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## **The Role of Education Toward Food Waste Minimization**

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### **Abstract**

Food waste represents a social, economic and environmental issue, and has been accounted among the 17 Sustainable Development Goals in terms of responsible food production and consumption. However, although authorities and academia have been interested in the issue, several efforts must be enhanced to educate people on sustainable food consumption behaviors. The present paper, according to a brief systematic and configurative literature review conducted on Web of Science Core Collection (WoS) from February 2011 to February 2021, tries to answer the following research question: How education could be enhanced to increase food waste awareness/perception among young generations? First, it has emerged that young generations are completely aware of food waste phenomenon, are largely interested in environmental issues but still generate huge amounts of food waste. Therefore, considering that young people seem to have a high reactivity in relation to environmental concerns, it is fundamental to steer this attitude toward more sustainable behavior patterns through food education. In addition, people between 18-35 years old represent the “healthy carriers” of inspiration, hope and culture on sustainable development. However, several efforts to make education interactive, comprehensive, engaging and inclusive are essential. Results highlight the opportunity of creating innovative education systems, interactive application, technical sheets adapted to different ages, in order to illustrate the precise meaning of food waste in terms of social, economic and environmental consequences. Finally, the authors stress the importance difference between education about sustainable development and education for sustainable development, which has to be intended as a purpose.

### **Keywords**

Food waste; Consumption behavior; Education; Sustainability

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### **Introduction**

Food waste takes part in all phases of the supply chain, from the farm's first processes to the final consumer stage (Evans and Nagele, 2018). It has economic and environmental costs estimated at around 1.7 trillion USD (European Court of Auditors, 2016), which is equivalent to 1.3 billion tons of food. The annual quantity of wasted food represents about 1/3 of all the food produced for human consumption, with the main categories of food losses and waste represented by cereals and dairy products. Further, beside its measurable costs, food waste also means losses of essential resources like raw materials, energy, water (Boys and Rickard, 2019) and labour (FDA, 2020). Only across the European Union (EU), it is estimated that around 88 million tons are thrown every year, equal to 173 kg of food waste per person (Ilakovac, et al., 2020). As a consequence, food waste has become a priority on the National Agenda of the United Nations, being accounted among the United Nation Sustainable Development Goals (SDGs) in terms of responsible food production and consumption. It is stated to “halve, by 2030, per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses” (United States Department of Agriculture,

2019). In this context, all stakeholders (e.g., farmers, companies, governments, consumers) are determined to act and diminish their unsustainable behaviour toward sustainable development. In order to mitigate food waste quantities at individual and sectoral levels, several typologies of food waste prevention strategies have been adopted (Treatwein and Langen, 2021). The findings suggest that young people's responsible food waste behaviour is positively influenced by the knowledge of the issue (Adriana et al., 2021). One of the most used measures is the *awareness campaign* that can deliver the message to the individuals and motivate them to improve and/or change their behaviour (Soma and Maclaren, 2021). Technology also plays a significant role in changing citizens' unsustainable behaviors and supporting companies to reduce food waste quantities in all phases of the supply chain. However, the COVID-19 pandemic, modifying foods' availability (Rodgers, et al., 2021) and the consumers' behaviour, has led to a deceleration of the sustainability trends. To highlight the necessity of reducing food waste and reach previous trends, all stakeholders should engage more in the whole food supply chain. Actually, adapting responsible food marketing practices to different customer types can make a valuable contribution to reducing food waste (Aschemann-Witzel, et al., 2021), including the focus on sustainable packaging, which recorded a growing interest from the consumers (Mergent, 2020). However, increasing efforts should be done to educate young generations toward the food waste issue and enhance their awareness. Indeed, as stated by the European Commission (2020), the direct involvement of consumers is essential to pursue SDGs and address climate change, either intervening through education, youth engagement and social innovation.

Considering young generations as "healthy carriers" of inspiration and being more open to change, the present paper reviews selected studies dealing with food waste issue among the young generation, highlighting opportunities and challenges toward sustainable behaviors and education enhancement.

