

# Preliminary Insights on Household Food Wastage in Lebanon

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**Abstract** Food losses and waste, generated across the whole food chain, implies serious environmental, social and economic costs. Lebanon suffers from lack of information about food waste. There is no national legislation related to food waste (FW). The paper provides insights on household FW in Lebanon with a focus on perceived importance of FW, attitude towards FW, quantity and value of food wasted. An online survey was conducted in the period January-March 2015 with 215 adult consumers. Sample is not gender-balanced, rather young and with high education level. Household's planning and shopping activities are important predictors of FW. Fruits, vegetables, and milk and dairy products are the most wasted food products. Most of the respondents have a good understanding of "use by" label while just the quarter know exactly the meaning of "best before" label. About 42% of respondents declare that their households throw away at least 250 g of still consumable food each week. The economic value of FW generated each month is more than 6 United States dollar (US\$) for 80% of respondents' households. Lebanese households show a positive attitude regarding FW and are willing to change behaviour to reduce it. An integrated policy mix is needed to foster transition towards zero-waste consumption patterns.

**Keywords:** household food waste, consumer behavior, online survey, Lebanon

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## 1. Introduction

About 1.3 billion tons/year of food produced for human consumption is lost or wasted in the world. Household food waste (FW) refers to food discarded in households that still has value. Food is mainly wasted when surplus food items are purchased, food items are stored improperly and food leftovers are thrown away [1]. FW is an issue also in the Near East and North Africa (NENA) region [2,3] including Lebanon.

The type of solid waste generated in Lebanon is mainly household solid waste which constitutes 90% of the total solid waste generated [4]. A study has been done by the American University of Beirut in order to estimate the rates of waste generation in Beirut area. The results revealed that the percentage of food waste in Beirut represents 62.4% of the total household solid waste [5].

Based on the conducted literature review and according to decree 2275 (dated June 15, 2009) released by the Ministry of Environment (MoE), solid waste management (including food waste management) is considered as part of the "Service of Urban Environment" at the Urban

Environmental Pollution Control Department at the MoE. Hence, the MoE is responsible for food waste management in Lebanon.

Local legislations related to food waste do not exist. Only national legislations concerning household solid waste management are found in Lebanon, however inadequate and outdated. The Ministry of Environment (MoE) prepared a draft law on Integrated Solid Waste Management (ISWM) in 2005 within the European Union-funded project "*Regional Solid waste Management Project in Maghreb and Mashreq Countries*" and then presented it to the Council of Ministers in June 2006. In partnership with other ministries (Ministry of Interior and Municipalities (MoIM), Ministry of Finance (MoF), Ministry of Public Works and Transport (MoPWT), Ministry of Public Health (MoPH), Ministry of Agriculture (MoA), Office of the Minister of State for Administrative Reform (OMSAR) and the Council for Development and Reconstruction (CDR)), the MoE placed solid waste management as one of the 10 priority themes into its work program for 2010-2012. One of the objectives of the solid waste management framework was to promote ISWM [4]. A national legislative framework specific to household food waste should be developed [6].

A case study was conducted by the American University of Beirut in 2005 in Greater Beirut area to evaluate household food waste disposers integrated within the solid waste management system of urban areas, which is a garbage grinder unit installed under kitchen directly connected to sewer pipes. This food waste grinder separates food waste from the entire municipal solid waste stream. These food waste disposers grind biodegradable organic waste (leftover meat, vegetables, fruits, etc.). The amount of solid waste generated in the study area is about 2,000 tons/day, whereby food waste constitutes 63%. This technology can potentially reduce 12-43% of the total solid waste [7].

Due to lack of governmental commitment to household food waste management, local institutions and non-governmental organizations are developing for the aim of food waste reduction. "FERN", "Food Blessed" and "Lebanese Food Bank" are local organizations dealing with food loss and waste.

*Food Establishments Recycling Nutrients*, known as FERN, is a non-profit social enterprise that aims for eliminating food waste, linking local food institutions that generate organic waste to organic waste treatment facilities and donating surplus food to local food banks. FERN also provides training sessions for local food establishments concerning on-site waste segregation and supplies them with reusable plastic bins for waste storage [8].

