

Consumer food waste

Fact sheet

The Netherlands Nutrition Centre informs consumers about sustainable food choices. This includes providing information about food waste and how to prevent it. In 2017, the total amount of food waste in the Netherlands was somewhere between 1.81 billion kg and 2.51 billion kg. Consumers create the most waste, with a share of between 23% and 32%.¹ This means that it is important to find solutions that are relevant to consumers, in order to enable them to change their behaviour.

In the Netherlands, 8 out of every 10 people are prepared to reduce their food waste. The arguments they give include that they find it 'simply unacceptable', that they consider it a waste of money or that it is wrong because many in the world are still going hungry. However, in reality, consumers are faced with several barriers in preventing food waste. Reasons why consumers throw away food include that they

- purchased too much;
- stored products incorrectly;
- had cooked or prepared too much of the product.

To fight food waste, it is important for consumers to change their behaviour in terms of buying, storing, cooking and preparing food. Simple solutions include:

- checking fridge, shelves;
- making and using a shopping list;
- storing products in the right place and in the right manner;
- using a measuring cup, measuring jug or kitchen scales to determine the correct portions.

This fact sheet focuses on consumer food waste. How much do consumers waste, why do they waste food and how can they reduce wastage?



Definition of food waste

Food waste occurs when food is not used for human consumption although it was intended for that purpose.¹ A distinction is drawn between avoidable food loss and unavoidable food loss. Avoidable food loss is viewed as food waste, since it involves the edible parts of food.² Unavoidable food loss involves, for example, peels, stalks, cheese rinds, eggshells, coffee grounds, used tea leaves and tea bags, and meat and fish remains (bones).³

Who is this fact sheet for?

In 2017, the total amount of food waste in the Netherlands was somewhere between 1.81 billion kg and 2.51 billion kg. This is the waste generated between the farmers – via shops and catering outlets – and the consumers. Consumers create the most waste in the Netherlands, with a share of between 23% and 32%.¹ This is followed by agriculture, the hotel and catering sector, the processing and storage sector, supermarkets and the food industry.³ This means that it is important to find solutions that are relevant to consumers, in order to enable them to change their behaviour. This fact sheet should prove useful for professionals and food chain involved in providing information and formulating strategy and policy to prevent consumer food waste.

What are the issues at stake?

Scale of waste in figures

How much food do consumers waste at home? Dutch consumers waste around 34 kg of solid food each year, at a cost of over € 120.³ Solid food includes thick liquid milk products (such as yoghurt and quark), soups and sauces, but does not include beverages, which usually are not disposed of in the household refuse. Of these 34 kg, 27 kg disappears via household waste collection, while an estimated 8 kg is disposed of in other ways (Figure 2). This is a decrease of 17% compared to 2016 (41 kg) and of 29% compared to 2010 (48 kg).

About 10 kg of the food wasted by consumers in the Netherlands has been prepared (this includes any water absorbed), for example by having been cooked or fried. About 5 kg remains untouched in its packaging or consists of unpeeled fruit and vegetables. The rest (almost 13 kg) concerns opened items or products that have been sliced or cut into. In total, Dutch consumers waste about 9.5% of the solid food they purchase.³ There is less information about waste of beverages. Some 46 litres of beverages per person are estimated to disappear down the drain every year, 23 litres of which are coffee and tea, while 14 litres concern drinkable milk products.⁴ This is a drop of 23% compared to 2016 (57 litres).

Figure 3 shows the products that are wasted the most, based on a waste composition analysis of household refuse and consumer surveys. Liquid dairy products, bread, vegetables, fruit and meat score highest among consumer food waste. The amount of waste measured in these surveys has shown a downward trend since the 2010, 2013 and 2016 surveys (Figure 1).³ Most of the products that are thrown away were stored in the refrigerator.²

Possible explanations for the decline

The question is whether the measured decrease in food waste can be explained. Although a number of possible causes can be suggested, there is no conclusive explanation.

First of all, there is a technical explanation related to the measurement method, which is based on the total amount of household waste. The total of the Netherlands decreased autonomously by 11% between 2010 and 2019. This could possibly be attributed to general policies in the areas of waste prevention and separation. The number of inhabitants in the Netherlands has been increasing since 2010, so the waste per person is decreasing. The percentage of food waste in residual waste and VFG waste (i.e. vegetable, fruit and garden waste) decreased between 2016 and 2019. The percentage of residual waste went from 13.9% to 13.1%, while the percentage of VFG waste went from 6.1% to 5.9%. This may be due to the policy aimed at reducing food waste.

