



## Full length article

## Explorative study about the analysis of storing, purchasing and wasting food by using household diaries



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## ABSTRACT

The issue of food waste is especially in light of ethical and environmental considerations of high interest with the endeavour to minimise food waste. The purpose of this study is first to test the diary method for gathering data about food waste in households and second to investigate the storage, purchase and food waste behaviour and show if there is a correlation between storing, purchasing and wasting food. The study was carried out by 25 test households in Germany, who kept a diary for seven days by using different questionnaires to document their food storage, purchase and waste each day. The results show that the diary method is suitable to get detailed data about daily behaviour in handling with food and food waste. Further the study showed that food storage, purchase and waste are correlated and should be seen together for example in awareness campaigns with the aim of reducing food waste.

## 1. Introduction and background

## 1.1. Background and objectives

Annually, one third of purchased food is wasted, a majority of which would have been suitable for human consumption (WRAP, 2008; Beretta et al., 2013). In light of ethical and environmental aspects the issue food waste is focused. Worldwide 795 million people suffer from hunger (FAO, 2015) and at the same time 1.3 billion tons of food were discarded (WRAP, 2008). Additional food production and food waste were connected to numerous environmental damages, for example arising greenhouse gas emissions or using resources like fresh water, and also with rising costs for the food industry and households (Quested et al., 2011; Kummur et al., 2012; Grizetti et al., 2013; Lipinski et al., 2013; Nahman and De Lange, 2013; Noleppa and von Witzke, 2012; FAO, 2013; Eberle and Fels, 2015; Noleppa, 2014). In the UK it is estimated that consumer pay 15 billion EUR per year in the UK for food that is not eaten. This is conform to 603 EUR per year and household (WRAP, 2009). Overall, the highest amount of food waste along the supply chain occurs at consumer level (Monier et al., 2010; Parfitt et al., 2010; Gustavsson et al., 2011; Kranert et al., 2014). Mostly food with short shelf life is discarded (Vanham et al., 2015), where generally various interacting activities influence the amount of food waste in households (Mondéjar-Jiménez et al., 2016; Quested et al., 2013). Yet, mainly food is wasted in households by preparing and serving food (Pekcan et al., 2014).

In the EU-27, consumers are responsible for 42% of food waste, amounting to 38 million tons food waste (Monier et al., 2010). In Germany, consumers are responsible for two third of food waste. Half of this waste is avoidable (Kranert et al., 2014). 20% of purchased food and 30% of packaged food is discarded (Rosenbauer, 2011). But food waste occur in households for a variety of reasons. Most commonly, food is discarded due to spoilage, leftovers on the plate or out of date (Koivupuro et al., 2012) and is wasted although it has been suitable for human consumption. This can mainly be attributed to individuals purchasing too much, using unsuitable or insufficient storage practices, out of date, finding the food unsavory either to the nose or the palate, forgetting to freeze food properly, cooking too much or simply not using leftovers (WRAP, 2008; Koivupuro et al., 2012; Cox and Downing, 2007; Porpino et al., 2015).

Consumers show a lack of awareness for the quantity of food waste occurring in their households. Moreover, consumers have a low level of awareness in terms of the environmental damages caused by food waste (Quested et al., 2011). Farr-Wharton and Foth (2014) identified three key factors that account for food waste in households: (1) consumers do not know what food they still have at home, (2) consumers lack of knowledge how food is stored and (3) it has not been proven how and to what extent past experiences and acquired knowledge influence purchasing decisions or food waste behaviour (Farr-Wharton and Foth, 2014). This forms the subject of the present study, to show causes for storing, purchasing and wasting food and contextualize these aspects together. Further for this investigation the diary method is tested,

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weather it is suitable to get insights to household behaviour especially food storage, purchase and waste.

### 1.2. Consumer behaviour related to food waste in households

The foremost motivator for consumers in reducing food waste is the desire not to waste money (Baker et al., 2009; Graham-Rowe et al., 2014). Ecological benefits resulting from lower food waste are less important for consumer (Baker et al., 2009). Further motivations in terms of reducing food waste are seen in concerns towards waste, doing the right thing, guilt and awareness about poverty and hunger (Baker et al., 2009; Quested et al., 2011; Graham-Rowe et al., 2014). However, there are also barriers relating to reducing food waste, as an excellent food supply or no responsibilities. Additional absent priorities and interest in this area are also a real barrier to minimising food waste, given that many consumers already consider themselves to have their food and waste planning under control and are satisfied with their own behaviour in this respect (Graham-Rowe et al., 2014). Other consumers are also indifferent to a certain extent and, for example, think that food waste do not have harmful effects on the environment, or do not perceive the issue as a problem (Doron, 2012; Cox and Downing, 2007; Graham-Rowe et al., 2014). Even the retail sector presents a barrier for effective strategies in reducing food waste, as their profits depend on sales volumes (Baker et al., 2009).