*FoodBlessed* is a community-based and volunteer-driven local hunger relief initiative founded in 2012. *Food Blessed* acts as a linkage between food donors and food recipients. It spreads awareness within the civil society and offers practical solutions to reduce food waste generation. It also develops fundraising events to provide surplus food to local non-profit partners in need [9].

The *Lebanese Food Bank* was launched in 2013 with the main objective to eliminate hunger from Lebanon by 2020, by building on strong partnerships in the public and private sectors as well as on cooperation, and donation from individuals. One of the many LFB's actions is the Awareness Program "Not To Waste Food" that targets hotels, restaurants, catering companies, food factories, and individuals. Instead of throwing away the excess food, the LFB distributes it to orphanage, nursing homes, and NGOs [10].

Many initiatives and awareness activities are carried out in Lebanon particularly on the waste at consumer level. From these initiatives, there are *Think.Eat.Save* and *MED-3R project*.

*Think.Eat.Save* is an international campaign supported by *Save Food: Global Initiative on Food loss and Waste Reduction* of the Food and Agriculture Organization of the United Nations (FAO) and *Messe Düsseldorf*, launched in June 2013.

The MED-3R project (*MED-3R Euro-Mediterranean Strategic Platform for a Suitable Waste Management*) is a waste management project. Regarding food waste, the aim of this project is to apply in Lebanon the same initiative carried out in France which regards the encouragement of the restaurants and the clients to get to be used to "doggy bags" which means basically to ask to take away the food that clients were unable to finish [10].

The purpose of this article is to analyze household food waste in Lebanon focusing in particular on: knowledge of and perceived relative importance of food waste; attitudes

towards the environment, waste and food waste; impacts of behaviors regarding food and food management on food wastage; quantity and value of food wasted; and barriers and willingness to behavioral change. This article will fill the major data gap of food waste in Lebanon, hence, further studies and research activities in this field will be able to rely on the collected data.

## 2. Materials and Methods

### 2.1. Research Context and Background

During the last years the Department of Sustainable Agriculture, Food and Rural Development of CIHEAM-Bari- 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 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 [11]. This research is the outcome of collaboration between CIHEAM-Bari and the Lebanese University.

### 2.2. Sources of Data

The paper is based on a review of literature and primary data collected by an online survey.

Literature review was done for gathering data on food waste. Credible websites and articles published by the United Nations Environment Program (UNEP), FAO, the Lebanese Council for Development and Reconstruction (CDR) and the Lebanese Ministry of Environment (MoE) were used to create a basis for survey results analysis.

The present paper was based on the results of a voluntary survey in the Mediterranean countries using a questionnaire that was adapted to the Mediterranean 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 [12], and by the University of Bologna [13].

### 2.3. Survey Procedure

The tool used to conduct the food waste survey is a self-administered questionnaire. It was designed and developed in English (<https://www.surveio.com/survey/d/F5A4W8V1S8D8J4K4G>) and Arabic languages (<https://www.surveio.com/survey/d/T2E4K6N2M1F8M2W5B>) in December 2014 and was made available from January till the end of March 2015 through the Survio website. Participation was entirely voluntary and responses were analyzed only in aggregate.

Survio online survey service ([survio.com](https://www.surveio.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.

## 2.4. Survey Questionnaire Structure

The questionnaire consisted of 26 questions. It included a combination of one option and multiple-choice questions. It was developed into 6 sections as follows:

- Food purchase behavior and household food expenditure estimation (place of food shopping, frequency, economic estimation, use of list, attraction to offers);
- Knowledge of food labeling information (knowledge of “use by” and “best before” dates);
- Attitudes towards food waste (perceived relevance of food waste);
- Extent of household food waste (quantity and type of food wasted, reason for throwing food);
- 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. The first section of the survey concerned respondents' profile.

## 2.5. Survey Dissemination Strategy

Various communication channels were used to reach the respondents:

- The questionnaire has been sent to university mailing lists: American University of Beirut (AUB), *Université Saint Joseph* (USJ), *Université Saint Esprit Kaslik*, *Notre Dame Université* (NDU), Balamand, Lebanese University (LU) and American University of Technology (AUT).
- The questionnaire has been distributed throughout social media: *Facebook* chats and messages and *WhatsApp* chats and groups.
- The questionnaire has been sent to a private company mailing list: Khatib & Alami Consolidated Engineering Company.
- The questionnaire has been sent to a non-governmental organization: Lebanese Reforestation Initiative (LRI).

