Date labelling in the Nordic countries

Practice of legislation

THE NORDIC REGION
– leading in green growth


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Hanne Møller, Nina Lødrup, Pernille Lundquist Madsen, Åsa Rosengren and Annika Nurttila

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Content

Summary

As part of the Nordic Prime Ministers' green growth initiative, The Nordic Region - leading in green growth, the Nordic Council of Ministers has initiated a project focusing on reducing food waste in the entire food supply chain. The overall aim was to reduce food waste without endangering food safety. The project consisted of three sub projects: 1) Definitions and surveys of food waste from primary production, 2) Date labelling, and 3) Redistribution of food. This report summarizes results from a Nordic project on date labelling and practice of legislations in the Nordic countries, phase 1.

The project group consisted of representatives from Danish Veterinary and Food Administration, National Food Agency in Sweden, Finnish Food Safety Authority Evira, Norwegian Food Safety Authority, Nofima and Ostfold Research. The project had a project leader from Evira (Finnish Food Safety Authority) from the start in august 2013 until April 2014 and then taken over by a Norwegian project leader from Ostfold Research.

The goal of the project was to identify how current food labelling legislation is practiced in four Nordic countries, find out if there are any differences in how the food safety authorities interpret the legislations, and give guidelines to the food business operators. To study the above raised issues, the following activities were conducted:

- Compilation of current legislation and guidelines.
- Survey on how the industry determines the date labelling and the shelf life.
- In depth-interviews with follow-up questions of selected food companies.

The same labelling legislation applies throughout the EU and the countries that have an agreement on the European Economic Area (Norway, Iceland and Liechtenstein). The legislation on general labelling and nutrition labelling is merged to a common regulation on food information to consumers (Regulation (EC) No 1169/2011). The FIC-regulation will enter force in all member states in December 2014.

The survey has shown that there are differences in guidelines and how it is practiced. The survey was web-based and 64 companies responded to the survey, representing 87 products (the survey was designed so that the companies could add response for more than one product). One of the main questions was how the shelf life is determined. Most of the companies answered that the shelf life of the products is determined by "Storage experiments in combination with microbiological and sensory analysis" (58%). Some companies also answered that "Experience from other products" (20%) and "Product characteristics" (16%) are important

After analysing the results from the survey, more questions were raised and interviews of selected companies were conducted to obtain more in-depth answers to these questions. The interviews focused on the usage of product date labels "best before" or "use by". The "use by" label refers to both product safety and quality (microbiological), while the "best before" label refers only to product quality. The interviews were conducted for the following product types:

- Fresh milk, pasteurised.
- Cold smoked sliced salmon, vacuum packed.
- Minced beef without water and salt, MAP-packed.
- Cooked ham, MAP-packed.
- Warm smoked ham, MAP-packed.
- Ready-to-eat salad, containing heat-treated chicken.
- Ready-to-eat sandwich, containing chicken (not N).

For each product type, 2–3 interviews were conducted in each country. A total of 67 interviews were conducted. The completed interviews were compiled and documented in separate reports for each country. The interviews focused on the applications of the legislation, type of labelling "best before" or "use by" and shelf life.

- Type of data label (best before or use by)?
- Why is this date label chosen?
- How long is the durability time (days) and how is it established?
- Processing and packaging technique?
- Other concerns regarding the date labelling (durability/quality/preservatives)?

For all products, there was a major difference in the shelf life.

Fresh milk, cold smoked salmon, cooked ham and warm smoked ham had a doubling of the shelf life in days from the shortest to the longest.

Minced beef had a threefold increase from the shortest to the longest shelf life. The ready-to-eat salads and sandwiches had even larger difference, but it must be emphasized that different packing methods were used for the ready-to-eat products. Therefore, the shelf life is not comparable for these products.

When it comes to the type of labelling, the interviews revealed different use of labelling for smoked salmon, cooked ham, smoked ham and ready-to-eat products. Swedish food manufactures use the "best before" label much more often than manufacturers in the other countries. This is probably because there has been an established practise of the Swedish manufactures to only use the label "use by" if the product is included in the guidance document to Swedish labelling legislation (LIVSFS 2004:27). Both the survey and the in-depth interviews have shown that there are different ways to interpret legislation, for the choice of the date labelling. Results indicate that there is a need for a better understanding and guidance on food labelling terms, since the companies has interpreted the legislation differently.

The project will be continued and the results from Phase 1 shows the following points that may be relevant to further research.

- Identify underlying causes to different labelling and shelf-life between the food companies in the four Nordic countries.
- There is a lack of empirical data where food waste is directly linked to date labelling.
- How much does the length of the shelf life affect the amount of food waste?
- Do manufacturers want to shorten the shelf life of the product to make it seem fresher?
- Do consumers prefer products with shorter shelf life?
- Why do companies in Norway generally set a longer shelf life of their products?
- Would it be possible to harmonize of date labelling and storage temperature in the Nordic countries?
- Durability of a product after opening of the packaging.

