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FOOD WASTAGE BY TUNISIAN HOUSEHOLDS

Khaled SASSI[1*], Roberto CAPONE[2], Ghassen ABID[3], Philipp DEBS[2], Hamid EL BILALI[2], Olfa Daaloul BOUACHA[1], Francesco BOTTALICO[2,4], Noureddin DRIOUECH[2], Dorra Sfayhi TERRAS[5]

[1]University of Carthage, National Agronomic Institute of Tunisia (INAT), Department of Agronomy and Plant Biotechnology, Tunis-Mahrajène, Tunisia
[2]Sustainable Agriculture, Food and Rural Development Department, International Centre for Advanced Mediterranean Agronomic Studies of Bari (CIHEAM-Bari), Italy
[3]University of Tunis El Manar, Center of Biotechnology of Borj Cedria, Laboratory of Legumes, Hammam-Lif, Tunisia
[4]Parthenope University of Naples, Department of Science and Technology, Naples, Italy
[5]National Agricultural Research Institute of Tunisia, Ariana, Tunisia
*Corresponding author: sassi_khaled5@yahoo.fr

ABSTRACT

Food waste (FW) is seen as an obstacle to achieving food and nutrition security and food systems sustainability. It is known in literature that households are significant contributors to the total amount of FW. This paper reports on results of an online survey that was conducted from February to April 2015 with a random sample of 281 Tunisian adults. The aim of the survey is to assess the knowledge and relative importance of FW; attitudes towards FW; impacts of behaviors regarding food and food management; quantity and value of FW; as well as barriers and willingness to behavioral change. The sample was not gender-balanced (71.2% female and 28.8% male). The majority of the respondents was young (70.8% aged between 18 and 34 years) and has high education level (95.4% having university and PhD degrees). Food waste is prevalent in Tunisia as about the half of respondents declare that they throw food. The most wasted food products are fruits, vegetables, and cereals and bakery products. Only 42.7% of respondents declared that the economic value of food waste generated each month is more than 6US$. Most of Tunisian respondents have a good understanding of food labels that is probably due to the high education level of the sample. About 37% of respondents throw weekly at least 250 g of still consumable food. To reduce FW in Tunisia it is important to set a strategy at all food chain levels. There is also an urgent need to raise people's and organizations awareness towards this problem. This article provides a basis for the development of other more context specific investigations and interventions for the prevention of household FW in Tunisia.

Keywords: *household food waste, consumer behavior, online survey, Tunisia.*

INTRODUCTION

Food security has become a global concern in recent years following the climate change conditions and global food security challenges and consequently food price volatilities. The Near East and North Africa (NENA) region, including Tunisia, relies on food imports to meet over 50% of its total food requirements and still experiences a food deficit. At the same time, the region loses and wastes a significant amount of food, up to 250 kg per person each year, a figure that is higher than the global average (FAO, 2014). Moreover, according to the Food and Agriculture Organisation (FAO) almost a third of all food produced globally, or 1.3 billion tons of food, is lost or wasted every year (Gustavsson et al., 2011). In Tunisia there is very little data on food losses and waste. The figures for food loss and waste are hard to quantify and are dependent on the types of foods. Municipal solid waste is characterized by a strong presence of biodegradable organic matter (68%) with a specific production of 0.815 kg/capita/day in urban areas and 0.150 kg/capita/day in rural areas. Only 5% of food waste gets composted (ANGed, 2014). Fruit, vegetables, meat, fish and dairy products are inherently perishable and without proper transport and storage, their shelf life is dramatically low. The lack of access to cold chain systems and reliable energy sources required to power them is therefore the major cause of food loss in Tunisia (Kader, 2005). Other causes include harvesting practices (e.g. poor harvesting methods where food is left in the field, substandard harvesting equipment and poor sorting-where pests or diseases are not detected or the mixing of good and bad quality products together during grading which lowers the overall quality); supply chain management (e.g. lack of quality control in managing post-harvest collection and storage, lack of sufficient systems controls in processing/packaging of food and failures in operation and maintenance of storage facilities); and government and policy regulations (e.g. poor regulations that impede innovation and trade, lack of unified and coherent national policies and lack of market mechanisms to reward cold chain investments). Such as the case for the majority of countries in NENA region, reducing food loss and waste is critical for Tunisia that faces limited possibilities to increase its food production, and that depends on food imports to meet the food needs of its population (Barre, 2013). Indeed, food loss and waste reduction is the most feasible and quick win approach to increasing food availability and security in contrast to increasing food production. To address and reduce food loss and waste, a strategic approach is required that emphasizes coordination between all relevant actors, including public institutions and private sector agencies, food producers and handlers, and civil society institutions, through responsible and sustainable policies and effective compliance mechanisms. In order to help achieving food security in Tunisia, the Tunisian government must develop a strategic framework in close collaboration with international organizations such as FAO, civil society organizations and private sector to reduce food loss and waste within the coming years.

