

Consumer approach to food waste: evidences from a large scale survey in Italy

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Abstract

In the EU 89 million tons of food are wasted every year, the largest fraction of which at the household level. Despite the key role of consumers in waste production, their approach to food waste has not been deeply analyzed so far. This paper aims at exploring the consumer attitude towards food waste, by analyzing the results of a survey held in two Italian cities in 2014, focused on the extent and reasons of the household food waste, and on consumers' perception of effects and possible remedies to food waste.

The results highlighted a general awareness of the effects of food waste, although the perception of such effects was more developed when they directly concerned the consumers. The main reasons of food waste declared by the respondents were the mismanagement of expiration dates, over-purchase, over-cooking, and a lack of knowledge about how to reuse the leftovers.

A cluster analysis was conducted to identify consumer profiles with a similar approach to food waste. Such profiles were then analyzed across the two samples in order to check for possible overlapping, which could lead to a careful generalization of the results. Namely, we found 4 consumer profiles, named as "careful", "virtuous", "aware" and "unconcerned", in both the samples analysed.

Despite the many limitations of this very first analysis on household food waste, some interesting insights emerge, which might be usefully deepened in order to design effective strategies against food waste.

Keywords

food waste; cluster analysis; consumer behavior

Introduction

Waste is a major social, nutritional and environmental issue, known in Europe, as well as overseas, as a huge challenge to be faced in the management of food systems. In the EU alone, 89 million tons of food are discarded every year, i.e. 179 kg per person (EC, 2011a).

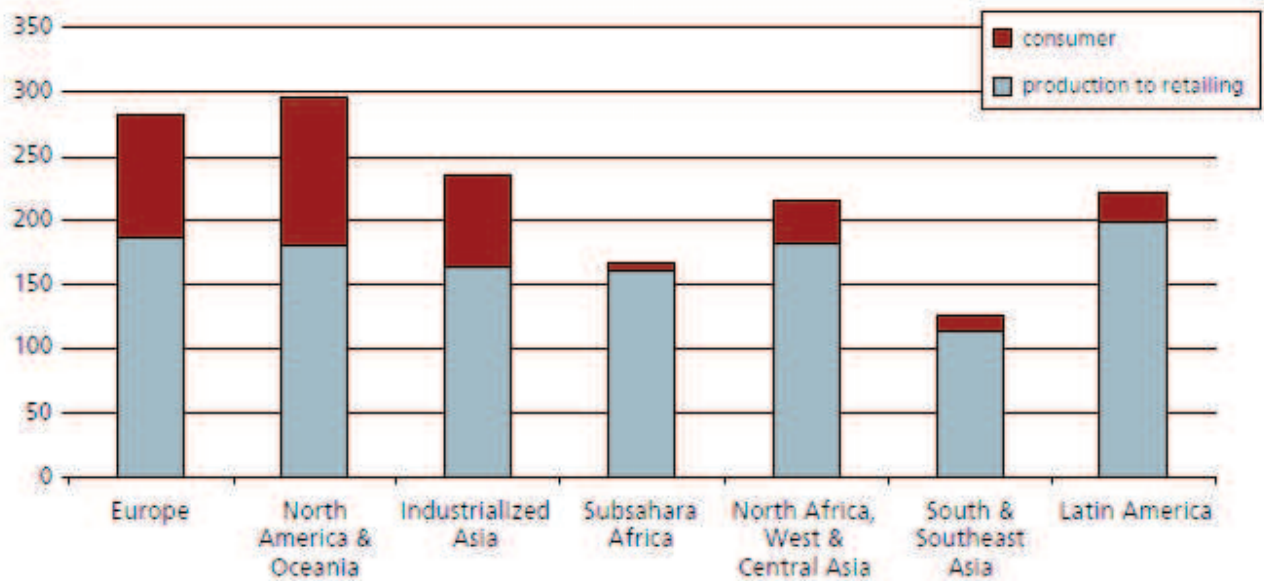
Waste occurs for different reasons: fruits and vegetables are left to rot in the fields because of structural and cyclical surpluses; food is discarded at industry and retailer level due to economic or commercial reasons as inappropriate storage, change of image of a particular brand, damaged packaging, seasonal goods, residues of promotional activities, non-compliance with physical-aesthetic standards, close expiry date; at catering and household level due to planning mistakes, too large portions, wrong shopping behaviors, unclear labels. More in general food waste can be caused also by the lack of appropriate technologies, difficulties in food management, lack of proper legislation and, last but not least, consumers' behavior (Gustavsson et al., 2011; Segré and Falasconi, 2011). The EU estimations show that - without the implementation of preventive actions or reduction measures - food waste will rise to approximately 126 million tons (a 40% increase) by 2020 (EC, 2011b). Reducing food waste is one of the goals in the Roadmap to a Resource-Efficient Europe. Indeed, the food value chain in the EU is responsible for 17% of Europe's direct greenhouse gas emissions and 28% of its material resource use (EC, 2011b), thus a reduction of the amount of food waste may limit the extent of the social, economic, nutritional and environmental impact of the food chain as a whole.