The findings presented in this report are part of the Nordic Prime Ministers' overall green growth initiative: "The Nordic Region – leading in green growth" - read more in the web magazine "Green Growth the Nordic Way" at www.nordicway.org or at www.norden.org/greengrowth

Foreword

This report focuses on the labelling of the date of minimum durability on prepacked food, one of the reasons identified by researchers for food waste from production to consumer. It presents the results of a Nordic project carried out by researchers in collaboration with national authorities and industry. The project is financed by the Nordic Council of Ministers through the Nordic Green Growth Programme.

In recent years, great attention is paid to food waste and what can be done to reduce the amount of food waste. There have been a number of projects on national, European and global level. A joint Nordic project will strengthen the ability of the Nordic countries to influence this work. The project provides the opportunity to give common Nordic viewpoints in future work on food waste reduction, both in the EU and other international arenas.

The world's population is increasing while natural resources are limited. A large proportion of the population is malnourished or undernourished. At the same time, we discard about 1/3 of the food produced globally. Reduction of food waste is a three-in-one gain. It increases the amount of available food, reduces the pressure on productive land and reduces the environmental impacts. In addition, it saves money for the consumers. Clear and well founded rules on date labelling and good practices in the entire food chain are of crucial importance to ensure food safety for the consumers while avoiding that food of good microbiological quality is discarded only due to the date labelling.

The project group in the Nordic date labelling project consisted of representatives from Danish Veterinary and Food Administration, Swedish Food Agency, Finnish Food Safety Authority Evira, Norwegian Food Safety Authority and Ostfold Research. Thanks to participants in the project group, the steering group and contributions from others who have provided inputs during the project.

Oslo 10. December 2014

Bent Høie
Minister of Health and Care Services, Norway

1. Introduction

The Nordic Council of Ministers has initiated a Nordic project focusing on reducing food waste in the entire food supply chain. The overall aim was to reduce food waste without endangering food safety. The project consisted of three sub projects: 1) Definitions and surveys of food waste from primary production, 2) Date labelling, and 3) Redistribution of food. Organisations involved in the project are food safety and agricultural authorities and research institutes in Norway, Sweden, Denmark and Finland.

This report documents the work and results concerning date labelling in subproject 2. The project addressed how the date label is determined and practiced with focus on reducing food waste. This was assessed by conducting a survey and selected interviews on what considerations Nordic food manufactures make when deciding the date mark.

The Nordic Prime Ministers' initiative, The Nordic Region - leading in green growth, defines eight priorities aimed at greening the Nordic economies, one of which is to develop technologies and methods for better waste treatment. Food waste is among the categories identified as particularly interesting in the context of green growth and environmental impact.

1.1 Background

According to current EU legislation, food business operators e.g. manufacturers and packers must carry out date mark labelling on almost all packed foods ready for delivery to the final consumer. The aim is to help consumers to use food in a safe and optimized way. The date mark is an indication that states the length of time a food product can be stored under specified storage conditions.

There are two types of date labellings, “best before” and “use by”. The “best before” is appropriate for most foods and indicates the length of time a food item can be expected to retain its original condition, and so relates to the food quality. Foods which have passed their “best before” date should be safe to eat, but may not have the best quality. If a product is labelled with a “use by” date, it can neither be sold nor be used after

that day. Hence, the date labelling should be chosen with care. Otherwise, fully edible and safe food may possibly be discarded and with unnecessary food waste as the result.

Food waste is an important issue not only in the Nordic countries, but also within the entire EU. In 2011, the EU Commission launched a long-term framework for actions for a resource-efficient Europe (flagship initiative). One of the goals is to half the amount of waste of edible foods by 2020. In addition, 2014 is the European year against food waste to create awareness for European citizens and to focus national governments' attention on this important topic.

1.2 Goal and scope

The overall scope of the project was to identify how current practice in the regulations is generating unnecessary food waste and how this practice can be modified to reduce the amount of food waste.

The goal of the project was to identify how food labelling legislations are practiced in the four Nordic countries (Denmark, Finland, Norway and Sweden) and find out if there are any differences in how the food safety authorities interpret the legislations and give guidelines to the food business operators. This was done by conducting a survey on how the industry determines the date label and the shelf life and follow-up questions in interviews with selected companies.

Data labelling is important for food waste. Measured in term of quantity, it is the food without date label (fruit, vegetables and bread) that generates the most of food waste. However, in terms of climate impact meat and meat products are important and these products have date label. Consumer survey in the ForMat-project shows that food is discarded because the product's shelf life has expired (Hanssen & Møller, 2013). Much of the wasted food is unnecessary and is probably due to the consumer's lack of understanding of the date label; although consumers in surveys say they have good knowledge of what the date labels means.

2. Legislation

The background for this chapter is that although the same legislation for food labelling applies in the Nordic countries, there may be differences between the understanding, interpretations and practice of it. In particular, this applies how companies implement legislation.