Another explanation could be that people are eating more out-of-home and less at home. The overall decrease in purchase volume is 3.5% compared to 2010. Compared to nine years ago, households are therefore purchasing slightly less for home use. The decrease in the purchase volume can therefore only explain a very small percentage of the decrease in measured waste, about 3.5% of the 29%.

A number of demographic trends may have contributed to a reduction in waste, while a number of developments also point in the other direction. For example, the number of single-person households is increasing (possible effect of adolescents and young adults could be more waste), while the number of families with young children is decreasing slightly (with less waste expected as a result). Increases in income and possibly education levels may have led to more wastage. Ageing may lead to less wastage.³

These demographic trends are not the direct cause, so it is important to understand why certain demographic factors lead to more waste or less waste.

In the period from 2010 to now, there have been many interventions aimed at reducing food waste in households. Awareness of the issue of food waste has grown considerably, possibly in part due to information and awareness campaigns. The sharp decline in wastage in fruit and vegetables may be related to matters such as the following:

- greater choice of smaller portions in the supermarket;

- longer shelf life due to better packaging material;
- better information on how to store fruit and vegetables.

In general, interventions cannot be linked directly to results, but the efforts in providing information and the interventions may have contributed to the reduction in food waste measured.¹⁷

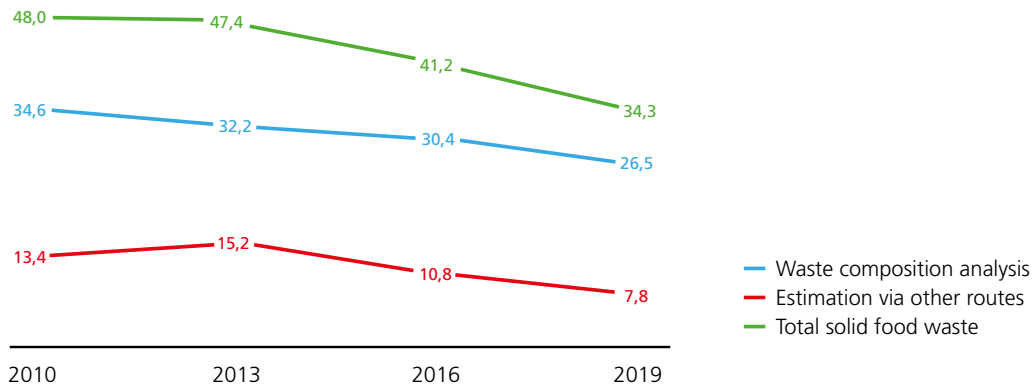


Figure 1: Declining trend in the measurement of food waste (measurements between 2010 and 2019)

The figures

	total	Residual waste	VFG waste	sink and toilet	animals	other
1. Self-assessment	100%	67.7%		25.5%	3.7%	3.1%
<i>wastage in kilogrammes per person per year</i>		2. Waste composition analysis			Extra-polation	
solid		18.0	4.9	0.7	2.0	0.7
thick liquid and dairy products		3.6	0.0	4.0	0.1	0.3
	34.3	26.5			7.8	
<i>wastage in litre per person per year</i>				3. Estimate liquids		
coffee and tea				23.2		
dairy products				14.2		
soft drinks and juices				5.7		
wine and beer				1.3		
sauces				1.1		
	45.5					

Figure 2: Food waste is made up of solid foods in household waste, alternative routes and beverages^{3,5}

Top 10 most wasted products, excluding beverages

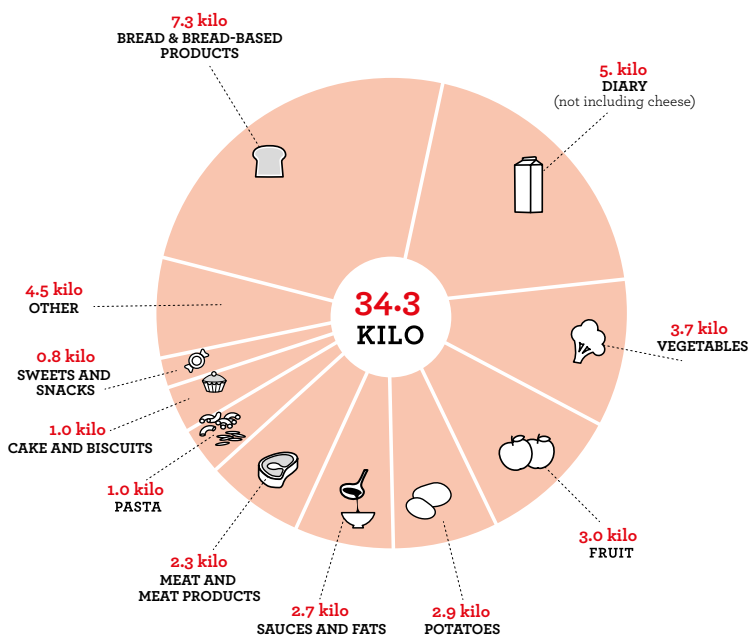


Figure 3: Top 10 most wasted products excluding beverages (in kilogrammes per year based on 2019 figures)³

How does food waste affect the environment?

