

Food Loss at Retail Stores in Lebanon: A Pilot Assessment Study

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Abstract

While the level of Food Losses (FL) in the retail sector is relatively low compared to others, there is a rising focus on FL reduction at the retail level because practices and strategies on this level exert a significant influence on the generation of Food Loss and Waste (FLW) on both the upstream and downstream stages of the food chain. This paper explores Retail Food Loss (RFL) in Lebanon. After a literature review, a survey was designed to collect the relevant data from various sizes of retail stores. Eighty-one retail stores participated in the survey. The data collected were statistically analyzed. The results show that these retailers make purchase decisions based on consumer demand, promotions and discounts offered by supplier, and quantities of those products still available in store, with consumer demand accounting for 38,59%, promotions/discounts for 25% and remaining quantities for 22.83% of purchase decisions. Retailers identify numerous causes of RFL related to the diverse types of food commodities, however, the expiry date and the loss of freshness are seen as the main ones. To prevent losses, retailers engage in different practices e.g., 92,59% apply discounts to food products nearing their expiry dates and 90.12% of the retailers surveyed consider these strategies to be efficient. The 79% of retailers consider their losses to be low, and 14% estimate them as average. None of the respondents consider their RFL to be high, and 7% find it challenging to provide an accurate estimation of the quantities involved. Based on the findings, it is obvious that the financial crisis in Lebanon is affecting RFL with discounted prices playing a role in encouraging consumers to buy food products that might otherwise be wasted. There appears to be a deficiency in consumer comprehension pertaining to food labeling. In parallel, the estimations made by retailers concerning the magnitude of retail losses may be prone to inaccuracies and thus misleading. Consequently, increasing awareness about food labeling and handling as well as recording quantities of RFL along with their causes are crucial to begin with.

Keywords: food waste and loss; retail; consumers, food system

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1. Introduction

The reduction of food waste has been incorporated into the 2015 Sustainable Development Goals (SDG), specifically Goal 12 “ensure sustainable consumption and production patterns” and more precisely SDG 12.3: “halve per capita global food waste at the retail and consumer level and reduce food losses along production and supply chains by 2030” (SDG 12.3). Reduction of food loss and waste (FLW) is therefore one of the actions needed for food system transformation. Adding up its estimated economic costs of USD 1 trillion, environmental costs of USD 700 billion and social costs of USD 900 billion, FLW globally costs a total of USD 2.6 trillion per year. (FAO; 2013) In recent years, the issue of FLW has grown at a great pace, acquiring special relevance in our society, and has now evolved into a pivotal global consideration for governments, businesses, and consumers alike.

Numerous definitions have been put forward for FLW resulting in inconsistent use among authors. This confusion creates unnecessary complications in terms of categorization and the occasional overlapping and double counting of data. The high-level panel of experts (HLPE; 2014) on food security and nutrition food loss

and waste, defines food loss and waste as a decrease, at all stages of the food chain from harvest to consumption in mass, of food that was originally intended for human consumption regardless to the cause. Food losses (FL) refers to a decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause. Food waste (FW) refers to food appropriate for human consumption being discarded or left to spoil at consumer level regardless of the cause.

The confusion between food loss and food waste is widespread in the literature. Food loss and waste manifest at various points along the food chain, with variations between countries influenced by complex factors such as income levels, urbanization, and economic growth. (Chalak A. et al; 2016, and Gustavsson J. et al; 2011). Recent assessments of FLW levels in the European Union indicate that a substantial amount, approximately 70%, occurs during the downstream stages of the food supply chain, encompassing households, food service, as well as the wholesale and retail sectors. The remaining 30% of FL is attributed to the upstream stages, involving production and processing. Among the various stages of the food supply chain, the wholesale and retail sectors contribute to the smallest proportion of Food Loss accounting for only 5%. (Stenmarck Å. Et al; 2016). In the United States, retail losses accounted for an estimated equivalent of 10% of the total food supply (Buzby, J. C. et al.; 2011). The FAO estimates that there is 7% of retail losses in developing countries (WRI; 2011). The food loss at the retail level, has attracted particular interest. Detailed quantities of retail loss measurement and estimations were conducted worldwide for different commodities. (Bagherzadeh, M. et al; 2014, Beretta, C. et al; 2013, Caldeira, C. et al; 2019, Chaboud G., 2017). While the food loss rate in the retail sector is relatively low compared to other sectors, there is a rising focus on food loss reduction at the retail level because retailers act as intermediaries between producers and consumers (Ytterhus B.E, et al; 1999) and their practices and strategies exert significant influence on the generation of FLW across both the upstream and downstream stages of the food chain (Eičaitė, O. et al; 2022).