The extent of food waste within a food system is closely linked to the local socio-economic context and to the features of the food system itself, namely to the crop production choices and patterns, the structure of the distribution channels, the purchasing behavior of consumers and their food use practices both at and outside home (Gustavsson et al., 2011). Buzby and Hyman (2012; p. 563) provide a comprehensive list of the causes of food waste at the three main stages of the food chain, namely the production, retail and household. With the exception of a few (damage by insects, rodents, birds or microbes, losses due to unfavorable climate), all these causes may be traced to human intervention in the food chain, to how food is handled or marketed, and to the consumption habits of people both at and outside the home (Sonnino and Mc William, 2011; Engstrom and Carlsson-Kanyama, 2004).

Consumer have a key role in the generation of food waste: in the EU, as much as 42% of the total food waste, i.e. about 38 million tons, is produced at the household level (EC, 2011a; Gustavsson et al., 2011). The key role of consumers in the generation of food waste particularly emerges in industrialized countries, whilst in developing countries up to 98% of the total food losses occurs in the production and retailing stages (Figure 1) although a lack of clarity over the definition of food waste (particularly considering its distinction from by-products) among different States makes this estimate fragile (EC, 2011a).

The food lost at the consumption stage is a direct consequence of the consumer purchasing and eating behavior, while this is not the case for the other stages of the supply chain, where much food is discarded due to other reasons not linked to human action. This makes particularly interesting the analysis on household food waste, as there are large opportunities to reduce it. Indeed, many of the causes of food waste can be prevented through information campaigns addressed both to the consumers and to the other participating the food chain, with the aim of increasing the awareness over food waste and educating the food chain actors to a stronger commitment to limit its extent (Ziegler and Floros, 2011; Gustavsson et al., 2011; Parfitt et al., 2010).

Figure 1 – Extent of food losses and waste (kg/per capita)



Source: Gustavsson et al., 2011

Some efforts have been made to this respect. Improved food labelling and innovative packaging that makes it possible to extend the shelf life of products (Parfitt et al., 2010), European initiatives such as the 2014 “Year against waste” and efforts of companies like WRAP (www.wrap.org.uk) and Last Minute Market (www.lastminutemarket.it) to support institutions and firms in the food chain to reduce their food waste, are just a few examples of a wider movement against waste which is gaining interest and favor in the public opinion.

Objective

This paper aims at exploring the consumer attitude towards food waste, by analyzing the results of a survey held in Italy in 2014. Indeed, the public opinion seems to be increasingly concerned about food waste, its generation and the possible strategies for its reduction. However, despite the general claim for the reduction of food waste, it is not clear whether consumers realize that the largest part of the waste occurs at their households. With this study, we aim to understand their perception of food waste, by analyzing the factors underpinning such perception.

Method

Consumer attitude towards food waste was analyzed basing on data retrieved through a direct survey. We conducted the same questionnaire in two different Italian cities, Bologna and Viterbo, with the aim of obtaining more reliable results, as the two towns are located in different areas of the country, they are different in dimension and socio-economic context, but they both host ongoing projects against food waste. The questionnaire was administered

at supermarkets belonging to the same chain, between April and June 2014 in Bologna and on November 2014 in Viterbo. In both cases consumers were approached after completing their purchases; participants were sorted according to their age, in order to limit the sample to the range 18-60 years old. Indeed, according to a previous survey conducted by Waste Watcher (2013), people in the working age are those who are most likely to waste food. A convenience sampling was applied: this technique is well-suited for exploratory studies, as it provides a gross estimate of the result, although it remains a non-probabilistic sampling method (Guerrero et al., 2010).