When food is thrown out further down the supply chain, it has a greater impact on the environment, since energy has been consumed in its processing, transport, packaging and preparation. The environmental burden of production for Dutch food consumption is 229 ReCiPe points per person (an environmental score including land use, greenhouse gas emissions and energy use). If nothing were wasted, it is estimated that it could be 14% lower.⁴ Across the world, waste causes approximately 500 kg of carbon dioxide equivalents (CO₂eq) of greenhouse gases, 38 m³ of water consumption and 28% of the land use per person per year.⁶

Wasting solid food in Dutch households causes about 131 kg CO₂eq per person per year. This is 18 kg CO₂eq lower than in 2016. Some 38% of those 131 kg come from meat and meat products. Dairy (15% without sink loss), sauces and fats (10%), vegetables and fruit (9%) and bread (8%) are the next biggest contributors. If we include dairy that is washed down the sink, then the emissions from wastage are 154 kg CO₂eq. That is 8–10% of the greenhouse gas emissions caused by our food.

Which groups waste more?

As all groups waste food, policy should be focused on all groups. However, the groups that waste more than average are the following:

- families with (young) children: households with children under the age of four waste the most food;
- adolescents and young adults (up to age 34, but mostly under 25) living in single or two-person households.⁹

Other significant characteristics are the following:

- Especially those under the age of 55 (people aged 34 and younger waste three times as much as those aged 55+) and those with an above-average income waste a lot of food (people with an above-average income waste twice as much as those with an average income).⁹
- Wealthier people and working people also appear to waste more on average.⁹⁻¹²
- Households that often buy too much are also households where more food is wasted (up to 10 kg more).⁹

It is not just the amount of food that is wasted that differs among groups. The reasons why food is wasted can also vary from group to group, so a target group-specific approach is needed.

Arguments to avoid food waste

Consumers have various reasons for wasting food (see Table 1). However, they also provide the following arguments for wanting to avoid food waste:

- Throwing away food is just 'not right'; it's unacceptable (67%).
- It is more economical to use everything (61%).
- There is a lot of hunger in the world (41%).
- It is better for the environment, nature and the landscape (31%).
- It saves resources, which is good for the economy (17%).¹⁴

The opportunity to save money contributes to wasting less or the intention to do so.¹¹ Saving on expenditure also partly results in better-quality food purchases.¹⁵ One problem is that food is relatively cheap, so there is no incentive to be thrifty or to eat leftovers from the previous day.¹⁶ Environmental concerns are also a motive for a third of people, but while most people are aware that waste has an environmental impact, almost half are not concerned about this.¹²

Factors influencing consumer behaviour

Various behavioural determinants influence food wastage. Figure 4 depicts the Consumer Food Waste Model.¹⁸ This states that **motivation, knowledge and skills** and **opportunities** influence wasteful behaviour and are all needed to bring about behavioural change. Motivation on its own is not enough, nor the ability to waste less. For consumers to indeed waste less, all of these factors must be met.

In the Netherlands, 90% of households intend to reduce wasteful behaviour,^{14,19} so the motivation to waste less does seem to be very high. Consumers do not want to waste, because they feel it is 'just not right', for financial reasons or because it harms the environment. However, the latter reason is not mentioned very often.¹⁴ Over 80% of Dutch inhabitants are prepared to do something about food waste by buying and cooking specific quantities and using better storage techniques. The same proportion say they are already