Consequently, in this paper we define as retail food losses (RFL) the decrease, at retail level, in mass, of food that was originally intended for human consumption regardless of the cause.

Literature identifies drivers/factors contributing to RFL, which can be categorized into four distinct groups based on the level of control the retailer has over them: i. Factors related to the product itself that are not under the control of the retailer. These include shelf lifetime, food safety standards (Thyberg K.L.; 2016), and can include the expiry date, poor packaging, expectation of cosmetic perfection, pack sizes, etc. ii. Factors under the direct control of the retailer such as insufficient skills, and knowledge of employees, improper quality control measures, inadequate handling of the product (storage, lack of refrigeration), poor infrastructure (store layout out, design, space, promotions and discounts, lack of planning (limited focus on waste), inappropriate product display and overstocked product displays. iii. Factors involving third parties: consumer behavior and variability of demand (consumer preferences for aesthetically perfect products or changing trends that lead to reduced sales of certain items, resulting in loss), insufficient skills and knowledge of consumers to read labels and select products properly; variability of supply or supply chain inefficiencies, trade agreements (e.g. "take back clause") (Rohm H. et al; 2017), limited adequate technology for storing, processing, measuring, (Beretta, C.; 2013), lack of communication and coordination (Heising JK. et al; 2014). And (iv). factors beyond the direct control of individual retailers or any other food chain actor: seasonal factors, (Buzby J.C. et al 2015), national infrastructure and logistics, lack of government support and inadequate legislation.

To mitigate and diminish RFL the following measures could be adopted: First, retailers implement a series of practices that prove to be advantageous (WRI; 2013, NRDC; 2013); these could include the analysis of needs at the item level, discounts on items close to their expiry date in-store promotions, providing guidance on food storage and preparation to consumers, improving inventory systems, redesign product displays and donation of unsold goods. Second, Governments measure FLW and establish national and regional visions, to reach their goals updated strategies and national standards are issued. In May 2020, the European Union's (EU) 'Farm to Fork' strategy, developed as part of the European Green Deal, mainstreams food waste reduction into the core of the EU sustainability agenda thus demonstrating that FLW is being taken seriously on a political level. And third, other stakeholders such as environmental advocacy and consumer organizations are contributing to communication related activities to increase awareness among consumers on ways to reduce food loss and waste, but also on its environmental impact e.g., implementing and managing food reduction activities such as food banks, green action week etc.

Lebanon, located in the Middle East and is classified as a West Asian country. 88,9% of its population are urban residents (UN-HABITAT; 2021) and this number is increasing particularly due to the increased influx of refugees. The Lebanese economy is defined by a rentier model (El Khazen F; 2020) whereby a substantial portion of its national revenue is derived from rent paid by foreign individuals, businesses, or governments for non-productive

assets. This model leads to notable inequalities and a concentration of both wealth and revenue. The agriculture sector contributes approximately 3% of the country's GDP, while the agri-food industry makes up 2.9 % of the economy (World Bank; 2020). Nevertheless, despite its modest contribution to the broader economy, agriculture plays a crucial role, especially in outlying rural areas, serving as a significant source of income generation and aiding local communities to deal with the repercussions of crises and shocks.