## 2.6. Statistical Analysis

Data were analyzed using descriptive statistics (e.g. means, maximum, minimum), in order to get a general picture of frequencies of variables, using Microsoft Excel.

## 2.7. Respondent Profile

From 229 questionnaires received, 14 were not considered because there were missing data. Therefore, the total number of the sample is 215 adult Lebanese.

The majority of the respondents were female (66.5%) compared to 33.5% of males; they were quite young since 63.7% aged between 18 and 34 years old. More than half of the respondents (55.3%) are living with parents while just 6% is single person household. The respondents present high level of education with 85.5% having university and PhD degrees. Regarding the household composition, 63.7% of the respondents have 4 to 6 members in the family. About 73% are workers (part-time or full-time paid work) while just 1.4% are unemployed and looking for work, and 1.4% are retired (Table 1).

Table 1. Respondent profile

Items		Percentage (%)
Gender	Male	33.5
	Female	66.5
Age	18-24	26.0
	25-34	37.7
	35-44	20.0
	45-54	9.8
	55 and over	6.5
Family Status	Single person household	6.0
	Living with parents	55.3
	Partnered	2.8
	Married with children	18.1
	Shared household, non-related	2.3
	Other	15.3
Level of Education	Primary school	2.78
	Secondary school	7.9
	Technical qualification	3.7
	University degree	56.7
	Higher degree (MSc, PhD)	28.8
	No formal schooling	0
Household Composition (Number of Members)	1 to 3	32.1
	4 to 6	63.7
	7 to 10	4.2
	> 10	0
Occupation	In paid work (full time or part time)	72.6
	Student	19.1
	Unemployed and looking for work	1.4
	Home duties	5.6
	Retired/ Age pensioner	1.4

## 3. Results and Discussion

### 3.1. Food Purchase Behavior and Household Food Expenditure Estimation

The respondents were asked where they purchase their food items (Figure 1), and the majority (64%) declared that their food purchase is mostly in hypermarkets/supermarkets. Only 29% buy their food from specific small markets such as butcheries, dairies and bakeries, and just 1% buys directly from the farmer or at farm. In Lebanon, more than half of the population is living in the city and this high urbanization resulted in keeping the Lebanese far from the rural area. This high number of citizens concentrated in a small area makes the hypermarkets and supermarkets grow in quantity. Sometimes many supermarkets are very near to each other and thus increase the competition for better prices.

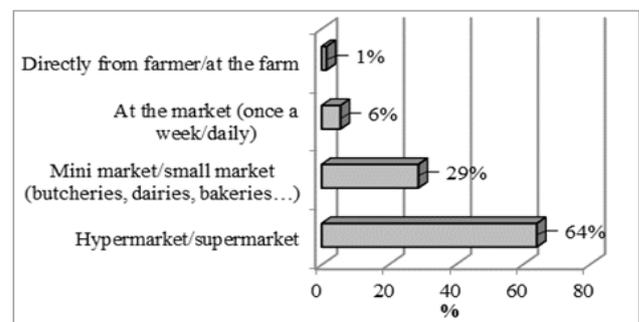


Figure 1. Place of Food Purchase

This high percentage of Lebanese that prefer buying from supermarkets may explain the fact that 55% said they purchase food once or twice a week, since once in hypermarket/supermarket consumers purchase not on a

daily basis but what is needed (or not) for the whole week. This is one of the reasons for increasing food waste at household level. Only 10% mentioned they buy food every day and 20% once every two days.

Supermarkets and hypermarkets have marketing strategies to attract consumers and increase their purchase. One of these strategies is the special offer (buy 2 get one free, buy 2 and get 30% off, etc.) and according to the Lebanese respondents, 43% of them are attracted to such offers while 45% are sometimes attracted. This strategy may play a key role in increasing food waste since a higher quantity is purchased even if it is not needed.