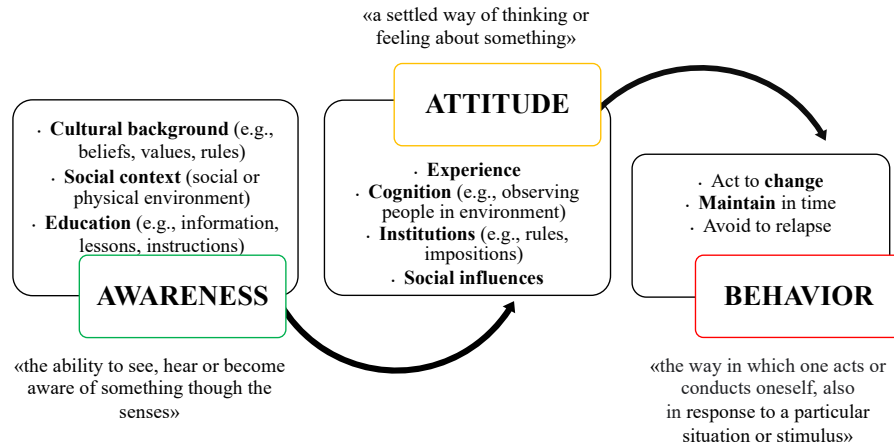
### **Research methodology**

The authors have conducted a brief systematic and configurative literature review on food waste education among the young generation within international empirical studies. In line with the approach proposed by Özbük and Coşkun (2020) and Rana et al., (2021), the present review has been performed in an explicit, transparent, and reproducible way achieving the double purpose of methodological rigor and usefulness of the review itself. First, the authors illustrate the main definitions considered within the study. Subsequently, general assumptions and review criteria are provided.

#### *Definitions: food waste awareness, attitude and behavior*

Food consumption behavior plays a key role toward food waste reduction (Gabriel, et al., 2021). However, it is important to highlight the impact of cultural background, social context and education on food waste awareness, as well as the role of personal experience, cognition and social influences in the field of food waste attitude. Over time, only positive changes in awareness and attitude could help people to change behavior and act, maintain and avoid relapse. Figure no.1 illustrates the main variables influencing food waste behavior at final consumption (remembering that more than 50% of food waste occurs at this stage), considering the importance of current awareness, attitudes and behavioral patterns among households. A plethora of studies have been dedicated to the influence of food waste awareness/perception toward more sustainable food consumption behaviors. As instance, Principato, et al. (2015) and Fanelli and Di Nocera (2017) stated the importance of educational and awareness campaigns in the field of food waste reduction, demonstrating how positive changes in perception, in the mid-to-long term, are more likely to affect waste behaviors. However, along with perception – considered as "the ability to see, hear or become aware of something through the senses" (Oxford Languages, 2021) – also habits and emotions should be taken into account as main variables involved in food waste at households. Being emotions as non-cognitive determinants of behavior (Klöckner, 2013; Russell, et al., 2017) while habits as stable patterns (Verplanken and Holland, 2002), it is essential to highlight and act on repeated negative behaviors, underestimated errors, reiterated and unsustainable attitudes to waste starting from problem awareness and social norms (van Geffen et al., 2019). It is generally considered that conventional communication campaigns on food waste are essential, but the majority tend to remain at a "provision of information" stage (Tan et al., 2008). To enhance these strategies, a few but significant steps are required: (a) increasing awareness through education; (b) changing attitudes through experience and cognition; and then, (c) changing and maintaining behavior over time. As stated

by reference literature (Giordano, et al., 2018), changes in attitude are not likely to lead directly to changes in behaviors, while it is crucial to arise the *urgency* or the *desire to act* at personal level through more specific information, calling for commitment and trying to instill concrete needs in the target audience.