The current situation in Lebanon is exacerbated by many ongoing dynamics, the food system profile to Lebanon (FAO, EU, 2022) identified several challenges facing the country and propose actions required to progress towards achieving a sustainable and inclusive transformation of the food system among them reduction of food loss and waste.

Scientific literature related to FLW around the world is growing. In the Arab countries, the HLPE (2014) roughly estimated the FL to be 44% of the food handled along the pre-consumption supply chain while about 34% of food served is wasted at or during consumption. In Lebanon, the literature reported that around one third of the food produced is lost or wasted. Consumers living in urban Lebanon waste around 0,2 kg per day of food (Chalak A. et al; 2019). The literature relates to food waste generation at consumer level (household and restaurants) (Mattar L. et al; 2018, Zeineddine M. et al; 2021, Chalak A. et al; 2021). However, no literature has yet been identified that describes or quantifies retail food losses. Thus, establishing a foundation for understanding the quantities/volumes of retail losses, along with identifying the causes and factors influencing its generation, is crucial. This groundwork will help future research aimed at devising solutions to alleviate the negative FLW environmental impacts, fostering sustainable practices, and formulating policies to effectively address the issue of RFL.

2. Methodology

While undertaking research into food system transformation in Lebanon (methodology framework in figure 1), the assessment at retail level was conducted to understand the quantities of RFL as well as its causes, and to describe how the retails prevent and reduce RFL. The methodology started with a literature review followed by conducting a survey among retailers to collect information on retail losses.

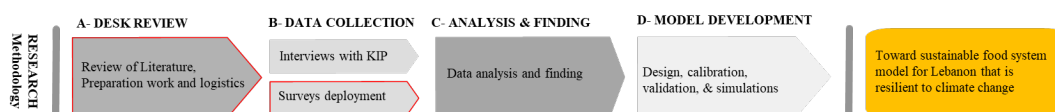


Figure 1: Methodology framework

2.1 Questionnaire development

As a survey tool, a literature-based questionnaire was developed for the purpose of this research. It includes twenty-one questions drafted in English and translated into Arabic. Data on the retail losses were collected for nine specific categories of food commodities, chosen based on their common presence in the Lebanese retail sector and on their food safety related procedures. The categories are 1- Eggs, 2- Bread, pastries, and sweets, 3- Fresh fruits and vegetables, 4- Fresh meat and fresh dairy 5- Prepared meals, 6- Cereals (Dried products), 7- Frozen Products, 8- Canned Products, and 9- Other.

The selection of retailers was randomly done. The survey took approximately ten to fifteen minutes to be completed. and it encompassed four sections:

Section 1: General information on the retailers,

Section 2: Management attitude and practices,

Section 3: Perceptions related to FLW causes and estimation about generated quantities,

Section 4: Practices at retail level to prevent/reduce the generation of FLW.

2.2 Data collection and analysis

Retail stores in Lebanon mainly fall into categories such as hypermarkets, supermarkets, minimarkets, and shops. In June and July 2023, a random sample of 81 retail stores covering the North Governorate and Beirut participated in the survey. The survey was conducted face to face on the premises of each retail stores. A

competent interviewer from the Faculty of Agriculture at the Lebanese University conducted the survey, engaging with store representatives responsible for stock management. The interviewer clarified the survey's objectives, guaranteed participant anonymity and confidentiality, and secured the consent of those involved. The Kobo Toolbox program (Kobo toolbox, 4.0) was employed to facilitate the collection of data, ensuring a streamlined and efficient process. Participant responses were recorded and managed in real-time through this platform. Furthermore, to uphold data integrity and accessibility, the gathered information was meticulously extracted and cleaned in an Excel spreadsheet. Following this, the data underwent coding and analysis utilizing the Statistical Package for Social Sciences (SPSS v 26). Pursuant to the goals of the study, first a descriptive statistical analysis is performed.

At the survey's commencement, participants received information about the purpose of the study. They were assured that their involvement was voluntary, entailing no associated risks, and that all data would be handled with confidentiality and anonymity.