In order to avoid possible bias due to the influence of the interviewer, respondents were asked to self-fill the questionnaire. Indeed, since food waste is an awkward topic, it is likely that respondents may feel judged while declaring the food wasted at their household. This feeling may be reduced by leaving people their privacy while filling in the questionnaire, although it cannot be excluded that the answers of some respondents might be conditioned by the tone of the questions.

The questionnaire was organized in 5 sections concerning:

food purchasing behavior;

extent and types of food discarded in the household;

evaluation of the motivations, effects and remedies of food waste;

personal attitude towards food waste;

socio-demographic data.

The questions of section 2 and 3 required the respondent to self-estimate, on a Likert scale ranging from 0 to 10, the extent of food waste at home, the importance of the motivations, the effects of food waste and the effectiveness of the possible remedies. Instead, sections 1 and 5 were made up of closed-ended questions. Section 4 was aimed at understanding the personal attitude of the respondent towards food waste by asking whether he/she would eat the peel of an apple and a wizened, bruised or rotten fruit.

In total, 1,188 questionnaires were collected, 938 of which in Bologna and 250 in Viterbo. Data were recorded in a Microsoft Excel database and then cleaned up in order to delete statistical units with missing values and/or contradictory answers¹. Thus, the final database was made up of 1,012 units, out of which 787 from Bologna and 225 from Viterbo.

The data were been analyzed with common descriptive statistics, in order to compare the features of the two samples. Then, a cluster analysis was carried out on each of the two samples, with the aim of identifying the profiles of consumers with respect to their approach to food waste. To this objective, four sets of variables related to food waste were considered: type of food waste (8 variables), motivations (7), perception of the effects (7) and remedies (9). A hierarchical k-means clustering technique was applied and the number of groups was decided basing on the analysis of the cluster dendrogram. Each group was then interpreted and named according to the centroid values of the clustering variables.

The groups obtained in the two samples were finally compared to each other with the aim of searching possible correspondences among the consumers profiles.

¹ Namely, the answers by 11 statistical units were considered contradictory because they declared to eat the rotten fruit but to throw out the peel.

Results

As a first step, the demographic features of the samples were studied (Table 1). In both the samples the majority of the respondents were women, representing about two thirds of the total. Respondents from Bologna were quite younger than in Viterbo, where the oldest age group was the most frequent. As for the education, in the sample from Bologna a significantly quota of consumer with higher levels was observed, as half of the sample owns a university degree. The composition of the household was very similar across the two samples, although in Viterbo the frequency of singles was quite higher than in Bologna. Finally, concerning the monthly income of the households, respondents from Bologna declared a higher income than in Viterbo. This result could however be expected given the historical disparity in the economic situation among different areas of Italy, with the regions of the North often being in better conditions; moreover, it should be considered that Bologna is one of the largest Italian cities, with 380.000 inhabitants and a density of 2.742 people/sqm, whilst Viterbo is a medium-sized town located in a rural area, with a total population of 67.000 people and a density of 167 people/sqm. Such structural differences may partly explain the different economic development of the two areas.

Table 1 – Demographic features of the two samples

Demographics of the sample	Quota of the sample from Bologna (n=787)	Quota of the sample from Viterbo (n=225)
<i>Gender</i>		
Male	36.3%	32.4%
Female	63.7%	67.6%
<i>Age</i>		
18-25	28.3%	11.3%
26-39	45.5%	33.5%
40-60	26.2%	55.2%
<i>Education</i>		
Primary	0%	0.9%
Low secondary	5.1%	17.8%
Upper secondary	44.9%	49.8%
University degree	50.0%	31.5%
<i>Components of the household</i>		
1	11.8%	20.0%
2	26.3%	31.1%
3	26.8%	26.7%
4	26.6%	34.2%
> 4	8.5%	13.3%
<i>Total monthly income of the household</i>		
< 1.000 €	6.0%	20.0%
1.000-1.500 €	19%	31.1%
1.500-2.000 €	18.3%	24.4%
2.000-3.000 €	29.1%	15.1%
3.000-4.500 €	17.3%	5.3%
4.500-6.500 €	5.2%	0.4%
> 6.500 €	5.1%	3.6%

As for the food purchasing habitudes, in both samples the majority of the respondents was used to purchase food at supermarket or hypermarkets (69% in Bologna; 57% in Viterbo), mostly once a week (45% of cases in Bologna; 38% in Viterbo). Food purchases came out to be highly affected by promotions: the average scores given by the respondents were 6.5 in Bologna and 7.2 in Viterbo (where 0=purchases not affected at all by promotions, and 10=purchases highly affected by promotions).