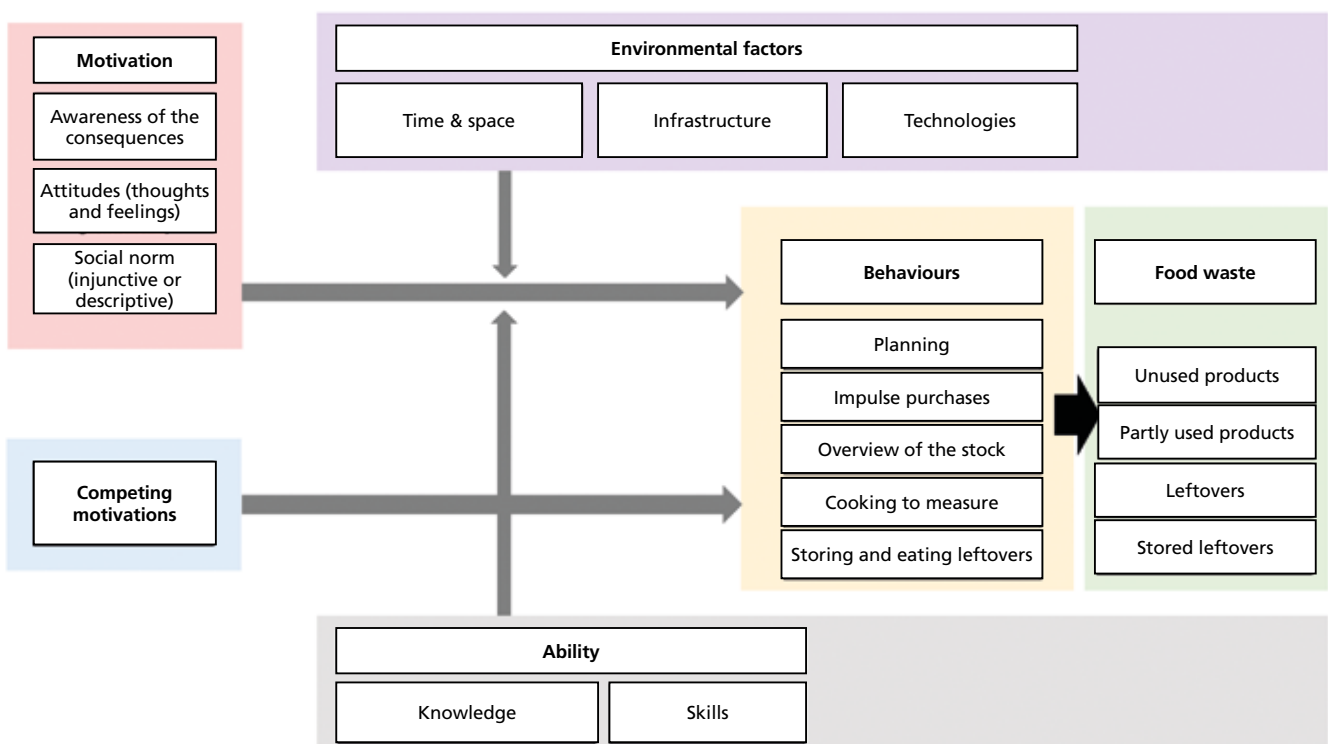


Figure 4: The Consumer Food Waste Model: behaviour leading to food waste by consumers is driven by motivation (awareness, attitudes and social norms), knowledge and skills, and environmental factors (infrastructure, time and schedule, technology). There are also motivations that compete with the motivation to waste less.¹⁸

doing something about waste. Both percentages have grown in recent years.^{5,17} It is unclear whether consumers would also want to do even more than they are currently doing. Their motivation is influenced by awareness, their attitude and the social norm.

Awareness: almost everyone knows that Dutch households throw away a lot (91%).⁵ Some 83% of consumers are aware of the fact that they waste food themselves. These are mostly people with secondary or higher education, aged 34 or younger or with children.⁵ This awareness is highest among women and seniors. Those who are aware of the issues have a high willingness to do something or are already wasting less.^{12,15,20} At the same time, consumers significantly underestimate their 'own' food-wasting behaviour and think that others waste more.^{11,14,19,21}

Attitude: consumers find it important not to waste food. The generations that lived through the Second World War think that wasting food is unacceptable. Although the generations that did not experience the Second World War are somewhat more indifferent, they also think that throwing away food is unacceptable.¹⁴

Social norm: when asked, consumers indicate that they believe others and/or their neighbours waste more than they do. The descriptive and injunctive norms positively influence intention, but they do not directly influence behaviour. This means that the social norm is important, but it is insufficient to change behaviour, in and of itself. The personal norm (i.e. personal values) does have a direct effect on behaviour. It is important to bear in mind that a lot of food is wasted when no one sees this happening, which may lead to the effect of a social norm (injunctive or descriptive) being limited.²²

Although the motivation is high, in order to convert that motivation into behaviour, consumers must also have the knowledge and skills to perform that behaviour.²³ This is influenced by knowledge and skills (abilities).