**Figure no. 1. Variables influencing the awareness-attitude-behavior process**

Source: Personal elaboration by authors. Definitions: Oxford Languages (2021)

#### General assumptions and review criteria

The main assumptions at the basis of the present research are: (a) food waste reduction represents a key-issue in achieving the SDGs and the European Green Deal targets; (b) major efforts should be done to change food consumption and food waste behavior at households' level; (c) young generations have a significant responsibility in minimizing food waste, because they can be considered as "healthy carriers" toward sustainable development and the most open to change. Therefore, how education could be enhanced to increase food waste awareness/perception among young generations? Conventional awareness raising strategies (e.g., moral approach, information provision) are not enough, but novel approaches should be explored to translate theory into practice, closing the awareness-action gap. The analysis starts investigating the awareness, attitude and behavior among young generations, considering "young" those people between (approximately) 18-26 years old (Arroyo, et al., 2013; Bonnie, et al., 2015), conducting a brief systematic and configurative review on Web of Science Core Collection (WoS), from February 2011 to February 2021. Suitable and adequate research strings such as "food waste" AND "canteens", "child", "cluster", "education", "school", "university", "young generations" and "young people" have been selected. Papers have been collected among the following research areas: (i) "environmental sciences technology"; (ii) "food science technology"; (iii) "business economics"; (iv) "educational research"; and (v) "behavioral sciences". Then, all resulting papers have been analyzed in title, abstract and keywords in order to create a list of articles on the topic. All words are related to the semantic field of youth. Subsequently, an accurate screening has been done in order to include in the database only papers perfectly in line with the scope of the analysis. The authors selected only articles from peer-reviewed journals, but also included some proceedings of international conferences as well as contributions based on existing knowledge, personal recommendations and serendipity.

#### Results and discussions

According to the previous research strings, a plethora of studies have been published on food waste topic from February 2011 to February 2021. Indeed, the following numbers of studies emerged from the literature review: "food waste" AND "young generations" (17), "young people" (20), "canteens" (66), "school" (121), "cluster" (126), "education" (206), "child" (220) and "university" 297. However, in this preliminary research only ten articles have been selected, including those specifically dealing with young people and young generations (i.e., pupils, school students, university students, teachers)

and excluding those dealing with households in general. The majority of studies has been conducted in recent years, especially in 2020 (n = 4) and 2018 (n = 2). At first sight, it is interesting to underline the heterogeneity of the approaches applied to investigate food waste issue among young generations. Several authors have been essentially analyzing the phenomenon at households, while others have conducted direct investigations at school or university canteens (Derqui, et al., 2018; Kowalewska and Kollajtis-Dolowy, 2018). However, interesting are the studies conducted on teachers, intending those people directly involved in education and awareness programs (Derqui, et al., 2020; Redman and Redman, 2014). Moreover, the analyses have been conducted all over the world, from Asia (Liu, et al., 2016) to Europe (Favuzzi, et al., 2020). Table 1 illustrates the selected studies (chronological order) and the sample size of the investigation.

Several trends in food waste education could be underlined in the light of selected papers. As stated by Wakefield and Axon (2020), it is crucial to consider age as a positive variable toward food waste minimization, considering older consumers as lower food waste producers compared to younger ones. Indeed, old people are more likely to discard less food in the light of life-experiences such as the austerity or the food rationing of previous times of crisis. Further, the presence of young children is likely to increase the amount of food waste per household. Therefore, the authors propose a sort of “shock tactic”, highlighting the importance of an empirical education instead of a theoretical one.

**Table no. 1. Selected studies on food waste awareness, attitude and behavior**

	Authors	Sample	Main features
1	Leal Filho et al., (2021)	52 university	“cultural change”
2	Feijoo and Moreira (2020)	77 university students	“environmental footprints”
3	Wakefield and Axon (2020)	100 respondents from 18 to 34	“shock tactic”
4	Favuzzi et al., (2020)	257-323 children	“meals judgement”
5	Derqui et al., (2020)	420 school headteachers	“sustainable schools”
6	Derqui et al., (2018)	Over 10,000 pupil's trays	“60-100 g per pupil per day”
7	Kowalewska and Kollajtis-Dolowy (2018)	555 students from 11 schools	“23 g per pupil per day”
8	Liu et al., (2016)	923 school students	“130 g per student per day”
9	Abe and Akamatsu (2015)	2659 Japanese students	“nutritional education”
10	Redman and Redman (2014)	364 teachers	“supervisor active role”