Then, the answers concerning the food wasted at home were analyzed. The self-evaluation of how often the respondents throw food away at home provided in general very low scores, both for cooked and uncooked food items (Table 2).

Table 2 – Frequency of food waste in the two samples

How often do you throw out...	Average score in the sample from Bologna (n=787)	Average score in the sample from Viterbo (n=225)
Uncooked food	2.33	2.31
Cooked food	1.98	2.48

Source: own elaboration on survey data

This could either be due to an underestimation of the food wasted in the household or to a real low frequency of throwing out food. However, the average scores observed in the two samples were very similar for uncooked food, whilst the respondents from Viterbo declared a higher waste of cooked food.

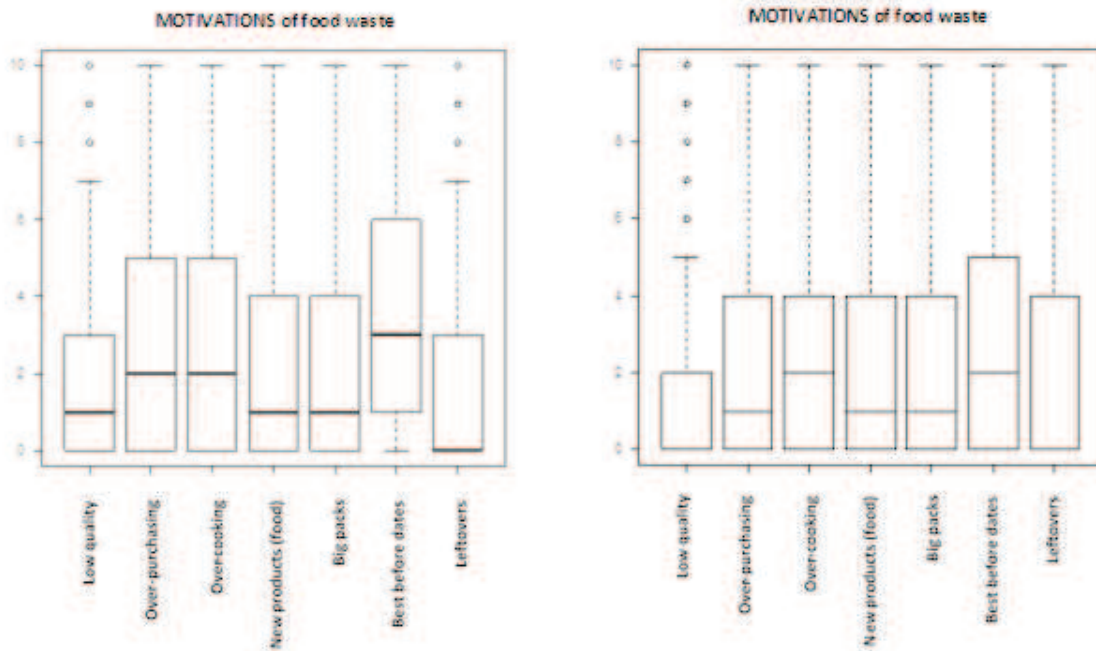
According to the answers of respondents, the discard of fresh products such as bread and vegetables was the most notable among all the food items. However, there was a high heterogeneity among the answers, with many outliers. Average scores were indeed quite low for all the food categories included in the questionnaire.

The main reasons for wasting food were quite similar among the two samples. The main declared reason for food waste was the management of best-before dates, with many food items thrown out because they have gone out of date. This might be due to a limited attention to the information reported in the labels, or to a lack of knowledge about the real meaning of best-before dates. Other significant motivations for food waste, which particularly emerged in the sample of Viterbo, were over-purchasing and over-cooking (Figure 2).

Consumers were also asked to rate the importance of the effects of food waste, and the answers to these questions showed that they were well aware of such effects. The average and median scores were indeed very high for most of the options proposed (Figure 3).