This preliminary paper summarizes findings from an exploratory survey to investigate the causes of food waste and identify solutions to reduce it in Tunisia.

MATERIALS AND METHODS

During the last years, the Department of Sustainable Agriculture, Food and Rural Development of the Mediterranean Agronomic Institute of Bari (IAMB), that is one of the four institutes of the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) - in collaboration with FAO and other Italian, Mediterranean and international institutions - has undertaken different activities on the sustainability of the Mediterranean food system. In the framework of these activities, a particular attention was devoted to the issue of food waste in the Mediterranean region. In the Mediterranean area, precise and accurate data regarding food waste and losses should be enhanced. In the final declaration of the 10th meeting of the CIHEAM member states' agriculture ministers held in Algiers in February 2014 the relevance of food waste issue in the Mediterranean countries was strongly stressed (CIHEAM, 2014).

The present paper is based on a review of literature and the results of a voluntary survey carried out in Tunisia using a questionnaire that was adapted to the Tunisian context from previous questionnaires and studies on food waste carried out by the Office of Environment and Heritage in 2011 in the State of New South Wales (NSW), Australia (OEH, 2011), and by the University of Bologna (Last Minute Market, 2014).

The tool used to conduct the food waste survey is a self-administered questionnaire. It was designed and developed in French language in December 2014 and was made available from January until the end of March 2015 through the *Survio* website (http://www.survio.com/survey/d/K2O7B2J5Y7J9N8N9A). Participation was entirely on a voluntary basis and responses were analysed only in aggregate.

Survio online survey service (survio.com) began as a start-up in the Czech Republic and was launched formally in April 2012. It provides a free and easy tool for any type of online survey. The product provides plenty of ready-made survey templates, layouts and styles. It helps to easily create a new survey with professional content and viewing the collected responses in real-time, using tables, charts, PDF reports and data files for most file types.

Various communication channels were used for survey dissemination, such as institutional websites (e.g. http://www.inrat.agrinet.tn), social media (e.g. Facebook) and emails.

The questionnaire consisted of 26 questions. It included a combination of one option and multiple-choice questions. It was developed into six sections: Food purchase behavior and household food expenditure estimation; Knowledge of food labeling information; Attitudes towards food waste; Extent of household food waste; Economic value of household food waste; Willingness and information needs to reduce food waste.

In the introductory part of the questionnaire, the concept of food losses and waste was introduced to inform the respondents.

Data were analysed using descriptive statistics (*e.g.* means, max, min), in order to get a general picture of frequencies of variables, using Microsoft Excel.

From 289 questionnaires received, 8 were not considered because there were missing data. Therefore, the total number of the sample is 281 adult Tunisians. The majority of the respondents were female (71.2%) compared to 28.8% of males; they were quite young since 70.8% aged between 18 and 34 years old. About 44% of the respondents are living with parents. The respondents present high level of education with 95.4% having university and PhD degrees. Three, four or five person-households have the highest share (89.7%). The number of households with six and more persons is almost negligible. About 50.9% of the respondents are employees (full time or part time work) and 39.1% are students (Table 1).

Table 1. Respondents' profile (n=281).