Approximately 20% of retailers expressed concerns about potential judgments based on their responses or jeopardizing their positive relationships with the government, wholesalers, and retailers. A portion of this group also reported feeling overwhelmed by the numerous surveys distributed across various contact groups, leading them to abstain from answering the survey. The implementation of face-to-face interviews was a crucial measure in mitigating these concerns.

3. Results and Discussion

3.1 General information on the retail stores

General information describing the stores was collected, to be disaggregated and analyzed subsequently to assess if there is any correlation between FLW related variables and the characteristics of the retailers. The data collected covered the size, the number of employees, the commodities sold and the internal management. In Lebanon, as elsewhere, there are different sizes of retail stores which can be categorized according to the following groupings: shops known as 'Dekenne' in Arabic, minimarkets, supermarkets, and hypermarkets. The number of employees and the internal management provide information on organizational factors, and the commodities sold, inform on the infrastructure required to maintain the food product safe.

Table 1 General information on the surveyed retail stores

General information		Percentages
Size	Shop	64.20%
	Minimarket	23.46%
	Supermarket	11.11%
	Hypermarket	1.23%
Number of employees	Less than 5	83.95%
	Between 6 and 20	7.41%
	Between 20 and 50	4.94%
	More than 50	3.70%
Commodities sold	Fresh Fruit & vegetables	51.85%
	Fresh Meat & cheese	13.58%
	Frozen products	62.96%
	Canned products	16.05%
	Cereal - dry products	95.06%
	Bread & bakery	96.30%
	Eggs	70.37%
	Prepared meals	1.23%
	Other	91.36%
Specific responsibility for RFL	Yes	3.70%
	No	96.30%
Record the quantities of RFL	Yes	8.64%
	No	62.96%
	Sometimes	28.40%
Record the causes	Yes	8.64%
	No	58.02%
	Sometimes	33.34%

Table 1 shows that despite their diverse sizes, most of the retail stores have fewer than five employees. Fresh

meats, fresh dairy products, and cheese, as well as prepared meals, are notably absent in smaller shops. These products, which pose higher risks in terms of food validity (or expiry) and safety, require specific skill sets and store infrastructure (refrigerators for example), elements typically lacking in small Lebanese shops. Concerning staff organization, it is noteworthy that 96.30% lack a designated individual specifically responsible for managing RFL, and 62.96% do not maintain records of volumes of RFL. This indicates that information related to this subject and the associated quantities stated here, is largely based on estimations rather than concrete data recorded systematically.

3.2. Retail management attitude and practices

Several decisions should be made by the retailers to manage their stocks in stores. What they purchase and the ‘conditions’ they agree with suppliers (traders, agro-industries etc...) are two variables that inform on the level of obligations and commitment of the retailer towards the food products purchased and their incentives to sell it instead of wasting it.

3.2.1 Purchasing Behavior

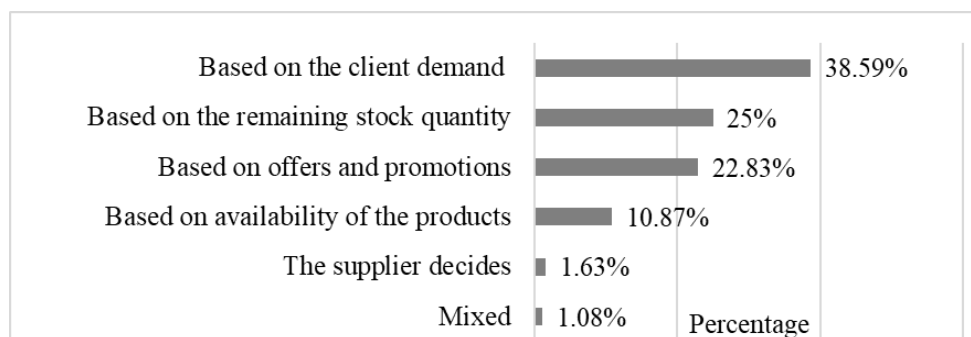


Figure 2: Retail purchasing behavior in North Governorate and Beirut

Figure 2 shows that 38.59% of retailers endeavor to align their product quantities with the anticipated demand from customers, while 25% of retailers make purchase decisions based on the quantity remaining in stock. Both of those purchase behaviors prevent overstocking and understocking of products. 22.83% consider offers and promotions provided by suppliers, and 10.87% make purchases based on product availability. In these cases, as demand is not taken into account, overstocking can occur, leading to RFL generation.