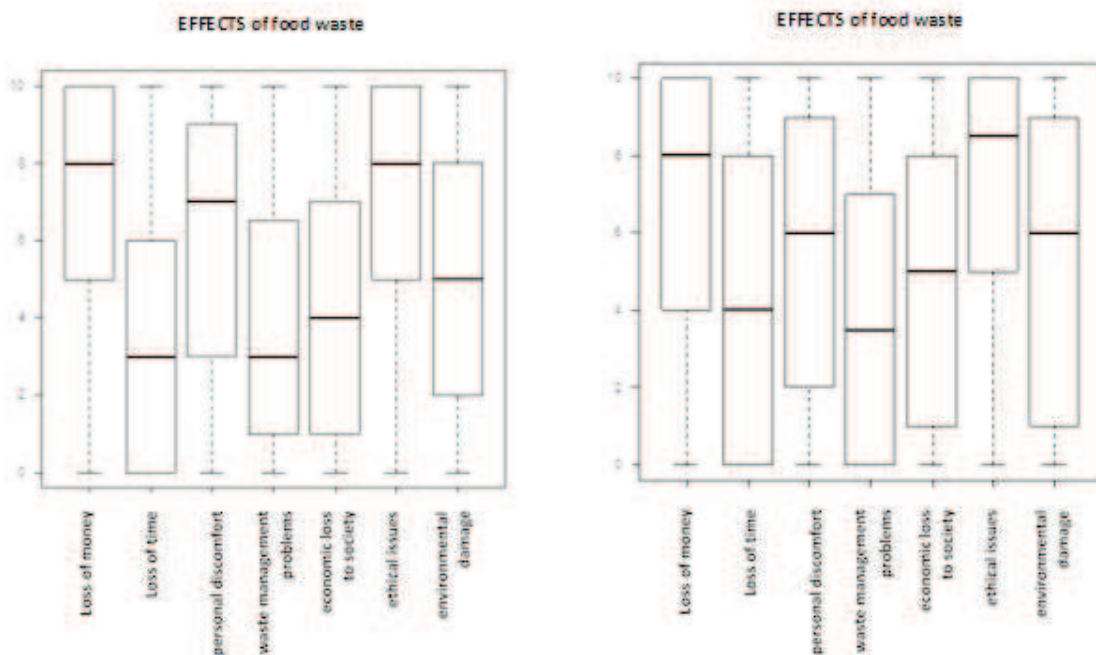
However, the awareness of such effects was more developed when consumers directly perceived the impact. Namely, consumers ranked as very important the issues related to loss of money and personal discomfort linked to throwing away products that might have been used by others, but ethical issues related to food waste were also strongly perceived by the respondents of both the samples.

Figure 2 – Motivations of food waste (Bologna on the left, Viterbo on the right)



Source: own elaboration on survey data

Figure 3 – Perception of the effects of food waste (Bologna on the left, Viterbo on the right)



Source: own elaboration on survey data

Other results concerned the opinions of consumers about the possible strategies to reduce food waste. Among the options proposed in the questionnaire, those linked to the need of wide cultural changes (e.g. improving environmental and social awareness) were ranked among the highest. This might be due, on the one hand, to the development of an ethical

concern over food waste and, on the other hand, to a resistance to change the individual habitudes for the sake of reducing food waste.

Basing on the same variables, two cluster analyses were carried out with the aim of dividing the samples in groups with similar attitudes towards food waste.

As for the sample of Bologna, the cluster dendrogram identified as a best option the partition in 7 groups, explaining 33% of the total variance. Despite the low variance explained, the resulting groups are well balanced and can be clearly interpreted. Table 3 shows the features of the 7 groups obtained in the case of the consumers' sample from Bologna.

Table 3 – Clusters of the sample from Bologna

	Items	Means	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
			n=114	n=100	n=105	n=126	n=153	n=83	n=106
CATEGORIES OF FOOD WASTE	not cooked	2.33	-	+	-	-	-	+	+
	cooked	1.98	-	+	-	-	-	+	++
	veggie / fruit	2.98	-	+	-	-	-	+	++
	meat/fish/cold cuts	1.41	-	+	-	-	-	+	++
	eggs /dairy prod.	1.87	-	+	-	-	-	+	++
	bread	1.87	-	+	-	-	-	+	++
	pasta	0.80	-	+	-	-	-	+	++
	long-life products	0.83	-	+	-	-	-	+	++
REASONS	low quality	2.04	-	-	-	-	-	++	+
	over-purchasing	3.18	-	-	-	-	-	+++	+
	cooking too much	2.87	-	+	-	-	-	+++	+
	trying new things	2.35	-	+	-	-	-	++++	-
	large packages	2.23	-	+	-	-	-	++++	-
	products expired	3.76	-	+	-	-	-	++	-
not eating leftovers	1.89	-	+	-	-	-	+++	+	
EFFECTS	loss of money	6.82	--	-	-	-	+	+	-
	loss of time	3.74	--	-	-	-	+	++	-
	feeling uneasy	5.90	--	-	+	-	+	+	-
	waste management	3.88	--	-	+	-	++	+	-
	economic loss for society	4.41	--	-	+	-	++	+	-
	food could be useful for others	7.38	---	--	+	-	-	-	-
environment	4.88	--	--	+	-	++	+	-	
REMEDIES	more time for purchases	4.07	--	-	-	-	+	++	-
	more suitable packages	5.43	--	-	--	-	+	++	-
	more informations about products	4.06	--	-	--	-	++	++	-
	better quality-price ratio	5.72	--	-	--	-	++	+	-
	incentives to reduce waste	5.68	--	--	-	-	++	+	-
	more know ledge about how to cook	4.31	--	-	-	-	++	+	-
	overcoming the economic crisis	4.07	--	-	--	-	++	--	-
	more kindness for others	6.43	---	--	+	-	++	+	-
	environmental sensitivity	6.37	---	--	+	-	++	+	-