2.1 EU legislation of date labelling

2.1.1 Until 2014

The same labelling legislation applies throughout the EU and also other countries such as Norway, Iceland and Liechtenstein that have an agreement on the European Economic Area (EEA).

The first EU legislation on labelling came 1978 (79/112 / EEC) and was updated in the labelling directive 2000 (2000/13 / EC). Articles 9–10 in this directive cover date labelling with "best before" (minimum durability) and "use by". Foods shall be labelled with expiration date "use by" instead of "best before" if they from a microbiological point of view are considered highly perishable and are likely to constitute immediate danger to human health after a short period of time.

There are some exemptions from the requirement of the date of minimum durability. These exemptions are for example fresh fruit, vegetables, bakers' wares, wines, salt, sugar, vinegar and chewing gums. This will also apply when FIC enters into force.

2.1.2 Regulation on Food Information to Consumers (FIC)

In 2011, the labelling legislation was merged with several directives including the legislation on nutrition labelling for food to one regulation

on Food Information to Consumers (FIC).[1] The FIC-regulation will be applicable from December 2014.

The new regulation maintains the rules regarding date labelling as follows:

Article 2
Article 2(2)(r) defines the "the date of minimum durability" as the date until which the food retains its specific properties when properly stored.

Article 9
In article 9 (1)(f) it is stated that the date of minimum durability or the "use by" date is one of the required mandatory particulars on food.

Article 24
In the case of foods which, from a microbiological point of view, are highly perishable and are therefore likely after a short period to constitute an immediate danger to human health, the date of minimum durability shall be replaced by the "use by" date. After the "use by" date, a food shall be deemed unsafe in accordance with Article 14(2)–(5) of Regulation (EC) No 178/2002 (General Food Law).

Article 24 explicitly states that after the "use by" date a food shall be deemed unsafe in accordance with Article 14(2) to (5) of Regulation (EC) No 178/2002. The aim of this provision is to clarify that when the "use by" date of a given food product has expired, it should not be consumed and, logically, should not be offered for sale to consumers.

Article 25
Article 25 (1) states that when foods require special storage conditions this shall be indicated on labelling.

Guidelines
The are no EU guidelines on durability labelling. In some EU-countries, there are guidelines on how to set durability and specifying if / when to use the "best before" or the "use by" mark.

[1] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers.

2.2 On-going work

Codex Alimentarius – Codex Committee on Food Labelling (CCFL)
The Codex Alimentarius Commission, established by Food and Agricutural organization of the United Nations (FAO) and World Health Organization (WHO) in 1963, develops harmonised international food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair practices in the food trade. The CCFL shall draft provisions on labelling applicable to all foods.

Most national and regional competent authorities use the Codex General Standard for the Labelling of Prepackaged Foods (GSLPF) to guide national/regional labelling requirements, including requirements for date marking of foods. Despite this, globally there are a number of different systems for date labelling and different terminologies are used on the package. This creates confusion for consumers, industry and regulators particularly in countries that lack national regulations for date labelling and where food import is significant. In 2013, it was agreed that the CCFL should review the GSLPF to address the issue on date labelling.

Food labelling legislation must control the clarity, format, meaning and application of date labelling information to contribute to effective use of food business operators, consumers and regulators, towards ensuring food safety and quality, as well as contributing to food security.

There is a need to review and clarify the definitions in the GSLPF related to date labelling and to establish clarity of expression and presentation. If there is confusion around these parameters, it increases the risk of unsafe food consumption and may increase the risk of food waste. This confusion can occur with both consumers and food business operators. Lack of clarity of also contributes to the complexity in regulatory monitoring of safety and quality.

The importance of reducing food waste caused by the incorrect use of and enforcement of date marking is highlighted as a critical issue.

ON- going work within EU
In cooperation with stakeholders, experts and Member States, the EU Commission is currently analysing how to reduce food waste without compromising food safety. This will hopefully lead to future EU actions for reducing food waste. A wide number of topics are addressed such as donation of surplus food to food banks, date labelling, feed, short food

supply chains, bio-energy, etc. More information may be found on the webpage of the EU Commission.[2] The Health and Consumers Directorate General of the European Commission (DG SANCO) wants to establish a working group with food waste experts from the Member States. The task of the group would be to support the identification and prioritization of actions to be taken at EU level to prevent and reduce food waste without losing food and feed safety and protection of animal health.

2.3 Legislation and guidelines in the Nordic countries

When FIC is applicable from December 2014, the same legislation applies in all EU- and EEA-countries. The following sections explain for each country the legislation up to 2014. This is relevant since it forms basis for different interpretations and national guidelines between countries.

2.4 Denmark

Legislation
BEK No. 1308 of 14/12/2005 – Regulations of labelling of food (now repealed as FIC is applicable). In Denmark, the Danish Veterinary and Food Administration give following advice: "Use by" is used on perishable foods, such as meat and fish, which can pose a risk to human health after that date.

