessible in memory influence attitude at any given moment" (p. 30). This implies that attitudes toward issues such as food waste are likely dictated by foreground beliefs that are carried and tended to on a daily basis. Those who hold stronger beliefs about their position on food waste may therefore be more inclined to reflect on their attitudes and behaviors in this regard, resulting in the construction of a self-perception that reflects their beliefs, but is not coherent with actual actions. As the findings suggest, the strength of such beliefs and attitudes is separate from the ability to objectively measure one's food waste. It is also possible that respondents' answers were influenced by desirability and positive illusion biases. Perhaps, respondents only tried to guess what the investigator was expecting [43], showing a high trait of desirability and positive illusion biases. As individuals, we want to believe that we possess above-average attributes, as these are required to make us above-average individuals [44]. Even when we are aware of undesirable traits or social positions, we connect them to the common standard (i.e., we believe they are common negative traits/positions), whereas we exaggerate the uniqueness of our positive qualities and stances [45]. Whilst it is possible that this phenomenon is due to self-serving bias, due to the overt tendency to perceive one's own actions more favorably [46] with food waste being a value-laden issue, the positive illusion bias could stem from the desire to congruently integrate one's beliefs with one's behavior.

4.1. Contributions and Implications of the Study

The main contribution of this study is (i) to present and discuss an investigation of the variables influencing respondents' likelihood of accurately self-assessing their food waste quantities; and (ii) to identify drivers and motivations, or categories of motivations, that are able to predict a higher awareness of food waste quantities produced at home.

The findings of the study have two major implications. Methodology-wise, a majority of HFW studies conducted through the means of questionnaires are based on the underlying mainstream assumption that the respondents will give honest responses. However, the inconsistencies between attitudes and actual behavior might indicate that we are dealing with the "fallacy of conscious choice" [43], leading the respondents to rationalize their motives, therefore falsifying their responses in order to make them more coherent with their beliefs despite their actual behavior. This poses strong implications with regard to food waste analysis methods, as it reveals significant limitations of questionnaires not only in relation to exact quantities, but also in relation to the nature of the relationship between attitudes, motivations, and awareness.

Given the highlighted inconsistencies, is the use of questionnaires reliable in detecting true consumer attitudes? It is our strong recommendation that future questionnaires rely on theories of measurement construction and psychometrics to enhance the ability to capture discrepancies relating to differing forms of bias and dissonance in responses. Coupling them with other methods—such as diaries and waste audits, but also qualitative-based methods such as ethnographic observations—might help to better capture the daily context and routines that surround food waste. An interdisciplinary dialogue with sociology and economics could be of further help, as food-related habits are part of a neoliberal economic regime that involves alienation from the process of production, as outlined by [47]. Such alienation might exacerbate emotional distance from the food itself, resulting in more waste.

Ultimately, questionnaires that lack the sensitivity to capture positive illusion bias run the risk of encouraging misplaced efforts in policy work. This is accentuated by the findings of the present study, which indicate the absence of a relationship between attitudes/motivations toward food waste reduction and awareness of food waste quantities.

From a policymaking perspective, the implications relate to the mitigation measures toward which states and governments decide to invest money and effort in fulfilment of SDG 12.3. For instance, awareness-raising or education campaigns are most often mentioned as principal actions against food waste, but do they really have the power to influence consumers' actions and awareness about their food waste? Or does an increase in commitment toward food waste reduction, achieved through an increase in awareness of the problem, really equate to lower food waste quantities? Findings from the present research contribute to existing studies analyzing the impact of interventions [48–50]. Indeed, the study contributes inductively to exploring the link between attitudes toward food waste, actual food waste quantities, and the power of awareness-raising campaigns on the consumer.

4.2. Limitations and Future Research Avenues

The present research does not come without limitations. The main limitation of this study is that "actual" quantities are based on diaries: the reader must keep in mind that actual waste quantities are best measured through garbage audits, as diaries also tend to underreport waste quantities when compared to waste compositional analysis [51]. In our preliminary study [30], the recorded difference was 23%, but other studies observed up to 40% [36]. However, the diary method provides an opportunity to gather information across a larger, more geographically distributed sample and with fewer human resources compared to the waste analysis method. Other advantages of using diaries over waste compositional analysis were discussed by [52–54].

A crucial question to be answered by future research relates to food waste reduction policies, considering that most respondents were not aware of their own food waste quantities, despite being sensitive to the issue, thus showing no real control over their behavior.

Indeed, contrary to previous studies [55], filling out a food waste diary for one week still did not make participants in our study more aware of their waste quantities, though we cannot exclude that waste quantities were reduced during the week of observation due to a progressive exposition bias, as in our pilot study [30].

Awareness-raising campaigns targeted at consumers are the most commonly used measure in encouraging food waste reduction in many countries. In Italy, awareness-raising campaigns are one of the few funded measures against food waste [56]. The underlying rationale behind this choice is that food waste is within an individual's responsibility and control. This focus on the individual has already been highlighted by many authors, and its critics stress the importance of structural variables—such as family obligations, how food is retailed, etc.—that are out of the individual's control and that widen the value–action gap [4,7,57]. The current study supports this direction in the literature. Perhaps, measuring the long-term effectiveness of awareness-raising campaigns through reliable methods (such as waste audits) should be the next step. Hopefully, the messages of these campaigns can be updated according to scientific evidence on actual drivers, keeping in mind the contextual factors that affect individual actions.

5. Conclusions

The present work focuses on the analysis of household food waste in terms of respondents' accuracy in self-assessing food waste quantities, which motivations and drivers are influencing food waste reduction habits, and if these drivers can predict higher levels of awareness of household food waste production. The study represents an important step in the field of food waste analysis since it highlights methodological implications regarding its assessment. In particular, the results showed that the majority of the respondents significantly underestimated their food waste production when compared to the food waste quantity information collected through diaries. This implies that questionnaires on food waste assessment have several limitations in detecting the real data on household food waste. The work has also tried to define some explanatory factors of this lack of accuracy through the different drivers influencing the reduction in food waste. These drivers enable us to assess the different levels of commitment regarding environmental and ethical aspects. The results showed that different levels of commitment do not imply differences either in the perception of food waste production nor in the food waste quantities. This paper then definitively confirms that environmental and ethical concerns are not necessarily representative of virtuous behaviors in terms of food waste prevention.

Author Contributions: C.G. coordinated this study by working on its conception and design, assisted in the acquisition and interpretation of data and drafted the manuscript. F.A. coordinated the acquisition and interpretation of data, performed the statistical analysis and co-drafted the paper. S.R. participated in the interpretation of data and revised the manuscript. G.D.F. assisted in the interpretation of data and co-drafted the manuscript. E.C. assisted in the interpretation of data and co-drafted the manuscript. L.F. contributed to the study from its first inception, assisted in the acquisition and interpretation of data and participated in revising the manuscript. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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