Thus the food waste behaviour is effected to a greater extent by purchasing routines than by intentions of wasting less food (Stefan et al., 2013). Shopping habits do not directly influence the food waste behaviour (Ponis et al., 2017). Mostly, consumers are taken aback when confronted by that fact that they are wasting food and feel guilty. They are aware how to avoid food waste, but do not adhere to their tips. For example, many consumers think that purchase planning can reduce food waste. Nevertheless, purchase decisions often are made spontaneously in retail environments (Baker et al., 2009). Given this fact, food waste arise due to an interaction of different behaviour in food planning, purchasing, storage, preparation or consumption (Quested et al., 2011). Some food is not purchased because of consumer requirements regarding optical properties, freshness, shelf life, variety or availability (Beretta et al., 2013). The prevention of food waste is strongly linked to consumer behaviour, which is, in the case of avoiding food waste, not simply visible for others, compared to other environmental protection activities like recycling (Quested et al., 2013). For this reason, many consumers are willing to recycle household waste (Martin et al., 2006). This leads to the importance of social norms and the visibility of an individual's effort for reducing food waste (Quested et al., 2013).

Further the expiration date has an influence on the amount of food waste (Milne, 2013; Van Boxtael et al., 2014). In Belgium, 80% of consumers are familiar with the label “best-before-date” or “use-by-date” and 70% also know the difference between these labels. The best-before-date is either used as standard value and is open to flexible interpretation, depending on the type of food (Van Boxtael et al., 2014). But consumer often are confused by the best-before-date and the use-by-date (Milne, 2013). Additionally, suitable packaging solutions that protect products in retail environments, during the distribution and in households can lead to lower food waste and environmental damages (Silvenius et al., 2014). Often, due to ill-suited packaging, food is wasted because packages are too large, cannot be emptied properly or due to the expiry of the best-before-date (Williams et al., 2012).

The quantity of food waste is affected by socio-demographical factors, like size of household, the gender that is responsible for food purchasing, guidelines for reducing food waste or settings regarding the impact of the purchase of particular packaging sizes (WRAP, 2008; Parfitt et al., 2010; Quested et al., 2011; Koivupuro et al., 2012; Secondi et al., 2015). Further these criteria are influenced by different interacting activities (Quested et al., 2013). According to Koivupuro et al. (2012) there are only single socio-demographical factors that demonstrate statistically significant differences in terms of avoiding food

waste (Koivupuro et al., 2012). There is a correlation between the quantity of food waste and the number of persons living in one household (Koivupuro et al., 2012; Edjabou et al., 2016). Single-Person households waste more food compared to other household sizes on a per capita basis (WRAP, 2008; Quested et al., 2011; Koivupuro et al., 2012). In this respect, food waste increase with rising household size (WRAP, 2008; Baker et al., 2009). Households where women are responsible for purchasing have a greater amount of food waste than households where men or both women and men are responsible for purchasing (Koivupuro et al., 2012). In contrast, women rather reduce food waste than men. Probable because women spend more time in kitchen and are aware about the costs for not used food (Secondi et al., 2015). Contrary to some investigations, like WRAP (2008), Parfitt et al. (2010), Quested et al. (2011) or Secondi et al. (2015), who stated that older people waste lower quantities of food, Koivupuro et al. (2012) could not find a correlation between age and the quantity of food waste (WRAP, 2008; Parfitt et al., 2010; Quested et al., 2011; Koivupuro et al., 2012; Secondi et al., 2015). Additionally, Baker et al. (2009), Parfitt et al. (2010), Secondi et al. (2015) and Setti et al. (2016) declared a correlation between income and quantity of food waste, which rises with increasing household income (Baker et al., 2009; Parfitt et al., 2010; Secondi et al., 2015; Setti et al., 2016). Furthermore, people of urban areas have more food waste than people in rural areas (Secondi et al., 2015). Overall, the variability of consumer behaviour is connected to individual characteristics which are important regarding the characterisation of their food waste behaviour (Secondi et al., 2015). Initiatives could be more effective if they are particularly oriented to this context (Southerton et al., 2011).

## 2. Methods

### 2.1. Conceptual framework

Currently, there is no standardised method of obtaining data on the quantity of food waste in households and each study about food waste generally employs another definition on this basis or uses different classifications when addressing the topic. Due to this fact, several studies are not comparable with each other (Lebersorger and Scheider, 2011). Furthermore in the literature both terms “food waste” and “food losses” are used, whereby the terms are demarcated differently. In all, food waste can be characterised as food which is produced for human consumption but discarded before consumption (Ponis et al., 2017).

In this study, simply the term “food waste” will be used, which comprises all food rests occurring along the supply chain, meaning avoidable, partly avoidable and unavoidable food left-overs. More precise, food waste is defined, following Östergren et al. (2014) and Ponis et al. (2017), as food produced for human consumption but not consumed by humans. This includes also food rests that are passed to animals. This explanation was also given to the respondents.

To compare data about costs of food waste, costs are stated uniformly in EUR, and foreign currencies are converted from the original currency into EUR, according to the average annual reference price of the German Bundesbank (Deutsche Bundesbank, 2015).

### 2.2. Diary-method

Originally diaries were used in early social networks research in the area of health and social science (Reid et al., 2011). The methodical approach was introduced in the early 1960s to gather information about cognitive changes in psychology or behaviour theory (Thiele et al., 2002). Later the method was used as research tool for collecting and analysing in-depth data and especially for long invested surveys (Hunter et al., 2006). However, solicited diaries are written with researcher in mind. The diary is filled regarding the topic of researcher's interest and with the knowledge that the content is read and interpreted by the researcher (Jacelon and Imperio, 2005). Thus, diaries are a form

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