"Best before" is used on non-perishable foods, e.g. bread, grains and pasta etc. The date indicates that until that date, the food is guaranteed to keep quality, but it still may be edible after this date.

Before the implementation of FIC in December 2014, it has not been permitted neither to sell food products after the expiry of the "best before" date nor the "use by" date.

[2] http://ec.europa.eu/food/food/sustainability/index_en.htm

Guidelines
Denmark has national guidance on durability labelling in guidance on general labelling section 12.[3] Further, Denmark has launched a consumer information campaign on durability labelling.[4]

2.5 Finland

Legislation
The Trade and Industry Ministry's regulation on labelling of food (1084/2004). Will be repealed as FIC enters into force.

Guidelines
The Finnish Food Safety Authority Evira has published guidelines on the labelling of foodstuffs, including date labelling. The guidelines are intended for both food control personnel and food business operators. The guidelines are being revised to correspond with the FIC regulation.[5] The revision will be completed by the end of 2014.

It is the responsibility of the food business operator to establish the durability of the product and on the basis of this information decide which date label "best before" or "use by" to use on the product.

"Use by" date should be used on microbiologically easily perishable foods. According to the legislation on the labelling of food, a food product is highly perishable when it is easily spoiled and poses a health risk after short-term storage. Examples of such food, unless they are made durable for example by means of heat treatment and / or conservatives are:

- Fresh cheese, i.e. unripened cheese (fresh cheese is usually easy perishable, however, pasteurized fresh cheese is not microbiologically easily perishable and instead of the "use by" labelling, "best before" labelling can be used)
- egg products
- fresh meat, intestines, blood and fresh plasma
- minced beef and other meat products not prepared

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[3] http://www.foedevarestyrelsen.dk/SiteCollectionDocuments/25_PDF_word_filer%20til%20download/06kontor/Maerkning/Faerdigpakkede_foedevarer/Mærkningsvejledning%20juli%202014%20-%20gældende%20fra%2013.%20december%202014.pdf
[4] http://www.tjekdatoen.dk
[5] http://www.evira.fi/files/products/1405331465406_elintarviketieto-opas_eviran_ohje_17068_1_fi.pdf

- fresh fish, fish eggs and shellfish
- salted fish and smoked and grilled fish
- ready to eat foods, desserts and bakery products, which have not been heat-treated.

In addition, other than those mentioned in the list can be easily perishable and thus require labelling with "use by". The manufacturer should always assess from case by case whether a product shall be considered microbiologically easy perishable. Food may not be sold after "use by" date, nor used in the preparation of a food to be sold or served.

In addition, it should be mentioned that Evira has issued a guideline on foodstuffs donated to charity. In this guideline some exceptions on use of products that have passed their use by date are given. The given conditions are very specific and restricted only to the specific context of foods donated for charity. Charity organisations that prepare food using fresh foodstuffs that have been donated can use products on the day after the "use by" date. The condition is that the quality of the product is sensorial evaluated and the products are heated to at least 70 °C during preparation.

- Food information guidance. Evira guide 17068/1.[6] The revision will be completed by the end of 2014.
- Labelling control guidance. Evira guide 17055/1/sv.[7]
- Foodstuffs that are donated to charity. Evira guide 16035/1/se.[8]

2.6 Norway

Legislation
The current Regulations on the labelling of food products is based on directive 2000/13/EC on labelling, presentation and advertising of foodstuffs.[9]

[6] http://www.evira.fi/files/products/1405331465406_elintarviketieto-opas_eviran_ohje_17068_1_fi.pdf
[7] http://www.evira.fi/files/attachments/se/evira/blanketter_och_anvisningar/livsmedel/paskrifter_forpackningar/pakkausmerkintojen_valvontaohje_versio_4_1_se.pdf
[8] http://www.evira.fi/files/attachments/se/evira/blanketter_och_anvisningar/livsmedel/livsmedelslokaler/ruoka-apuohje_16035_2013_se.pdf
[9] http://www. lovdata.no/forskrift/1993-12-21-1385

Guidelines

On the web site of the Norwegian Food Safety Authority, some guidance is given on the labelling of durability.[10] This guidance is related to the legislation before December 2014. Below follows a shortened version.

Prepacked foods shall be labeled with a use-by or best before date. The labelling requirement takes health and quality into account. The date should be the date the food product keeps its specific properties, quality etc. based on the given storage conditions in unopened packaging.

For foods that are highly perishable and therefore after a short period is likely to constitute an immediate danger to human health, the date of minimum durability shall be replaced by the "use by" followed by the date. Such foods can not be sold after the expiry date. The wording "use by" can not be replaced by other terms.

Highly perishable foods should always be labelled with specified storage conditions. For meat and meat products there are the specific hygiene rules, including temperature requirements.

After the expiry of the "best before" – date, the products may still be offered for sale. The business is responsible for the quality or other specific features of the product.

2.7 Sweden

Legislation

Livsmedelsverkets föreskrifter om märking och presentation av Livsmedel; LIVFS 2004:27.