Knowledge: especially knowledge about proper storage, correct portions, leftovers and use-by and best-before dates could be improved. One in every five consumers (often single people younger than 35 and families with young children) says they would like access to more information or advice.^{5,19,21,24}

Skills: the skills for wasting less food are generally relatively easy to implement. For example, for many consumers, drawing up a shopping list is no problem, or storing their avocados in a fruit bowl, or measuring the amount of rice with an aid like a coffee cup or an Eetmaatje food measure (a Dutch measuring device

with a name that plays on the Dutch words for eating (eet) and measure (maat), with the latter also meaning friend or companion). So self-efficacy – the confidence that you can perform the behaviour – is often high.

For consumers who want to waste less, it is important that they have the confidence that these 'simple' behaviours will actually make a difference. They must feel that they can contribute to wasting less food. Some 83% are confident of being able to contribute to less food waste.⁹ It is not clear whether they feel that concrete behaviours contribute to less food waste. **Environmental factors** (opportunities) are also important in order to achieve behavioural change. The target group must have access to the necessary resources: time and opportunity, technology and infrastructure.¹⁸ This is an important reason why cooperation is essential to reduce food waste.

Time and opportunity: many consumers indicate that they are busy and lack time. They also often find themselves in unexpected situations. For example, they occasionally continue working into the evening or have unexpected guests. This increases the chances of food being wasted.²⁵

Technology: this could, for example, concern a negative influence on wasteful behaviour due to limited space for storing products or a poor refrigerator. Although such consumers might be motivated, they are simply not able to waste less food.

Infrastructure: the likelihood of wasting is influenced by purchasing large or relatively large packages, the limited quality of purchased products and the accessibility of shops. For example, supermarkets can have a negative influence on wasteful behaviour by making larger packages more attractive by pricing these relatively low.¹⁸

Competing motivations

Motivations can compete with each other. The motivation to waste less thus competes with various other motivations: we also want to eat well, eat enough and eat healthily. For example, some consumers buy a lot of healthy products in order to eat healthily, but then do not consume them.

Due to their nature, the influence of these competing motivations is great. The reward of wasting less food is an abstract and distant one, while the reward of tasty food, for example, is very personal and direct. People often prefer direct and personal rewards. It is therefore important that the goal of generating less food waste does not compete with achieving other goals, but complements these instead.²⁶

- Positive attitudes about food safety and quality have a negative influence on wasteful behaviour.^{10,21,27} Consumers who focus more on food safety or food quality tend to waste more.
- When asked, the motivation of consumers to waste less food is very high. However, when wasting less food is made concrete and it becomes clear that it sometimes conflicts with other goals, they react more indifferently to food waste. So while consumers can be vehemently against food waste, they will ultimately exhibit different behaviour because they are also motivated to eat healthily, leading them to buy a lot of healthy products.²⁶

Group behaviour

When people share common goals – and thus have less influence on the end result – it becomes more likely that individual effort will be reduced.²⁸ This is called the ‘social loafing effect’, which is also to be expected with regard to food waste. Consumers are the biggest wasters in the chain, but that waste can only be reduced as a group. As an individual, the contribution to the total waste is limited.

Habits and routines

Food waste is often closely linked to various household routines such as planning, eating and cooking.²² These habits make it difficult to change behaviour. For example, according to theory, good intentions will not be converted into behaviour if existing habits interfere with them.²⁹ This also holds true for wasteful behaviour: previous attempts to prevent wasteful behaviour and the habits that subsequently resulted from this are an important positive predictor of current wasteful behaviour and allow individual effectiveness to be assessed.^{21,30}

Households that put effort into recycling, home composting and proper waste separation are more engaged and waste less.³¹ Most people in the Netherlands are prepared to further reduce their food waste, but they face several obstacles, as shown in Table 1. Food waste is the result of many different behaviours: you can buy too much, cook too much or not store the products properly.³²

Table 1: Main reasons for wasting food and associated possible measures and tools, compiled from various studies.^{3,5,24,30,33}

	Reasons why we waste	Percentage of total waste*	Desired behaviour as a solution
Purchasing	Too much of the product in a single package	9%	Adjusting portion sizes and thus offering smaller package sizes to consumers
	Too much/many of the product purchased	7%	Custom purchasing with, for example, a shopping list and stock check
Cooking	Cooked or prepared too much of the product	22%	Cooking to measure with, for example, a measuring jug or scales
Storing	The expiry date has passed*	22% **	Best before: look, smell and taste after the date Use until: use or freeze before or on the date
	It is left over from a product that I no longer use or that I want to eat later (but then do not do so))	24%	Creative cooking with leftovers
	Product stored incorrectly and then spoilt	6%	Setting the refrigerator to the right temperature (4 degrees) and looking, smelling and tasting if the product is still good
Other	Did not have time to eat or drink the product	16%	Not stocking too many products
	I did not like the product and so did not eat it	8%	

* Date expired because: a package was too big (30%), they forgot they had bought the product (28%), they had spent little time at home (16%) and they had bought too much (8%).³

** This is self-reported: calculations for each product group lead to the estimation that consumers can reduce their waste by at least 14% by not being too rigid about the best-before date.