3.2.2 Relationship with supplier

Table 2: Take back agreement allowing to return unsold food to supplier

Products	Not allowed to return	Allowed to return	
		after	Only before
Fresh Meats	60.00%	10.00%	30.00%
Frozen Products	23.08%	0.00%	76.92%
Cereal (Dry products)	63.64%	0.00%	36.36%
Prepared meals	0.00%	100.00%	0.00%
Fresh Fruit and Vegetables	95.24%	2.38%	2.38%
Canned Products	67.57%	1.35%	31.08%
Dairy Products	45.10%	5.90 %	49.00%
Eggs	67.80%	6.80%	25.40%
Bread, Pastry, and sweets	56.16%	8.22%	35.62%

Data related to whether retailers have the option to return unsold products to the supplier is investigated. When examining those able to return products, respondents were specifically asked whether it was possible before or

after the expiry date. Observations as presented in Table 2, reveal a common pattern across all stores: 100% of prepared meals are permitted to be returned after the expiry date. On the contrary, 95.24% of fruit and vegetables are not eligible for return. Products like frozen foods, dairy, and cheese are generally allowed to be returned, but other products such as fresh meats, cereal (dry products), canned products, eggs, bread, pastries, and sweets are not. A better understanding about the relationship between the retailer and the supplier is needed to analyze if the take back agreement plays a role in Lebanese markets similarly to that in developed countries such as in Sweden (Ghosh, 2019, Eriksson, 2017). The literature reveals that when retailers are permitted to return products to suppliers, there is a tendency to overstock shelves without considering consumer demand. This practice often results in the generation of FL at the supplier level. Further details on the return policies of other food commodities remain to be explored.

3.3 Perception related to retail loss causes and applicable prevention strategies

Various factors affect RFL generation. Identifying the causes can be considered an initial step towards finding a