Items		Percentage (%)
Gender	Female	71.2
	Male	28.8
Age	18-24	31.3
	25-34	39.5
	35-44	18.5
	45-54	5.0
	55 and over	5.7
Family status	Single person household	2.8
	Living with parents	43.8
	Partnered	7.5
	Married with children	33.1
	Shared household, non-related	11.4
	Other	1.4
Level of education	Primary school	0.4
	Secondary school	0.7
	Technical qualification	3.2
	University degree	48.4
	Higher degree (MSc, PhD)	47.0
	No formal schooling	0.4
Household composition	1 to 3	32.3

(number of members)	4 to 6	57.4
	7 to 10	10.3
	> 10	0
Occupation	In paid work (full time or part time)	50.9
	Student	39.1
	Unemployed and looking for work	8.2
	Home duties	0.7
	Retired/ Age pensioner	1.1

**Source: Authors' elaboration based on the survey results.*

RESULTS AND DISCUSSION

To estimate the proportion of food waste in households waste, methodologies such as enquiries or waste sorting analyses have been used. The results of enquiries give qualitative information like kind and frequency of wasted food and reasons for wasting it based on self-reported behavior of the respondents. Furthermore, information about interrelated conditions (e.g. level of employment, age of household members) and behaviour (e.g. buying, cooking and diet habits) have been gathered. The collected data are also important for monitoring and planning of waste management systems.

There are large differences concerning shopping behaviors between respondents. More than thirty-nine percent of the respondents reported that they exclusively shop in large supermarkets. Thirty-seven percent of the respondents purchase food also in small shops and 23.5% visit local markets in addition to other shopping facilities. Supermarkets and hypermarkets have marketing strategies to attract consumers and increase their purchase, thus increasing the possibility to wasting food. The answers to the question "*Do you think you are drawn to special offers?*" (e.g., "*buy one get one free*", "*three for the price of two*", *etc.*) revealed that 46.3% of households are attracted by special offers. Surprisingly, no person among all respondents declared to produce own food, to shop online or to use home delivery.

Interestingly, most households purchase groceries every day (34.5%), every two days (14.6%) or twice a week (18.9%). It is known that there are specific amounts of food thrown away in relation to shopping frequency. In general, a decreasing in food waste generation with decreasing shopping frequency could be observed. Only 29.2% of households use a shopping list. According to Jörissen et al. (2015), the amount of food waste is higher when no shopping list is used.

In general, the highest percentage (more than 30%) of foods that are thrown away sometimes or often relates to fruit, vegetables, cereals, legumes, milk, bread, fish, roots and tubers.

With respect to the reasons why food is wasted, "food conserved in fridge for too long time", "food is out of date", "food is moldy" and "food smelled/tasted bad" (63.3%, 51.2%, 35.9% and 34.2%, respectively) are mentioned much more frequently as reasons for discarding food (Figure 1). All other reasons were mentioned less frequently (less than 25%), which suggests that they are of minor importance.

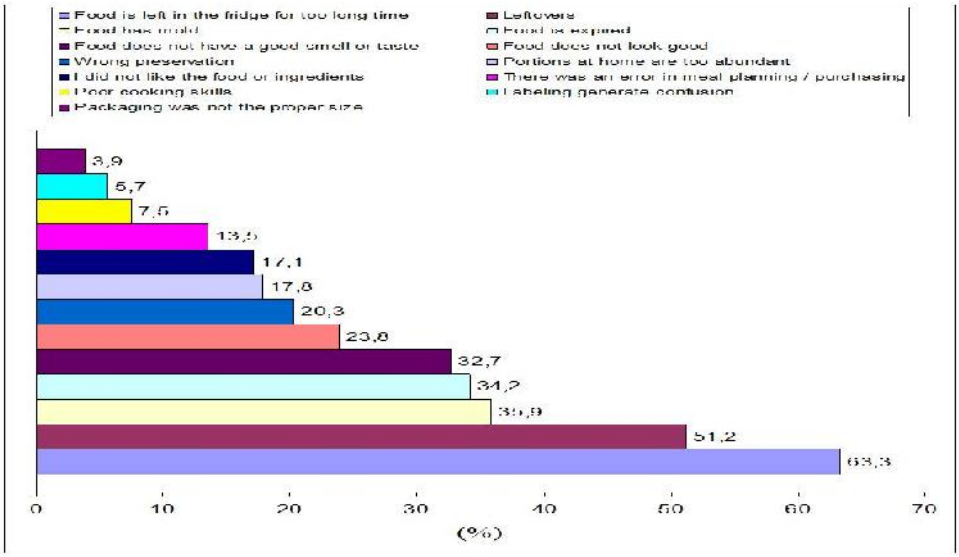

Figure 1. Reasons that lead to food being wasted (percentage of respondents who ticked the given reasons).