Respondents were asked about how much they spend on food purchased in a month. More than half of the respondents (53%) spend more than 300 US\$ on food purchased in a month, which is about more than third of the minimum salary in Lebanon. While about 25% of respondents spend between 200 and 300 US\$ and 13% between 100 and 200 US\$.

Not preparing a list of food products needed before shopping is considered to be one of the main reasons of household food waste. However, the results of this survey showed that 41% of the respondents prepare a list before buying the products and 16% do not use it.

Regarding the attitude of participants towards food waste, a high percentage of participants discard uneaten food in garbage bins (50%), whereas around 30% of participants feed uneaten food to animals. 15% of participants donate uneaten food for people in need, and 5% use uneaten food for compost production.

### 3.2. Knowledge of Food Labeling Information

Consumers' poor understanding of complex and conservative "use by" and "best before" dates labelling may encourage food waste at home. This behaviour is made largely by the confusing system that some countries adopted for the expiration date of the products. Many studies have called the attention to inconsistencies that exists in the labelling of products, which cause many products to be discarded for this reason. The European Commission wants to help consumers reducing food waste by making "best before" and "use by" dates clearer on the packaging [14].

To investigate knowledge about food labels, respondents were asked what is meant by "use by" dates. About 84% of respondents correctly understood that food must be eaten or thrown away by this date, while just 13% of the respondents incorrectly said that "use by" date means that foods are still safe to eat after this date as long as they are not damaged.

Regarding the label "best before", only 24% of the respondents correctly identified that food is still safe to eat after the "best before" date as long as it is not damaged or deteriorated, while a very high number (74%) answered

wrong and said that food must be thrown away by this date. That means there is still some confusion surrounding the definitions of the labels.

Various studies in the USA [15], Europe [16], the United Kingdom [17] and Spain [18] have underlined that food date labelling, and confusion about it, are a major indirect cause of food loss and waste at retail and consumer levels, as consumers tend to assume that dates are linked to food safety when they are in reality more often grounded on food quality.

### 3.3. Extent of Household Food Waste

Using a five-point scale from "much more than you should" to "none", respondents were asked how much uneaten food was thrown away in their household.

The amount of general uneaten food thrown out by respondents' households was not perceived to be particularly excessive; 49% indicated they throw out "very little" and 30% indicated they threw out "a reasonable amount". Only 5% of respondents indicated they threw out "more food than they should". Additionally, 15% reported that they don't throw out food at all (Figure 2).

In a survey on food waste conducted in New South Wales (Australia) 52% of the respondents indicated that they throw out "a reasonable amount" and 16% threw away "more" or "much more" than they should, and 9% reported they throw out no food at all [12].

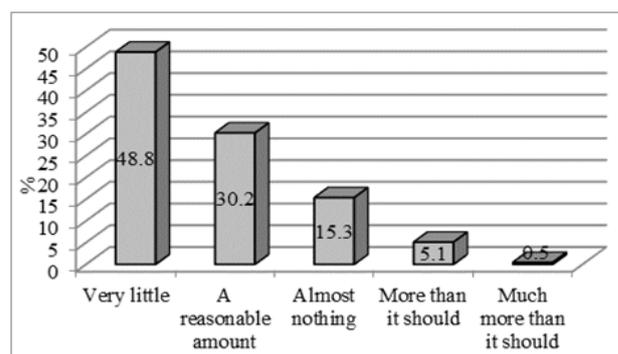


Figure 2. Quantity of Uneaten Food Thrown Away

Throwing away leftovers or the food remaining in the plates is considered as food waste. Generally speaking, leftovers present the highest food thrown away. About 62% of the respondents declare to throw leftovers less than once a week, while 7% throw them away more than twice a week and just 9% of the respondents mentioned that they do not throw leftovers.

There are many solutions regarding what to do with the leftovers. What is left from the dishes can be transformed into compost, can be conserved well in the fridge in order to be eaten the second day, or can be given to animals.