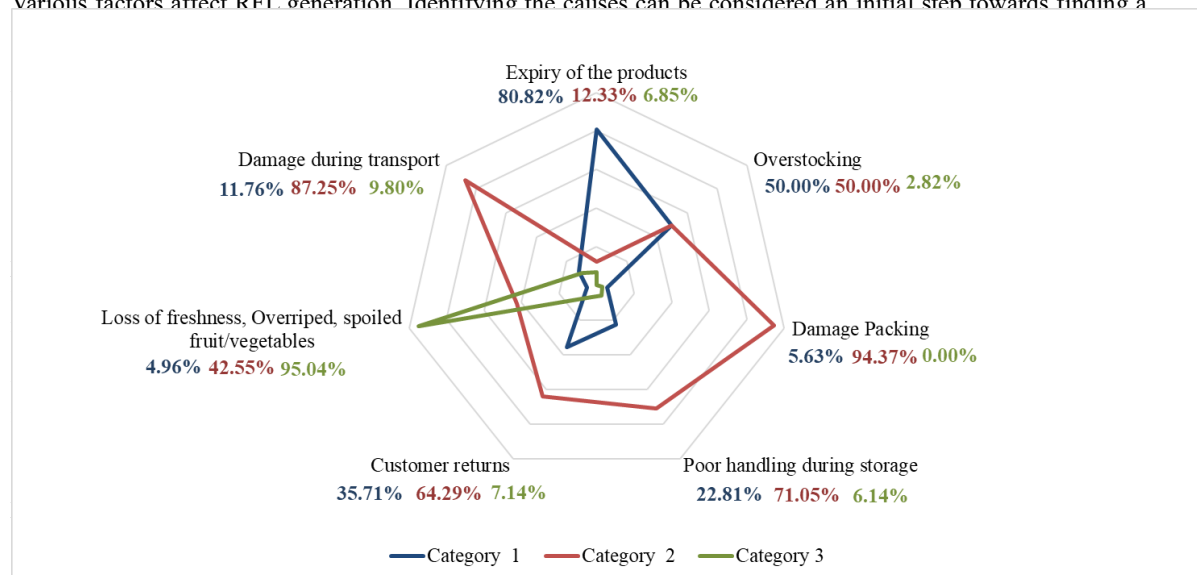


Figure 3: Perceived causes of RFL per food commodities categories.

Various studies in the USA (NRDC; 2013b), Europe, (Bio, 2010) the United Kingdom, (WRAP, 2011) Spain, (HISPACOOP, 2012) and Sweden (Xiao, Y.; 2021) have underlined that food date labelling, and confusion about “best before” or “use by” usually used for quality rather than food safety, represent a major indirect factor on 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. In Lebanon, labeling is also the main cause of food waste at consumer level; 74% of consumers throw away food by the expiry date without knowing the difference between best before and expiry date. (Charbel, L. et al; 2016)

Figure 3 indicates that customer returns do not hold meaningful value as a reason for retail losses. This case may be attributed to the Lebanese system's limited openness to such practices. Despite legal provisions allowing customers to return purchased products, the lack of prevalence in this behavior could decrease from cultural factors and a lack of established practices gained through experience. Customers refrain from utilizing this option, possibly due to cultural habits that discourage such practice.

3.3.2 Retail practices to prevent and reduce the retail losses

Table 3: Retailers strategies for disposal of unsold food products and products approaching expiration

Strategies employed by retailers	When it is unsold at its initial selling price	When it approaches its expiry
Try to sell at discounted price	79.01%	75.31%
Donate to family and friends	41.98%	41.98%
Return to suppliers/trader	37.04%	40,74%
Donation to employees	3.70%	4.94%
Donation to a third-party organization	2,47%	0%
Throw them in the garbage	1.23%	2.47%
Agreement with organization to redistributing surplus food	For humanitarian aid	For animal feed
Yes	8.64%	13.58%
No	91.36%	86.42%

Table 3 shows that the fundamental strategy to prevent RFL is to offer unsold food products at a discounted price compared to their initial selling price. Retailers also commonly engage in both donating to family and friends and returning products to suppliers with similar frequency as additional measures to minimize retail losses at their stores. Similar strategies are employed for products that are approaching their expiry date. However, retailers refrain from donating any product when it's on the verge of expiring to organizations. This might be due to the Lebanese legal framework that governs donations.

It is not unexpected that retail stores in Lebanon maintain a consistent approach in mitigating RFL for both unsold products and items that approach their expiry. This consistency could potentially be attributed to a deficit in understanding the importance of expiration dates, a viewpoint that these dates are primarily for adhering to national standards, or a belief that products maintain their marketability even beyond the stated expiration date.

Table 4: Percentage of retail stores that separate food from package before disposal

Separate the package from food before disposal	Percentage
Yes	13.58%
No	86.42%

The typical disposal of retail losses is in the garbage - the municipal waste bin. Notably, as shown in Table 4, 86.42% of retailers do not separate the food from its packaging before disposing of it. This aligns with expectations, given the current lack of appropriate legal framework for waste management in general and the absence of dedicated facilities for organic waste in particular. There is no obligation to separate the packaging from the food during disposal as is the case in some other countries under the extended producer's responsibility for packaging.