**Source: Authors' elaboration based on the survey results.*

The respondents were asked to estimate the amount of edible food they dispose off in their households per week based on predefined categories, ranging from throwing away nothing up to more than 2 kg at highest (the specified categories were: nothing, less than 250 g, 250-500, 500-1000, 1000-2000, and more than 2000 g per household/week). More than thirty-nine percent of the respondents stated that they do not throw away any edible food, whereas only 1.8% of households conceded that they dispose off more than 2 kg (Figure 2). A simple extrapolation of these figures to the entire Tunisian population results in 292,000 tons of food waste per year for Tunisia. Compared to the quantities estimated in the GIZ study (ANGed , 2014) of 4,033 million tons per year for Tunisia, the amounts of food waste calculated based on our survey are very small.

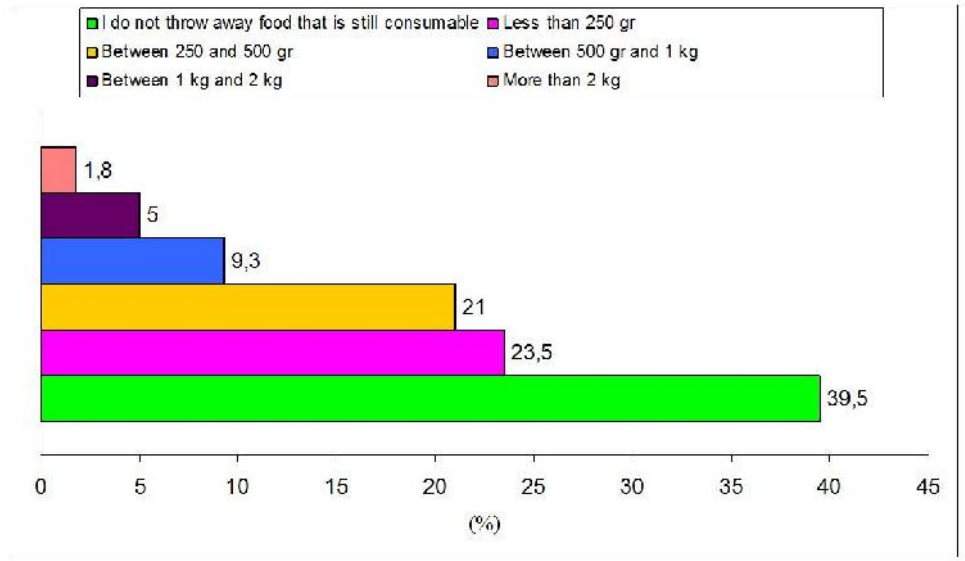

Figure 2. Average amount of household food waste per capita and per week.
**Source: Authors' elaboration based on the survey results.*

The majority of respondents indicated that they already strive towards reducing food waste (64.4%). The most mentioned activities referred to organizational improvements, like optimized planning of meals according to needs, tailored food purchases, consumption of perishable food items in time, adequate storage and reuse of leftovers.

Information that would be needed to reduce food waste by households is primarily knowledge on the freshness and durability of a product. With similar significance, advice is required about how to share or donate food, how to store food correctly and recipes for how to use leftovers. Respondents would like to receive further information. Further ideas for the distribution of information are related to the products themselves, supermarkets, and websites of local authorities. A considerable share of respondents needs and wishes no further tips.

As mentioned above, the population of the survey presented in this study is not representative for Tunisia. The main reason is that the survey was limited to an academic environment. Moreover, the questionnaire was distributed via Internet and the response to it was voluntary. Due to the method used and the circle of addressees, lower income classes, households with a lower educational level, young people (below 18 years) and the elderly (persons aged 60 years and above) were not adequately represented in the sample. Thus, the results cannot be reliably extrapolated to the entire population of Tunisia. Nevertheless, they provide some interesting insights into households' behaviors.