Table 2. Estimated quantity (in %) of purchased commodities thrown away

Food categories	Less than 2%	3 to 5%	6 to 10%	11 to 20%	Over 20%
Cereals and bakery products	67	15	5	6	7
Roots and tubers	64	20	7	5	5
Pulses and oil seeds	72	12	9	5	2
Fruits	43	31	12	8	6
Vegetables	41	29	14	5	10
Meat and meat products	60	17	12	7	4
Fish and seafood	71	14	7	5	2
Milk and dairy products	47	23	16	8	6

Regarding the estimated quantity of purchased food that gets thrown away by the consumers, the majority of the respondents (more than a half) declared that they waste less than 2% of the total food purchased (Table 2) except for fruits, vegetables, and milk and dairy products.

At global level, most wasted food categories in households are fruits and vegetables (39%) followed by cereals (33%) [1].

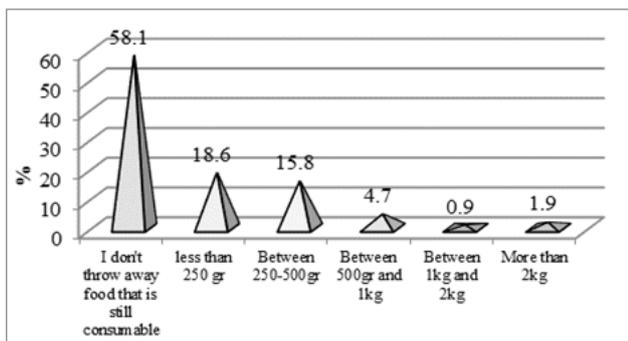
Respondents were asked about the reasons behind throwing away food at their household (Table 3). About 54% said they throw food because it does not have a good smell or taste, while 36% throw it because it is left for too long time in the fridge, thus consumers should know well how to conserve food in the fridge since bad conservation is one of the major reasons of household food waste. About 41% said that food is thrown after discovering that is expired. Consumers should control the food label data and sometimes even if the food product data is expired, food product is still consumable and for this consumer have to taste or smell it before deciding whether throwing it or consuming it. Few respondents mentioned that the reasons behind throwing food are lack of cooking skills and that product package was not proper (3% and 2%, respectively).

**Table 3. Reasons for Household Food Wasteage (more than 1 item has been selected)**

Reasons for Discarding Food	%
Food is expired	40.9
Food does not look good	34.4
Food has mold	29.8
Food does not have a good smell or taste	54.0
Labeling generate confusion	9.3
Food is left in the fridge for too long time	42.8
There was an error in meal planning / purchasing	7.9
Packaging was not the proper size	2.3
Poor cooking skills	2.8
Leftovers	36.3
Portions at home are too abundant	11.6
I did not like the food or ingredients	15.3

### 3.4. Economic Value of Household Food Waste

Regarding the quantity of food thrown away, about 58% of the respondents mentioned that they do not throw away food that is still consumable (Figure 3). Around 18.6% throw less than 250 grams (g) of food in a week and 23% throw more than 250 g per week.

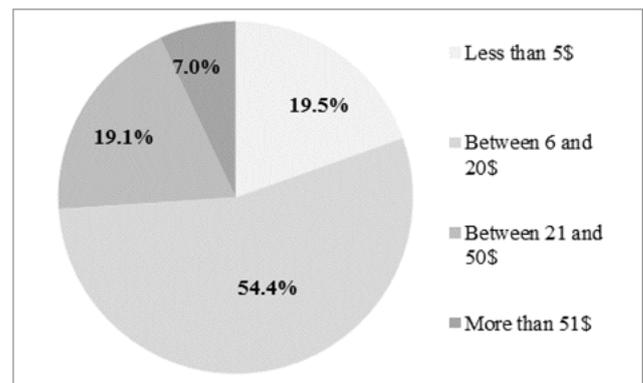


**Figure 3. Quantity of Consumable Household Food Disposed in a week**

Regarding the economic value of food waste at household level (Figure 4), 54% of the respondents

mentioned that it is between 6 and 20 US\$. About 20% said that the value is less than 5 US\$ while 7% declared to throw food at a value higher than 51 US\$ per month.

Food waste has an economic implication for producers and consumers as well. Food loss and waste represent a wasted investment that can reduce farmers' incomes and increase consumers' expenses [19] as food losses during harvest and in storage translate into lost income for farmers and into higher food prices for consumers [20]. Food loss and waste imply that consumers are paying a higher price for food due to inefficiency and/or inequity of the food system as a whole. In general, with a reduction in food losses and waste, the overall food supply would increase, which would drive down food prices and benefit consumers.