From December 2014: Livsmedelsverkets föreskrifter om livsmedelsinformation; LIVSFS 2014:4.

Guidelines

Livsmedelsverket is currently revising "Vägledning till Livsmedelsverkets föreskrifter (LIVSFS 2004:27) om märkning och presentation om livsmedel". A new version should be updated according to the FIC-regulation.[11]

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[10] http://www.mattilsynet.no/mat_og_vann/merking_av_mat/generelle_krav_til_merking_av_mat/holdbarhetsmerking_paa_matvarer.2711

[11] Regulation (EC) No 1169/2014 on the provision of food information to consumers.

According to the current guidance, the use-by date is the last day a food, that from a microbiological point of view is very perishable, last is expected to be consumed without being unfit.

The guidance also states that a food should be considered as very perishable if there is danger that the food may pose a risk to human health, and that this occurs in a short time *i.e.* within a few days. Such foods should be labelled with the "use by" date instead of "best before" date.

Foods labelled with "use by" date on the time of packaging is assessed to be unfit or harmful after a certain date. These foods should be considered to be unsafe and must not be sold.[12] Food should be regarded as unfit for use even if it in a particular case cannot be shown that the food really is harmful to health.

Foods that are labelled "best before" are allowed to be sold after expiry date, but the seller and not the manufacturer is responsible for the quality of the product.[13]

Foods are generally regarded as very perishable if the durability is less than five days at a storage temperature of +4 °C or lower. Even among food with slightly longer durability, they may be regarded as highly perishable. Based on the above criteria, the person responsible for the labelling should consider whether the product is considered highly perishable or not.

[12] Article 14 of Regulation (EC) No. 178/2002 laying down the general principles relevant to requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food and feed safety.

[13] www.livsmedelsverket.se

3. Survey

3.1 Purpose and approach

The purpose of the survey was to map and to gain increased knowledge about how the date labelling ("use by" or "best before" date) is set by Nordic food industry and retail trade today.

A web-based survey was send by e-mail to Nordic food companies during April and May 2014. In Denmark and Finland, the survey was sent out through the industries' own organizations, and therefore, the total number of companies is unknown. In Norway and Sweden, the survey was sent directly from the Finnish Food Safety Authority Evira to companies based on a list of companies producing relevant product groups. The survey was translated into each country's own language and the dispatch included an introduction to the survey.

3.2 Description of participating companies

In total, 64 companies responded to the survey. The response was low, especially for Norway and Finland (Table 1). However, the companies that responded, represented a large percentage of food products on the market.

Most of the companies were medium or large. Only a few very small and small companies responded the survey. In addition, most of the countries represented the food industry, (Table 2). Since the responding companies had a multiple choice, some responders were also marked as packers and producers.

The survey was designed so that the companies could add response for more than one product. In total, there were responses for 87 products. Table 3 shows which categories the products were representing.

Table 1. Company size

Company size	Denmark	Finland	Norway	Sweden
very small < 10 employees	1	0	0	2
small < 50 employees	4	1	1	9
medium < 250 employees	9	2	1	10
large >250 employees	5	9	5	2
Other	1	0	0	2
Total number of companies	20	12	7	25

Table 2. Type of company

Company type	Denmark	Finland	Norway	Sweden
Packer	0	1	3	1
Producer	5	1	3	8
Retail trade	0	5	0	2
Food industry	18	7	7	22
Importer (3. countries and internal market)	3	1	0	2
Total number of products	26	15	13	35

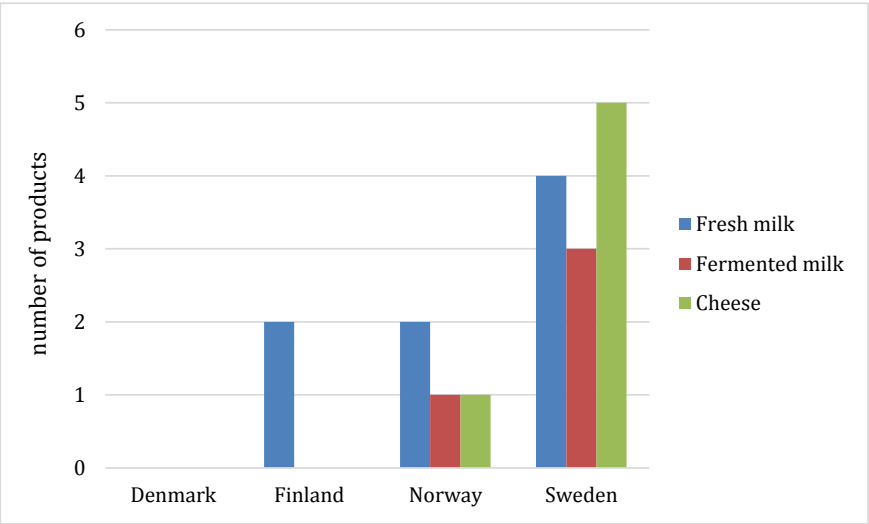
Table 3. Food categories of the products represented in the survey