Current state of scientific knowledge

Most scientific studies deal with the amount of food wasted and the reasons for wasting food. There is not a great deal of research yet on how to tackle waste effectively. There is a lack of evaluations of interventions. The Netherlands Nutrition Centre provides the public with advice, based on current scientific knowledge.

Changing behaviour

As we have seen, there are many behaviours that lead to waste. Consumers can prevent waste, for example, by cooking the right amount, going to the supermarket with a shopping list or storing products in the right place. In order to encourage consumers to engage in these behaviours, it is important to consider what factors are relevant to each behaviour. To encourage people to store products in the right place, for example, it can be effective to stimulate knowledge. However, that does not mean that stimulating knowledge is also effective in encouraging consumers to make shopping lists. The Consumer Food Waste Model¹⁸ and the competing motivations are the foundation, but deciding which factors should be acted upon depends on the desired behaviour.

What is the best way to prevent food waste?

Anyone wishing to reduce their food waste needs a concrete action plan. The most appealing ways for them to prevent food waste are³⁴:

- checking pantry and fridge before going shopping;
- preparing a meal with products that are close to their use-by or best-before date;
- preparing the right amounts;
- freezing bread.

This is still only done to a limited extent by consumers.^{19,30} Research shows that consumers waste less if they cook with leftovers and do not throw everything away after the best-before date. Research also shows that consumers who plan their meals, make shopping lists and use these and weigh and store their food properly, waste less,¹⁵ that is to say the organisation of the daily household.^{21,32} People who store food more carelessly are more likely to buy too much and to throw something away if it does not look appetising.^{9,21}

The immediate disposal of products that are past their use-by or best-before date, buying and cooking too much food, having too much food in the house and not using leftovers all adversely affect the level of food waste by a factor of at least two.⁹

Table 1 gives the reasons for food waste and the solutions for reducing food waste. The possible solutions are further elaborated below. The 'Eyes on the future' section discusses solutions that still need to be developed by the food supply chain.

1. Portion sizes

One in every five consumers purchases excessive quantities if a particular product is not available in smaller portions. Some 58% indicate that being able to buy the right-sized portions would help them waste less food.³⁵ One in ten consumers throws out food regularly due to the package size being too large or the packaging being non-resealable. Oversized packaging is the main reason for exceeding the use-by or best-before date (30%).⁵ For young singles and double income households, this problem is greater,¹⁰ as they face more barriers. The numbers of single-person households, two-person households and elderly who need smaller packaging are experiencing strong growth.³⁶

Possible solutions:

- raising consumer awareness of smaller packages and of the risk of buying products on offer in bulk. However, with regard to packaging sizes, it is primarily up to the supermarkets and producers to make changes;¹⁹
- buying the right amounts and reducing excessive stocks. Around a quarter to half of consumers say they buy too much food.^{21,30} They do this due to special offers, unavailability of the product packaged in a smaller amount, inability to properly assess the amount or concerns about stocking too little of the product.³⁵ Consumers who try to avoid buying excessive quantities of food throw out almost 10 kg less than those who prefer having a lot of food in stock.⁹ About half of consumers say that they try not to have too much food in stock;³³
- using a large pack for longer if a product has a longer shelf life. However, consumers say that they sometimes do not have time to finish a product;
- making a shopping list and sticking to it helps reduce food waste,³⁷ accounting for a reduction of around 6-11 kg in waste per person per year. One in ten never make a list, while an increasing proportion (66%) are doing so regularly, mostly on paper.⁵

2. Food shopping

Checking the pantry/ shelves, fridge and/or freezer and cooking and/or weighing the proper amounts of food are determinants that have a positive effect on the level of food waste, capable of at least halving it. Using a shopping list also helps (halving waste when 'always' using a list versus 'never').⁹



Possible solution: make consumers aware of the fact that the above actions help to make shopping more efficient. This saves time in the shop that can be spent, for example, on exercise or socialising.