**Figure 4. Economic Value of Monthly Household Food Waste**

### 3.5. Willingness and Information Needs to Reduce Food Waste

Respondents were asked what information they need in order to reduce food waste (Table 4), 43% said that they would reduce food waste if they were better informed about the negative impacts of food waste on the environment and if they are informed about organizations and initiatives that deal with food waste. About 37% said that they would reduce food waste if the food product packaging was more suitable, and they know some recipes made with leftovers. Regarding the food labels that create confusion among consumers, only 25% mentioned that food waste could be reduced if these labels were clearer.

A practical solution for food waste reduction in Lebanon is the introduction of a waste minimization strategy whereby concerned organizations should conduct awareness campaigns to inform the public of the negative impacts of food wastage, take initiatives dealing with food wastage reduction such as improving product packaging and clarity of labels, and disseminate recipes to make use of leftovers. As a result, the community's consumption behavior will vary, whereby food bills will be reduced causing a decrease in food waste generation [21].

The lack of studies related to food waste and loss in Lebanon was a limitation regarding the comparison of the results obtained from this survey with results of different studies. Usually, results obtained from a survey should be compared to studies conducted in countries having similar living conditions. Hence, a study related to Food Consumption and Waste conducted in Kuwait in 2012 [22] was used for comparing the results obtained from this survey. The results were also compared to an online

survey conducted on food waste worldwide in March 2012 by the FAO's Global Forum on Food Security and Nutrition [23]. This study focused mainly on the types of food items consumed by the participants.

**Table 4. Information needs for reducing food waste (more than 1 item has been selected)**

You would waste less food if...	%
You were better informed about the negative impacts of food waste on the environment	43.3
You were better informed of the negative impacts of food waste on the economy	30.7
The packaging of your food was more suitable	37.2
Labels were more clear	25.1
You had to pay higher taxes on the basis of what you throw away	14.9
Recipes with leftovers	35.8
Tips on how to conserve food properly	51.2
Information on the freshness of product	32.1
Organizations and initiatives that deal with food waste	42.8

Worldwide, the highest percentage of participants (26%) waste cereal and the lowest percentage of participants (2%) waste chicken. The highest percentage of participants in Kuwait (36%) waste rice and the lowest percentage (13%) waste meat.

The highest percentage of participants in Kuwait (52%) discards food due to excess food purchasing. Whereas food discarded in Lebanon is mainly due to its bad taste or smell. Hence, the extent of food discarded in Lebanon is mainly due to improper conservation, whereas that in Kuwait is due to improper food purchasing behavior.

The highest percentage of participants in Kuwait (94%) believes that food waste can be reduced by education and awareness approaches. The participants' attitude in Kuwait is similar to that in Lebanon whereby consumers would reduce food waste if they receive tips on how to conserve food properly and are willing to change their attitude.

Around 26% of participants in Kuwait and 15% of participants in Lebanon will donate leftovers to people in need to make use of leftovers. Hence, consumer attitudes are considered to be encouraging with respect to food waste reduction.

## 4. Conclusion

Food losses and waste in the Mediterranean area is still under exploration due to the scarce studies carried out to evaluate its extent, amount, value and causes. This study will serve as an example for further research and case studies in this field and will help trigger the establishment of national legislations specific to household food waste.

Regarding the perception of food waste importance, survey results show that Lebanese households are concerned about the issue of food waste. Moreover, around a quarter of respondents believe that their own household spend up to 5 US\$ on food that is never eaten, and more than the half spend up to 20 US\$ on uneaten food. Fresh food and leftovers present the highest food thrown away. Regarding the food categories, fruits and vegetables, and milk and dairy products represent the most thrown foods. There is still confusion regarding the definition of food labels which has implications in terms of household food waste. Food is generally thrown when

it does not present a good smell or taste or is left for too long time in the fridge.

Positive attitude and awareness of Lebanese consumers towards food waste issue is demonstrated by willingness to change their attitudes if they were better informed about the negative impacts of food waste on the environment and if they have more information about organizations or initiatives dealing with food waste so that they can be informed about how to reduce food waste.