Surprisingly, the survey revealed that the generation of food waste per capita per week is higher than 250g for 37.1% of respondent households and less than 250g for the 23.5%, far below the level found in other studies (Monier et al., 2010; Kranert et al., 2012) such as in Germany (1500g) and Italy (from 884 to 2000g).

We suggest that among the reasons for the low waste rates in the survey might be that the predefined choices for food waste generation offered in the questionnaire were scheduled too low. This may have misled respondents to specify their real waste rates at the lowest limit. Moreover, it is possible that households in general tend to underestimate their food wastage. Interestingly, 39.5% of respondents testify in the interview that they throw away nothing, while Ventour (2008) reports that households testifying in the interview that they throw away nothing actually generated 88 kg of avoidable food waste a year. Another reason could be that the survey was restricted to an academic milieu. Furthermore, the food waste generated by the respondents out of home in hotels, restaurants, canteens, take away, coffee shops, etc. was not subject of the survey. Moreover, it is likely that people who have completed the questionnaire were mostly already sensitized to the issue of food wasting or are at least more aware of the problem than other people. This assumption is backed up by the fact that more than 72.2% of the respondents stated that they care very much about food waste and try to avoid it whenever possible. According to Williams et al. (2012), the participants who have a high environmental consciousness waste less food.

Concerning the food items wasted, survey data revealed that cereal and bakery products such as bread, rice and pasta followed by vegetables, milk and dairy products are the largest contributors to food waste. The present data are not in agreement with previous results of Langley et al. (2010) and Quested et al. (2013) who reported that, the largest contributors to food waste are easily perishable items like fresh fruit and vegetables, followed by bakery, dairy products and eggs. Several studies investigated the reasons for the generation of food waste (Graham-Rowe et al. 2014) and have come to quite similar results. The most common reasons that lead to food wastage are: Food is out of date; Food looked, smelled, tasted bad/moldy; Food conserved in fridge/cupboard for too long; Wrong planning of meals; No need-based shopping; Wrong packaging size; Insufficient cooking skills; Incorrect storage; Food is served in high quantity; Household member did not like ingredients.

Looking at the findings of the survey with respect to previous researches, the most commonly cited reason to discard food in Tunisia was “In fridge/cupboard too long” (63.3%), “Served too much, leftovers, did not like ingredients” (51.2%), “Looked, smelled, tasted bad/moldy” (35.9%) followed by “Out of date” (34.2%). This indicates that respondents in Tunisia seem to trust more in their sensory perception.

In accordance with previous studies, the survey endorses the finding that households’ shopping practices have a huge impact on the level of food wasting. The most frequented stores for purchasing groceries in Tunisia are large supermarkets and mini-markets (39.5 and 37%, respectively) and only 23% for local markets. Previous studies found that the amount of food thrown away is highest when people exclusively shop in large supermarkets, decreases when purchasing takes place in different shopping facilities, and is lowest when people also grow their own food (Jörissen et al., 2015). This would suggest that people

who spend a lot of time shopping in small shops or local markets attribute a higher value to foods than people who prefer the quick and convenient large supermarkets.

Next to the type of shopping facility chosen, the shopping frequency also could affect the amount of food waste. Here the survey shows that 34.5% of respondents do shopping every day. According to Williams et al. (2012), an increasing shopping frequency allows for a better matching with the daily needs. The purchase of large quantities for the whole week in contrast, would increase the probability of spoilage, especially of perishable products, such as vegetables, bread and milk. Graham-Rowe et al. (2014) provide another rather psychological foundation.

In Tunisia, only 29.2% of the households surveyed use a shopping list. Previous studies revealed that when using a shopping list, the amount of food thrown away per capita is lower (Lyndhurst et al., 2007).

CONCLUSION

The available studies show that there are great discrepancies between the amounts of food waste calculated based on statistical data on food supply or municipal waste and the amount of food waste measured in household surveys. The results of statistical estimates are in general higher than the results of household surveys. This observation indicates that great efforts are required to improve the methods for statistical data collection and processing. Lower income classes, households with lower education level, and the elderly (persons aged 65 years and above) are not adequately represented in this study. Further considerations are much needed on how to overcome these barriers.

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