3. Preparing the right amounts

The main reason people throw away food is because they prepare too much. About half say they weigh or measure the ingredients as much as possible when preparing a meal, with 13% using a cup and 10% using a measuring cup or jug, such as the *Eetmaatje* (8 %).⁵ Those who do not use a measuring cup or jug do not know the right amounts (of rice, for example); they just follow their instincts (when cooking pasta, for example) or simply cook the whole pack. Households that never weigh or measure throw away more.^{19,33} Because of the *Eetmaatje*, more people have started to measure, wasting less as a result.³⁸

Possible solution: correct knowledge of portion sizes and measuring/weighing with a measuring cup or jug (such as *Eetmaatje*) or a kitchen scale. Breaking the habit of not measuring by placing a measuring jug in sight could also help.

4. Flexibility regarding the best-before date

Confusion and lack of knowledge regarding the best-before and use-by dates are an important cause of food waste.³² Some 59% of consumers now know the difference between best-before and use-by dates. The percentage that knows the difference has increased by 14% since 2011,^{19,30} but has remained stable in recent years.⁵ Based on self-reported waste, the share due to use-by and best-before dates is highest for dairy, meat and meat products, sauces and bread products.

For eggs, margarine/butter and beer, it is the main reason for waste.⁹

For example, when people forget they have a product in stock or have not been home much, the best-before date expires or food spoils.^{19,21,30} People who look at and smell their food are willing to use products two or more days after the best-before date.³⁹ Consumers are discarding food immediately after the best-before date has expired less frequently than in 2011.^{19,30} According to the Netherlands Food and Consumer Product Safety Authority (NVWA), a number of product groups, such as canned vegetables, coffee, tea, pasta, rice, sweets and syrup, can be consumed after the best-before date without any problem. If consumers approach the best-before date with a degree of flexibility, they can reduce waste by 14%.

Possible solution: dealing flexibly with the best-before date. Explaining the difference between the best-before date and the use-by date and emphasising the importance of looking, smelling and tasting before you decide to throw out products past their best-before date.

Difference between the best-before date and the use-by date

There are two types of dates on food packaging: the best-before date (THT in Dutch, i.e. *ten minste houdbaar tot*) and the use-by date (TGT: *te gebruiken tot*). Products with an expired best-before date (i.e. until then, their quality and specific characteristics are guaranteed) can often still be consumed without people becoming ill. Products with an expired use-by date (last possible date they can be consumed) should be thrown out immediately, as people may contract a food-borne disease if they consume the product.

Other possible solutions include eliminating fear of illness and increasing people's trust in their ability to recognise when a product is no longer fit for consumption. The biggest gains can be made in liquid dairy products.

5. Creative food preparation

The reason for throwing away food that has been cooked in too large an amount is that consumers think they have too little left to store. They also often do not know what to do with their leftovers or any product left over in the packaging,²¹ such as dairy products, vegetables and sauces. Consumers store products with the intention of consuming them later and only throw them out if they feel the food can really no longer be eaten. Two thirds of consumers sometimes throw out leftovers from the fridge.⁴⁰

Possible solution: increasing food skills by providing recipes and apps that give ideas for using leftovers and leftover products. These can be both healthy and tasty.

6. Freezing and cooling

Many people mention freezing or refrigeration as the most important measure in fighting food waste (though cooking the correct quantities is more important).²⁴ Freezing products will keep them for a very long time. Products suitable for freezing are bread, leftovers and meat. Plastic trays, bags and stickers are very useful in this respect. Refrigeration is important for products such as dairy, meat and vegetables. Storing products at a temperature of 4 °C extends or maintains their storage life. Some 39% of households say that their refrigerator is at or above 7 °C, and only 12% say that theirs is at 4 °C. Only 12% of households have a fridge with a

digital temperature display.⁴¹ More than half check the temperature of their refrigerator from time to time. Some 31% know that 4 °C is the best temperature for the fridge. This is more than in 2013.^{5,19,30} Households that consciously use a fridge thermometer set the fridge at the right temperature.

A possible solution would be to explain proper freezing and refrigeration methods and the best places for storing particular food items. A fridge thermometer can help keep the fridge at the right temperature of 4 °C. Clear storage recommendations on packaging can also help.

7. Smart storage

Storage methods play an important role. Two thirds of consumers think that they should keep products such as fruit and vegetables outside their packaging, even though this is not the case.⁴²

Possible solution: informing the public about correct storage methods. An important message to convey is that packaging may help to keep a product fresh for longer, both at home and in the shop.⁴²

Special offers and consumer buying behaviour

Special offers, promotions and large packaging tempt consumers to buy more of a product than they might require.³⁶ The more often consumers make unplanned purchases, the higher the degree of food waste there may be. This applies to those who tend to make impulsive purchases.⁴³ The results of research on this are mixed, as there are also several studies that suggest that people who frequently buy products on offer actually waste less. This could be partly because they are thrifty (in terms of both money and food).⁴⁶