Source: own elaboration on survey data

Considering the features of the clusters, they were named as follows.

Unconcerned: they declared to waste only occasionally (fewer than the whole sample); they were not able to recognize the reasons, the effects and the remedies, thus it is likely that these consumers don't consider food waste as a problem.

Selfish: they declared a bit of food waste but they recognize the reasons. The loss of money was the highest rated effect. Remedies affecting the individual approach to food waste were considered more important, thus it is likely that these consumers considered food waste as an individual issue.

Responsible: they declared little food waste and had very low scores in the motivations. They recognized effects and remedies at society level.

NIMBY: they declared little food waste and could not identify a clear set of reasons. They seemed quite unaware of the problem, but they had the tendency to score lower than the sample the effects on the society.

Virtuous: they declared little food waste; they did not recognize reasons, but they declared effects and remedies higher than the average scores of the sample.

Careful: they declared a very high food waste in all the items, but they also showed a deep awareness of the effects and the remedies of food waste.

Aware: they declared higher food waste than the other groups and seemed to be well aware of the reasons behind.

Another cluster analysis was performed on the data of the sample from Viterbo, which also resulted in 7 groups, whose features are reported in table 4.

Table 4 – Clusters of the sample from Viterbo

	Items	Means	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
			n=39	n=22	n=24	n=40	n=23	n=30	n=47
CATEGORIES OF FOOD WASTE	not cooked	2,31		-	++	-	++		-
	cooked	2,48		-	++	-	+		
	veggie / fruit	2,75		-	-	-	+++		-
	meat/fish/cold cuts	1,51			-	-	----		-
	eggs /dairy prod.	1,78		++	+	-	+++	-	-
	bread	2,65		+	+	-	+++		
	pasta	1,38				-	+++++		
	long-life products	1,26			++	-	+++	-	
REASONS	low quality	1,6			-		++	-	
	over-purchasing	2,43			++++	-			-
	cooking too much	2,49			----	-	+	-	
	trying new things	2,3	-	-	----	-	+		-
	large packages	2,04		-	++++	-	+	-	
	products expired	3		++	++			-	-
EFFECTS	not eating leftovers	2,14			++	-	+		
	loss of money	6,75	--		+	+		--	+
	loss of time	4,14	--	--	++	+		--	+
	feeling uneasy	5,49	--		+	++		--	
	waste management	3,84	-	--	+++	++		--	
	economic loss for society	4,93	--	-	++	++		---	+
	food could be useful for others	7,06	-	+	++	+		---	
REMEDIES	environment	5,29	-	--	++	++		---	+
	more time for purchases	4,48	-	--	+	+	+	--	-
	more suitable packages	5,58		-	++	+		--	
	more informations about products	4,84	-	-	--	--	+	--	--
	better quality-price ratio	6,34	+	--	++	+		---	
	incentives to reduce waste	5,84	+	-	++	++		---	-
	more know ledge about how to cook	4,88	-		+	++		--	-
	overcoming the economic crisis	5,72		-	+	+		---	
	more kindness for others	6,84			+	++		---	
enviromental sensitivity	7,09			+	++		---		

Source: own elaboration on survey data

As already done in the case of Bologna, we analyzed the clusters features in order to name them.

Demanding: they waste as the sample average; among the reasons, the dislike towards unusual food items emerged, as well as over-cooking and a lack of attention towards best-before dates. The main remedies envisaged were a better quality/price ratio and incentives to reduce food waste.