Food category	Denmark	Finland	Norway	Sweden
Dairy product	0	2	4	13
Fish product	1	1	1	5
Meat product	5	6	5	12
Ready-to-eat foods and ready meals	20	8	1	3
Total number of products	26	17	11	33

3.3 Dairy products

The survey included 19 dairy products. One product was removed from the analysis due to unclear answers. Figure 1 shows the types of dairy products. No Danish dairy products were included. Two Finnish fresh milk products were included, one labelled “use by” and one “best before”. Two Norwegian fresh milk products were labelled “best before”. One fermented milk product and one cheese were labelled “best before”. Three Swedish fresh milk products were labelled “best before” and one “use by”. Three Swedish fermented milk products and five cheese products were also included, all labelled “best before”.

Figure 1. Type of dairy product



The shelf life is determined mainly by storage experiments and microbiological analyses/sensory analysis (Norway and Sweden) and recommendations by the manufacturer and microbiological analysis (Finland) see table 4.

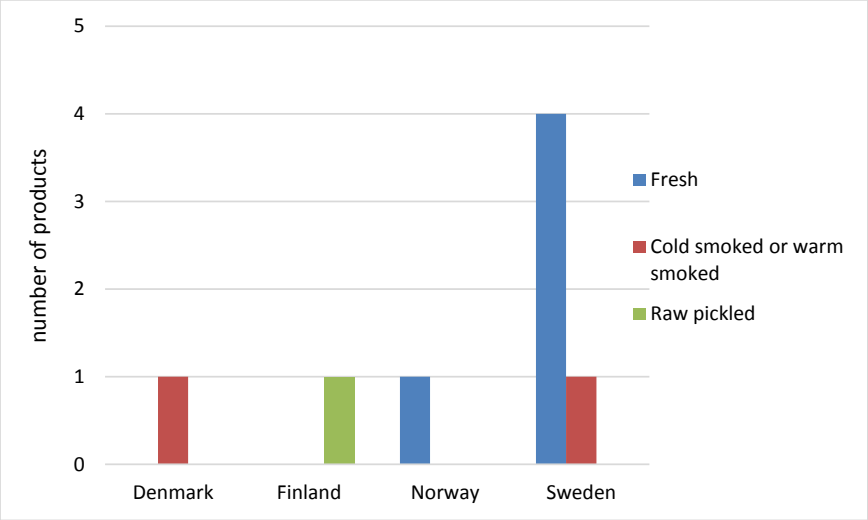
Table 4. How is the shelf life determined for dairy products? This question had multiple choices and the number of products does not add up to the number of answers here

	Denmark	Finland	Norway	Sweden
Storage experiment, microbiological/ sensory analysis	0	0	4	12
Experience from other products	0	0	1	4
Product characteristics	0	0	0	2
Market profile	0	0	0	0
Other	0	2	0	0
Total products	0	2	5	18

3.4 Fish products

The survey included 10 fish products, fresh, cold or smoked fish and raw pickled (Figure 2). From Denmark, one cold smoked fish product was labelled "use by", from Finland, one raw pickled product was labelled "best before". From Norway, one fresh fish product was labelled "use by". From Sweden, seven fish products were included in the survey, but two products were removed from the analysis due to unclear answers. Of the four fresh fish products, two were labelled "use by" and two "best before". The cold smoked fish product was labelled "best before".

Figure 2. Type of fish product



The results show that shelf life is mainly determined by storage experiments in combination with microbiological analyses/sensory analysis. However, for the Finnish raw pickled product, shelf life was also determined by experiences from other products. For the Swedish fresh fish products, the shelf life was additionally determined by products characteristics/experiences from other products (Table 5).

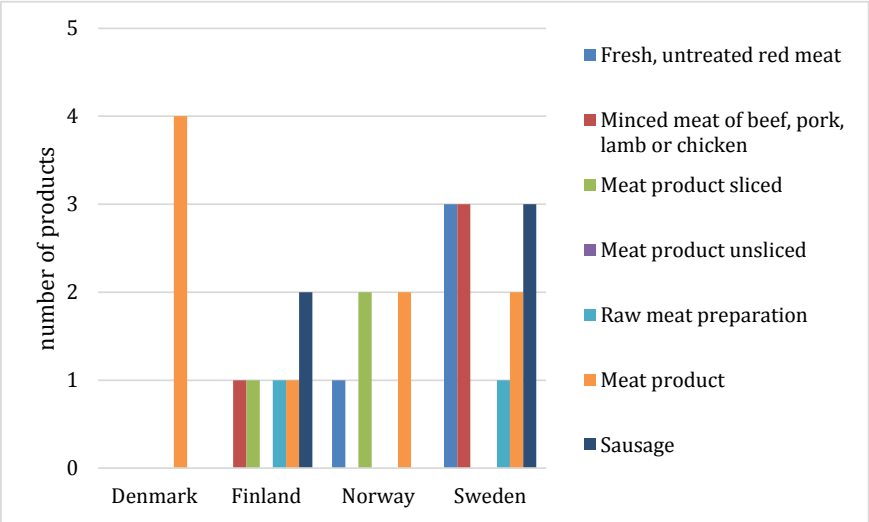
Table 5. How is the shelf life determined for fish products? The companies had multiple choices, therefore the number of products does not add up to the number of answers