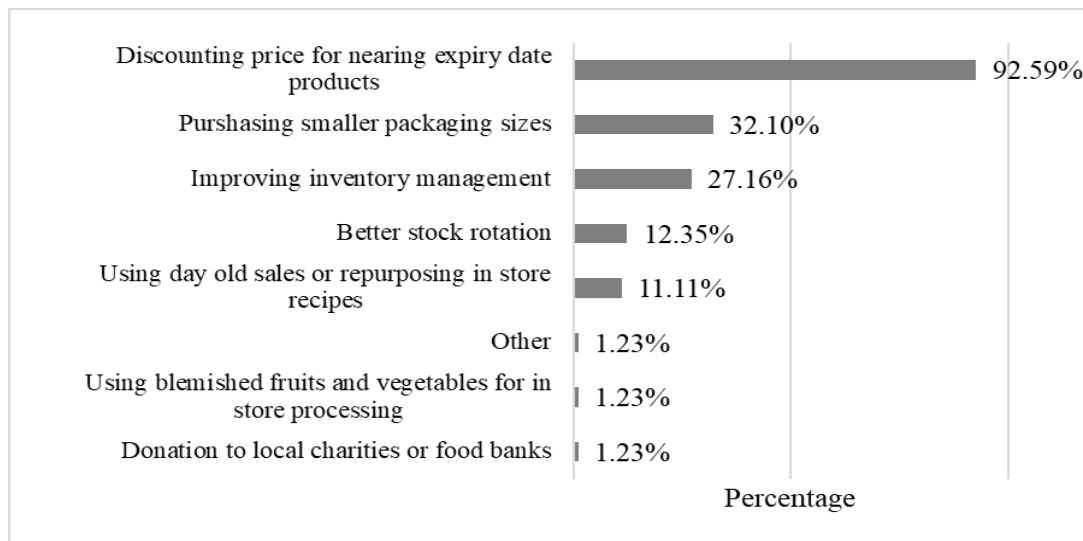


Figure 4: Retailer practices to prevent and reduce the generation of retail losses

To prevent and reduce the generation of retail losses, retailers apply different actions and practices. The results shows that 90.12% of retailers consider their strategies to be efficient. Figure 4 shows that 92.59 % of retailers apply discounts to food products nearing their expiry dates. These marketing strategies have proved to be efficient and do increase consumer purchases: 43% of Lebanese consumers are attracted to those offers and 45% are sometimes attracted. (Charbel, L. et al; 2016). Nonetheless, these strategies could potentially contribute to the rise in food waste at the consumer level, as they lead to the purchase of larger quantities than necessary. Purchasing smaller packaging sizes items and improving inventory management are the two other most common practices, with 32.1% and 27.16%, respectively.

3.4 Estimated quantity of retail food losses generated

The quantity of RFL generated in Lebanese retailers is unknown and not yet documented. Measurement process requires specific developed and delicate approach and tools to conduct. In this paper, we asked the retailers about their estimation /perception of the generated quantity in both qualitative (a little, average, a lot, cannot estimate) and quantitative (with a number to add for a specific unit per food commodity). The responses are summarized in Table 5 and 6.

Table 5: Perception toward the overall RFL quantity generated

RFL generated	Percentage
A little	79.01%
Average	13.58%
A lot	0.00%
Cannot estimate	7.41%

Regarding the perception toward the overall RFL quantity generated, Table 5 shows that approximately 79% of retailers perceive it to be a small amount, while 14% estimate it as average. None of the respondents consider their retail losses to be a lot, and 7% find it challenging to provide an accurate estimation of the quantities involved.

Table 6: The average RFL generated in a one-week period per Kg

Estimation of RFL Quantity	Range (Kg)	Average retail loss in Kg per week
Fresh fruits and vegetables	0-55	14.63
Fresh meat	0-10	3.22
Milk, dairy and cheese products	0-5	0.42
Canned food	0	0
Cereal (dry products)	0-2	0.079
Bread, pastries, and sweets	0	0
Eggs	0	0
Prepared meal	0	0

To understand the quantities related to their qualitative description, retailers were prompted to estimate their weekly RFL for each specific food commodity per specific unit (liters, Kg, box, can). The results were transferred to Kilogram (kg) to facilitate the comparison. Table 6 shows that retail losses include losses in fresh fruits and vegetables, and fresh meat mainly, and non-significant losses in milk, dairy and cheese products, and cereals. No losses at all were cited for products such as canned foods, bread, pastries and sweets, eggs, and prepared meals.