Inconsistent: although the food waste declared was higher than in the rest of the sample, they were not able to clearly identify the food items wasted. Moreover, they did not show a relevant perception of the effects of food waste, nor of the remedies.

Careful: they declared a very high food waste in all the items, but they also showed a deep awareness of the effects and the remedies of food waste.

Virtuous: they declared little food waste; they did not recognize reasons, but they declared effects and remedies higher than score sampling.

Aware: they declared higher food waste than the other groups and seemed to be well aware of the reasons behind, although they did not show a remarkable perception of the effects and remedies of food waste.

Unconcerned: they declared to waste only occasionally (fewer than all the sample); they scored very low all the reasons, the effects and the remedies, thus it is likely that these consumers did not consider the food waste as a problem.

Indifferent: they declared little food waste and could not identify a clear set of reasons. They seemed only concerned by few of the effects of food waste, and they were not confident in any of the remedies proposed.

The members of each group share a common vision of the food waste issue, so that they are likely to react in a similar way to strategies of food waste prevention. The features of the groups, as they came out from the two cluster analyses, were validated by looking at the "apple profile", i.e. at the answers given to the question about the willingness to eat the peel of an apple and a wizened, bruised or rotten fruit. In all cases, the result was positive: the quota of the statistical units willing to eat the peel, the bruised and the wizened fruit was always higher within the groups identified as more concerned towards the issue of food waste.

The consumer profiles were then analyzed across the two samples in order to check for possible similarities of some profiles, which could lead to a careful generalization of the results. Looking at the results of the two cluster analyses, we were able to identify 4 consumer profiles common to the two samples: *Careful*, *Virtuous*, *Aware* and *Unconcerned*.

Such consumer profiles, emerging in both case study areas, are thus likely to be representative of a general attitude of some consumer types. These groups could thus be a first target for strategies aiming to prevent household food waste. Namely, *Careful* and *Aware* consumers were already quite concerned with the problem of food waste, therefore a campaign targeted to this consumers should focus on the tips to reduce the extent of the food wasted at home. Instead, *Virtuous* consumers were very sensitive to food waste and they seemed to already have a righteous behavior in managing the food items at their households. Therefore, no policy interventions are needed on this people, although they could usefully be pushed to share their good food management practices with others. On the contrary, much work has to be done on *Unconcerned* consumers, as they were not aware of the food wasted at their household and, at the same time, they did not recognize food waste as an outstanding issue, with major effects both at the individual and at the society level. The first step of a campaign targeted on unconcerned consumers could then be to increase their awareness towards the issue of food waste, to increase their sensitiveness and therefore improve their food management practices.

Conclusions

The issue of food waste is increasingly the focus of the media and the political debate. Despite having the great merit of turning the spotlight on this issue, the research on this topic seems however not fully aware of the challenge to face the complexity of this issue through a comprehensive scientific approach. This is true, in particular, for the consumption stage of the food chain, which, while being responsible for the highest proportion of food waste, rarely has gained the necessary attention as subject of specific studies.

This work had the objective to give a contribution in this direction, by presenting the first results of a survey carried out on a large consumers' sample in two different Italian cities.

The quantitative analysis carried out had both a descriptive and an exploratory approach aimed, on the one hand, to a better understanding consumer behaviours, and, on the other hand, to attempt a typological classification of the different consumer attitudes towards household food waste.

The results, while not devoid of interest, must be considered with great caution, as they encompass various limits concerning the subject of study in general and the specific survey. As regards the first aspect, it should be considered that there is a problem of consumers' self-assessment, linked to the objective difficulty of precisely quantifying the waste of food and to the discomfort they feel when they realize an ethically and socially not acceptable behaviour, so they are not aware to be food wasters. On the other hand, the study itself has some limitations that concern primarily the lack of representativeness of the sample and secondly the method of data processing that, in the research further steps, should shift to models that get more deep into the consumers' perceptions and motivations of food waste.

Despite these limitations, some interesting insights emerged, especially linked to the identification of some common consumer profiles across the two case studies, which may be considered as first targets for interventions aimed at the reduction of household food waste. However, beyond the results of this work, it is necessary to continue the in-depth analysis of consumer behaviour about household food waste, as it is the starting point of any intervention aimed at increasing awareness of food waste issue and at spreading virtuous habits starting from inside our homes.

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