Lebanese researchers and policy makers should devote more attention to FW in order to reduce it by an integrated, holistic and systemic food supply chain approach. A recommended action to reduce food waste is the introduction of targeted awareness-raising and information campaigns and education programs. Hence, public awareness campaigns and workshops concerning proper storage of food items should be held to improve consumers' behavior, inform them on better food purchase planning in supermarkets for rational food purchasing patterns. In addition, educational programs should inform students and educate them about household food waste and waste reduction measures. Food waste reduction measures include donating consumable food to charities or people in need. A clear and adequate national legislative framework concerning household food waste should be established to propose appropriate initiatives and financial fees that will as a result change people's attitudes towards household food waste.

Research results should help designing adequate policies, guidelines and recommendations for the main actors in the food system. Given the entity of the problem, Lebanon should urgently adopt food waste prevention and reduction strategies. Research and policy activities must be well coordinated if sustainable qualitative and quantitative results are to be achieved.

Food loss and waste is considered a threat to food security. Solutions applied at harvest and post-harvest stages, good agricultural practices and good veterinary practices at the primary stage of production, as well as good manufacturing practices and good hygienic practices during food processing can reduce food loss and waste.

Finally, to get deeper insights into Lebanese consumers' perception and attitude with regards to food wastage issue, it is recommended to carry out further surveys with a more representative sample.

## References

- [1] FAO, Global Food Losses and Food Waste—Extent, Causes and Prevention. *International Congress at Interpack Düsseldorf, Germany*. 2011. <http://www.fao.org/docrep/014/mb060e/mb060e.pdf..>
- [2] FAO, Reducing Food Losses and Waste in the Near East & North Africa Region, *32nd session FAO Regional Conference for the Near East*. 2014. <http://www.fao.org/docrep/meeting/030/mj427E.pdf>.
- [3] FAO, Report of the Expert Consultation Meeting on Food Losses and Waste Reduction in the Near East Region: Towards a Regional Comprehensive Strategy, FAO Regional Office for Near East and North Africa, Cairo. 2013. [http://www.fao.org/fsnforum/cfs-hlpe/sites/cfs-hlpe/files/files/Food\\_losses\\_waste/Report%20on%20Expert%20consultation%20meeting%20on%20Food%20Losses%20and%20Waste%20in%20the%20NE%20Region%20December%202012%20-%20English%20.pdf](http://www.fao.org/fsnforum/cfs-hlpe/sites/cfs-hlpe/files/files/Food_losses_waste/Report%20on%20Expert%20consultation%20meeting%20on%20Food%20Losses%20and%20Waste%20in%20the%20NE%20Region%20December%202012%20-%20English%20.pdf).