*Source: Personal elaboration by the authors on Web of Science Core Collection*

At primary school, as stated by Favuzzi, et al. (2020), one of the main variables influencing food waste is related to “meals judgement”, with particular reference to meals size, palatability and appearance. Further, the authors have considered the setting where food is served as a crucial variable influencing food waste. Therefore, they stressed the ambitious goal of training and educating either pupils, teachers or parents to consume food conscientiously. In the field of school students, Derqui, et al. (2020) highlighted the importance of proceeding on two parallel tracks: on the one hand, that of social sustainability; on the other, that of environmental sustainability, engaging people toward food waste minimization by an improvement of communication, an advanced training or the introduction of flexible portions. The aim is to create “sustainable schools” with specific sustainable educational programs. In terms of quantities, it depends on students’ nationality and relative educational background regarding food waste issue. Derqui, et al. (2018), in Barcelona schools, assessed food waste quantity in roughly 60-100 g per day per pupil, considering as the main driver the schools’ educational perspective. Kowalewska and Kollajtis-Dolowy (2018) estimated food waste in Polish schools at roughly 23 g per day. The main category of wasted food is represented by potatoes, bread, fruit and vegetables. However, the highest rates were found in China (Beijing), with 130 g per student per meal of thrown away meals

(Liu, et al., 2016), where the main category of wasted food was composed of staple food and vegetables. The main recommendations to decrease food waste in Beijing schools included awareness campaigns at the food serving place and using on-site cooking sites to keep the food appealing and freshness. Similar findings were found in Japan (Abe and Akamatsu, 2015). Japanese elementary school children are more likely to leave meals uneaten if the feed does not look delicious or the time to eat is not enough. In this context, nutritional education is essential to raise children's awareness about the high implications of food waste. To positively impact the children's behaviour, educators should involve more, as supervisors' active implication during the meals and as change creators (Redman and Redman, 2014). At university level, Leal Filho, et al., (2021) has highlighted the urgency of "awareness-raising", specifying that more information should be raised among students. Indeed, it is stated that university students must contribute to a "cultural change" which could encourage "cherish food and be responsible eaters". Under an empirical perspective, Feijo and Moreira (2020) have suggested the introduction of the calculation of "environmental footprints", throughout the entire food life cycle, to increase food waste awareness among university students. The authors consider the combination of financial awareness with environmental impacts as an essential tool for decision making, enhancing the role of eco-efficiency as a crucial variable toward sustainable food purchase and consumption. Further, the research introduces a significant construct: "young people are more open to media influence and fashion trends", indirectly meaning that young people are malleable and easily influenced by external variables.

### Conclusions

Education is considered as one of the main roots of life quality, improving young generations' economic status and life settings toward sustainable models declined under the three pillars of sustainability (economic, social and environmental). As conception of education evolves and its value fluctuates in relation to extend backgrounds by including the environmental issues, the education metrics now seek to quantify not only *what* people know or can do, but *who* people are and who they can turn out to be. Challenges and solutions toward sustainability are deliberated upon in a constant cycle of reflection and action that is inclusive of all relevant actors. Understanding consumer behavior toward food waste in their natural context and finding the relationships between awareness, knowledge, values and perceptions, current practices and tools, and willingness to its reduction for different groups defined by socio-economic and cultural background is a prerequisite for empowering food waste education. The conception of other educational programs for schools aims to develop a global understanding of human capital valuation. In addition we underline the importance of promoting education for sustainable development as yearly recommended by the United Nations Commission on Sustainable Development. The authors, in line with Rosalyn McKeown (2002), suggest the introduction of educational toolkits containing exercises to explain the concept of sustainable development, considering the important difference between education *about* sustainable development and education *for* sustainable development, where *for* or has to be intended as a purpose. Indeed, education represents a tool to achieve sustainability. Developing a global ethic for improving the education for diminishing food waste is a necessity nowadays as part of education for sustainable development. It is important to understand the need of food waste diminishing as global issues that must be solved as local issues in connection with local culture, education system and consumer behavior.

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