	Denmark	Finland	Norway	Sweden
Storage experiment microbiological/sensory analysis	1	1	1	4
Experience from other products	0	1	0	1
Product characteris.	0	0	0	3
Market profile	0	0	0	0
Other	0	0	0	0
Total products	1	2	1	8

3.5 Meat products

The survey included 27 meat products consisting of fresh untreated meat, minced meat of beef, pork, lamb, chicken, sliced and unsliced meat products, raw meat preparations, meat products and sausages (Figure 3). From Denmark, the four meat products were marked “best before”. From Finland, one minced meat, meat product sliced, raw meat preparation, were marked “use by”, one meat product was marked “best before”. One of two sausage products was marked “use by” and one marked “best before”. From Norway, one fresh, untreated red meat product was marked “best before”, two sliced meat product were marked “use by” and one meat products was marked “use by «and one “best before”. From Sweden, three fresh, untreated red meat products were marked best before. Three minced meat products had different date labelling, one product was labelled “use by” and two products “best before” (one of these was a frozen product). One raw meat preparation was labelled “best before”. Two meat products were included, one labelled “use by” and one “best before”. One raw sausage product was labelled “use by” and two smoked or heat-treated sausage products “best before”.

Figure 3 Type of meat product



The shelf life was determined mainly by storage experiments and microbiological analyses/sensory analysis (Table 6). Since the companies had multiple choices here, the number of products does not add up to the number of answers here.

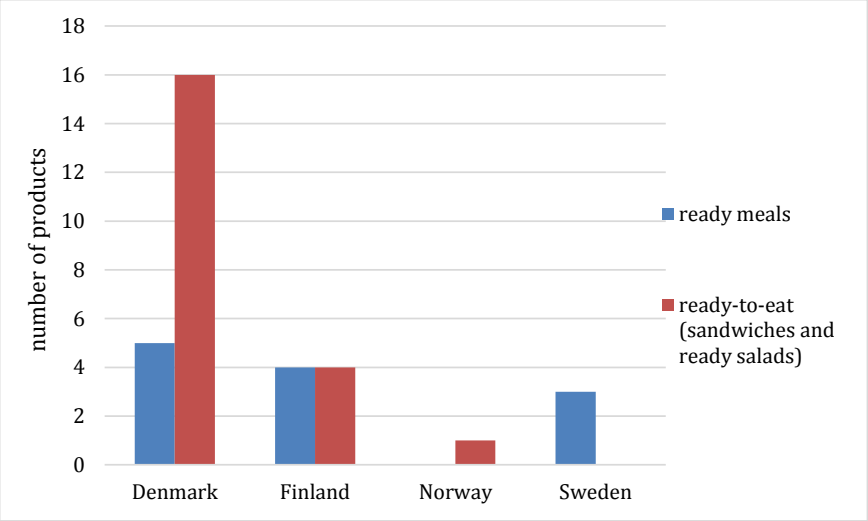
Table 6. How is the shelf life determined for meat products? The companies had multiple choices, therefore the number of products does not add up to the number of answers

	Denmark	Finland	Norway	Sweden
Storage experiments and microbiological analyses/Sensory analysis	5	6	5	10
Experience from other products	0	0	3	6
Product Characteristics	0	2	3	2
Market profile	0	0	0	3
Other	0	0	0	0
Total number of products	5	8	11	21

3.6 Ready-to-eat foods and ready meals

The survey included 33 ready-to-eat foods and ready meals (Figure 4). From Denmark, 16 ready-to-eat foods and 5 ready meals were labelled “best before”. From Finland, 4 ready-to-eat foods and four ready meals were all labelled “use by”. From Norway, one ready-to-eat product was labelled “use by”. Three Swedish ready meals were marked “best before”.

Figure 4. Type of ready-to-eat food and ready meals



The results show that shelf life mainly is determined by storage experiments and microbiological analyses/sensory analysis, but also experiences from other product and product characteristics were used (Table 7).

Table 7. How is the shelf life determined for ready to eat food and ready meals? The companies had multiple choices, therefore the number of products does not add up to the number of answers

	Denmark	Finland	Norway	Sweden
Storage experiments and microbiological analyses/Sensory analysis	17	8	1	2
Experience from other products	8	1	0	1
Product characteristics	8	1	0	0
Market profile	0	0	0	0
Other	0	3	0	0
Total number of products	33	13	1	3

3.7 Summary of results from survey

The results from the survey are summarised in table 8. The table shows that most companies answered that the shelf life of the products are determined by “Storage experiments in combination with microbiological and sensory analysis” (58%). Some companies also answered that “Experience from other products” (20%) and “Product characteristics” (16%) are important.