- [4] Ministry of Environment, United Nations Development Program and ECODIT (MoE/UNDP/ECODIT), *The State and Trends of the Lebanese Environment*. 2011.  
[http://www.undp.org.lb/communication/publications/downloads/SOER\\_en.pdf](http://www.undp.org.lb/communication/publications/downloads/SOER_en.pdf).
- [5] Ministry of Environment, Climate Change Enabling Activity Report. Lebanon's First National Communication Report. 2002-2011.  
[http://test.moe.gov.lb/ClimateChange/p1\\_waste\\_management.html](http://test.moe.gov.lb/ClimateChange/p1_waste_management.html).
- [6] Council for Development and Reconstruction (CDR), Solid Waste. 2012.  
[http://www.cdr.gov.lb/eng/progress\\_reports/pr102012/index.asp](http://www.cdr.gov.lb/eng/progress_reports/pr102012/index.asp).
- [7] Marashlian, N. and El-Fadel, M., "The Effect of Food Waste Disposers on Municipal Waste and Wastewater," *Waste Manag. Res.*, 23(1), 20-31. 2005.
- [8] FERN, About Food Establishments Recycling Nutrients (FERN). 2015. <<http://ferminternational.org/about>>
- [9] Food Blessed, About food Blessed. 2015.  
<http://foodblessed.org/AboutUs.html>.
- [10] Oneissi, F., Food Waste in Lebanon: some interesting initiatives to tackle it. *Watch letter, Food Losses and Waste in the Mediterranean* [online], Watch Letter n°30. pp. 61-63. 2014. ISSN 2114-3129.  
<http://ciheam.org/images/CIHEAM/PDFs/Publications/LV/wl30%20official.pdf>.
- [11] CIHEAM, 10th meeting of the Ministers of Agriculture of CIHEAM's Member Countries: Final declaration. 2014.  
<http://www.ciheam.org/index.php/en/cooperation/ministerial-meetings>.
- [12] NSW-EPA, Food Waste Avoidance Benchmark Study, State of New South Wales (NSW) Environment Protection Authority (EPA), Australia, September 2012.  
[http://www.frankston.vic.gov.au/files/34d7963e-24ab-455b-a1f5-a22300d89be2/Love\\_food\\_hate\\_waste.pdf](http://www.frankston.vic.gov.au/files/34d7963e-24ab-455b-a1f5-a22300d89be2/Love_food_hate_waste.pdf).
- [13] Last Minute Market, Last Minute Market - *Trasformare lo spreco in risorse*. 2014.  
[http://www.lastminutemarket.it/media\\_news/wp-content/uploads/2013/03/RESOCONTO-WASTE-WATCHERS-2013\\_def.pdf](http://www.lastminutemarket.it/media_news/wp-content/uploads/2013/03/RESOCONTO-WASTE-WATCHERS-2013_def.pdf).
- [14] HLPE, Food losses and waste in the context of sustainable food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. 2014.  
[http://www.un.org/en/zerohunger/pdfs/HLPE\\_FLW\\_Report-8\\_EN.pdf](http://www.un.org/en/zerohunger/pdfs/HLPE_FLW_Report-8_EN.pdf).
- [15] NRDC (Natural Resources Defense Council), The dating game: how confusing food date labels lead to food waste in America. 2013. NRDC Report R:13-09-A  
<http://www.nrdc.org/food/files/dating-game-report.pdf>.
- [16] Bio Intelligence Service, Preparatory study on food waste Across EU27. Technical Report 054. 2010.
- [17] WRAP, Consumer insight: date labels and storage guidance, UK. 2011.  
<<http://www.wrap.org.uk/content/consumer-insight-date-labels-and-storage-guidance>>.
- [18] HISPACOOOP (*Confederación Española de Cooperativas de Consumidores y Usuarios*), *Estudio sobre el desperdicio de alimentos en los hogares*. 2012.  
[http://www.hispacoop.es/home/index.php?option=com\\_docman&ask=doc\\_view&gid=279](http://www.hispacoop.es/home/index.php?option=com_docman&ask=doc_view&gid=279).
- [19] Lipinski, B., Hanson, C., Lomax, J., Kitinoja, L., Waite, R., and Searchinger, T., *Reducing Food Loss and Waste*. Working Paper, Installment 2 of Creating a Sustainable Food Future. World Resources Institute, Washington, DC. 2013.  
<<http://www.worldresourcesreport.org>>.
- [20] FAO, SAVE FOOD: Global Initiative on Food Losses and Waste Reduction: Key findings. 2013.  
<http://www.fao.org/save-food/resources/keyfindings/en/>.
- [21] The Regional Solid Waste Exchange of Information and Expertise Network in Mashreq and Maghreb Countries (SWEENET), Country Report on the Solid Waste Management in Lebanon. 2010.  
<http://www.databank.com.lb/docs/CountryreportLebanon-En-mai2011.pdf>.
- [22] Aljamal, A. and Bagnied, M., "Food Consumption and Waste in Kuwait: the Prospects for Demand-Side Approach to food Security," *International Review of Business Research Papers*, 8(6), pp. 15-26. 2012.
- [23] FAO's Global Forum on Food Security and Nutrition, Survey on Current Research and/or Activities on Food Losses and/or Waste Worldwide. 2012.  
[http://www.fao.org/fsnforum/sites/default/files/file/Survey\\_food\\_loss&waste/SUMMARY\\_Survey%20FSN%20Forum-07-26-12-11-50.pdf](http://www.fao.org/fsnforum/sites/default/files/file/Survey_food_loss&waste/SUMMARY_Survey%20FSN%20Forum-07-26-12-11-50.pdf).