One of the main reasons that can be attributed to these relatively low estimates of retail losses are the take back agreements with suppliers that allow the retailers to return unsold food to the supplier. In section 3.3.2, retail practices to prevent and reduce retail losses shows that the reduction of prices and selling at a discount is an efficient practice used to reduce losses, and this can be considered the second reason for the low quantity of retail losses. Specially in the current financial crisis that Lebanon is facing, where the inflation continues to raise to be one of the main drivers of food insecurity. In August 2023, food inflation was 274%, and among the highest food inflation rates worldwide. (IPC; 2023). This food insecurity seems to be diminishing the customers' purchasing powers, influencing their behavior and preferences toward less expensive products.

4. Conclusion

The reduction of FLW is a fundamental responsibility of all food chain actors from farmers through to consumers. At retail level, RFL should be considered seriously as the strategies used by retailers to prevent losses also has negative implications in terms of pushing waste back to suppliers, or forward to consumers. The objective of the survey carried out, was to understand the management attitude and behavior of the surveyed Lebanese retailers that has an effect on the generation of RFL, their perceptions about RFL causes, and their estimation of losses quantities. And, to identify the practices they engage in to prevent and reduce those losses. This study is a first of its type where gaps in knowledge about RFL are addressed at retail level in Lebanon. A summary of the findings is listed below:

- Retail stores primarily aim to align their product quantities with the expected demand from customers. Lack of knowledge and variability in consumer demand can result in the overstocking of products that end up unsold. Some unsold food commodities are allowed to be returned to the supplier.
- Preliminary observations reveal a common pattern across all stores: 100% of prepared meals are permitted to be returned after the expiry date. On the contrary, 95.24% of fruits and vegetables are not eligible for return. Products like frozen food, dairy and cheese products are commonly allowed to be returned, but other products such as fresh meats, cereal (i.e., dry products), canned products, eggs and bread pastries and sweets are not.
- Retailers observe that the main causes of unsold food are different between food commodities, but the expiry date is a main factor as well as the loss of freshness specifically in the case of fruits and vegetables. Other causes identified included damage during transportation specifically for cereals and dry products.
- To prevent and reduce the generation of RFL, retailers engage in different actions and practices. 90.12% of retailers consider those strategies efficient. About 92.59 % of retailers apply discounts to food products approaching expiry. In Lebanon, a developing country living through a financial crisis, where poverty has increased and consumers' purchasing power has become very weak, discounted food at retail stores is very attractive and allows financial savings at household level, meaning that food which might have been wasted in retail is instead sold to consumers.
- Regarding the quantity of RFL generated, approximately 79% of retailers consider it to be a small amount,

while 14% consider it to be average. None of the respondents consider their retail losses to be a lot. 7% find it challenging to provide an accurate estimation of the quantities involved. This is just an estimation as 62,96% of the retailers do not record the amount of RFL generated.

RFL are relatively low in the samples from Northern Lebanon and Beirut and could even be considered negligible as compared to the known 7% estimated for retail losses in developing countries. These findings are in all probability related to the financial crisis in Lebanon, and the low purchasing power of consumers. If the financial crisis is not considered, the gathered RFL related information can be confusing. In addition, it is obvious that retail knowledge about RFL is lacking, the assumptions regarding its quantity can be misleading. Thus, increasing awareness about food labeling and food handling as well as recording and tracking quantities of RFL along with their causes are crucial to start with. Further research using specific measuring tools (such as weighting and recording RFL) is needed to better understand the RFL and their causes. This will allow the development and testing of strategies to prevent and minimize these losses, rather than shifting the burden onto suppliers or passing it onto consumers.

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