Netherlands Nutrition Centre: tools and resources

- Website: voedingscentrum.nl/minderverspillen;
- The digital food storage guide: voedingscentrum.nl/bewaarwijzer and apps: voedingscentrum.nl/apps;
- Useful recipes (including tips for what to do with opened products and weekly menus): voedingscentrum.nl/recepten;
- The recipe app Slim Koken! (with easy recipes, help preparing the right amounts and smart storage): voedingscentrum.nl/receptenapp;
- The *Eetmaatje*, a useful measuring cup specially designed for measuring out portions of pasta and rice: voedingscentrum.nl/eetmaatje;
- The *Koelkastthermometer* (fridge thermometer), which allows you to see at a glance whether your fridge is cold enough: voedingscentrum.nl/koelkast;
- The *Ja-Nee Koelkaststicker* (Yes/No fridge sticker), a reminder about the proper storage location of 12 products: voedingscentrum.nl/koelkaststicker;
- The *Vriezersticker* (freezer sticker) to help keep products longer: voedingscentrum.nl/vriezersticker;
- The FoodBattle created by Milieu Centraal and WUR, a tool for groups or individuals to waste less in three weeks' time: foodbattle.nl. Including the Verspillingsvrije Coach (waste free coach) app.



However, the main reasons for buying too much are not special offers, but a change in planning, counting on more people, trial purchases, recipes or purchases for special occasions.^{37,47}

Future outlook

Solving the complex food waste problem cannot happen overnight. In recent years, considerable effort has been put into raising awareness and knowledge, and several interventions have been carried out. Between 2010 and 2019, there was a decrease in the amount of food wasted. Influencing behaviour will be a key aspect of further reducing food waste in the future. This will require more resources, such as web shops and smart shopping apps with self-learning shopping lists. But it will also require technological innovations, such as stickers for fridges that change colour when the temperature is right or chips on packages that keep track of the use-by or best-before date.^{20,21,42}

Future policy interventions that increase consumers' food management skills are likely to have an impact. However, campaigns that only provide information and raise awareness about the negative effects of food waste seem to have little impact. Therefore, it is important that, in the future, policymakers conduct campaigns that attempt to influence social norms. They must also consider interventions based on regulations, economic instruments and a nudging strategy. There is also a need for a comprehensive approach to overall food policy, for example in relation to health policy, the economic framework, efficient use of resources and waste policy.⁴⁸ Measures to combat food waste are more effective when consumers, producers, retailers and authorities work together. A good example is offering smaller-sized portions and packages due to the rising number of smaller households and the increasing older population. Some consumers are prepared to pay extra for smaller portions and do not consider the extra packaging a problem.⁴² Better, smart packages adapted to storage conditions offer a solution, especially for products with a short shelf life.³² In addition, consumers would benefit from clear and legible storage advice on packaging that features more prominently. Clarity and uniformity with regard to the best-before date can also contribute to less food waste.⁴⁹

It is important that interventions be tested for their effectiveness, if possible with random control trials so that researchers and those implementing matters can learn from each other. Interventions need to be monitored and evaluated to gain insight into their effectiveness and to allow for adjustments.

Finally, offering discounts on products with a short remaining shelf life can be a financial incentive to help supermarkets waste less.²⁰ Apps can help inform consumers about this. Significantly reducing food waste in the future is an essential prerequisite for more sustainable food patterns.

Government objectives

The Ministry of Agriculture, Nature and Food Quality has been pursuing a policy aimed at reducing food waste since 2009. One of the objectives of the UN Sustainable Development Goals (SDG 12.3) is halving per capita food waste by consumers and supermarkets by 2030, as compared to 2015, and minimising food losses in the rest of the chain (<https://sustainabledevelopment.un.org>). The European Union has subscribed to this objective, and the Dutch government also endorses it.

Stichting Samen Tegen Voedselverspilling

Stichting Samen Tegen Voedselverspilling (Food Waste Free United Foundation) is a foundation focusing on preventing, reducing and adding value to food waste throughout the food chain. Organisations, companies, the government and knowledge institutions work together in the foundation to fight food waste by joining forces and working towards a single common goal: 'Together, we can make the Netherlands one of the first countries in the world to reduce food waste by half.' Over 70 stakeholders have joined. samentegenvoedselverspilling.nl

The foundation mascot Becky plays the leading role in the joint *#verspillingsvrij* (waste-free) campaign. Becky is determined to do the right thing with food, together with everyone in the Netherlands. The aim is to motivate and inform the Dutch about becoming *#verspillingsvrij*. The aim is to achieve this by giving smart and easy tips.



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