Table 8. How is the shelf life determined? Answers for all product categories in % of total answers

	Denmark	Finland	Norway	Sweden	Total
Storage experiments, microbiological/Sensory analysis	59%	60%	61%	56%	58%
Experience from other products	21%	8%	22%	24%	20%
Product characteristics	21%	12%	17%	14%	16%
Market profile	0%	0%	0%	6%	2%
Other	0%	20%	0%	0%	4%
Total	100%	100%	100%	100%	100%

4. In-depth interviews

4.1 Purpose and approach

In-depth interviews of selected companies were conducted to investigate how Nordic food companies relate to labelling legislation and determine the date labelling / shelf life of their products. The purpose was to determine if there are any differences between companies and countries regarding practice of legislation and to clarify determination factors for durability. Another aim was to investigate if differences in the use of date labelling were based on different product characteristics and storage conditions or if it was due to different legal interpretation and national guidelines.

The interviews focused on food processing and packaging companies and their usage of product date labels “best before” or “use by”, for following product types:

- Pasteurised fresh milk.
- Cold smoked sliced salmon, vacuum packed.
- Minced beef, without water and salt, MAP (Modified Atmosphere Packaging).
- Cooked ham, MAP.
- Warm smoked ham, MAP.
- Ready-to-eat salad, containing heat-treated chicken.
- Ready-to-eat sandwich, containing chicken (not Norway).

The interviews were done through personal interviews, phone interviews and some questions were asked by email. For each product type, 2–3 interviews were conducted in each country. The completed interviews were compiled and documented in separate reports for each country, including responses for specific questions and relevant additional information coming up during the interview. The interviews were conducted from June to October 2014 and performed by DTU in Denmark (Andersen, 2014), MTT in Finland (Reinikainen & Pinolehto, 2014), Nofima in Norway (Hagtvedt, 2014) and SIK in Sweden (Båth, 2014).

Questions asked were:

- Type of data label (best before or use by)?
- Why is this date label chosen?
- How long is the durability time (days) and how is it established?
- Processing and packaging technique?
- Other concerns regarding the date labelling (durability/quality/preservatives)?

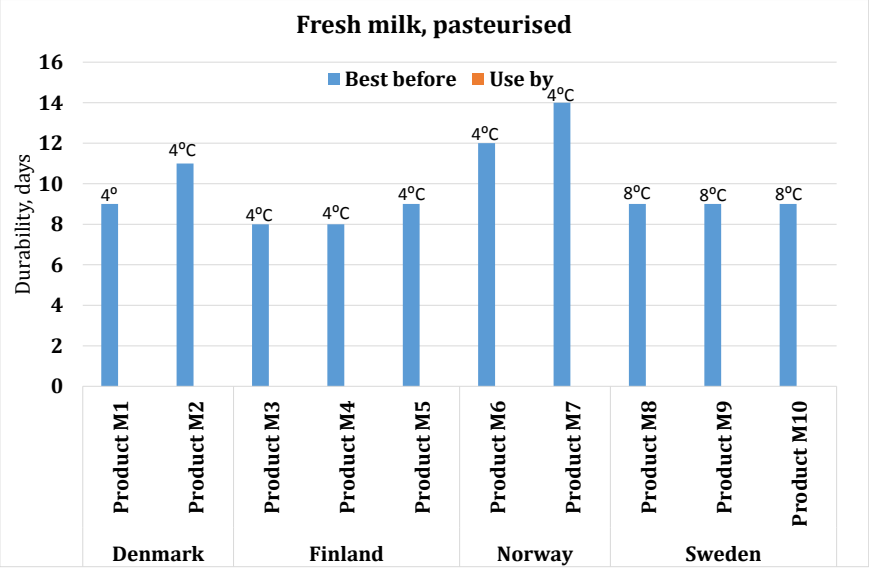
The results from the interviews reproduce what the companies have expressed in the interviews, but it is not necessarily the same as facts about the current regulations. The names of the food companies were anonymized.

4.2 Results of the interviews

4.2.1 Pasteurised fresh milk

Figure 5 shows shelf life for fresh pasteurised milk for the Nordic countries. All the fresh milk products (M1–M10) used the date label "best before". The shelf life varied from 8 days (Finland) to 14 days (Norway). The legislation does not state explicit rules how to test the durability, it is up to the companies to decide. Hazard Analysis and Critical Control Point (HACCP) is a tool for the companies to control the quality and safety of pasteurised milk. Storage temperature has the greatest influence on durability but packaging and processing technique also have an influence. Therefore, improvements in the process techniques will influence durability and allow extending the "best before" dates. All companies test durability by microbiology and sensory analysis.

Figure 5. Durability in days and type of date marking for pasteurised fresh milk. Marked storage temperature for each product is shown above each bar



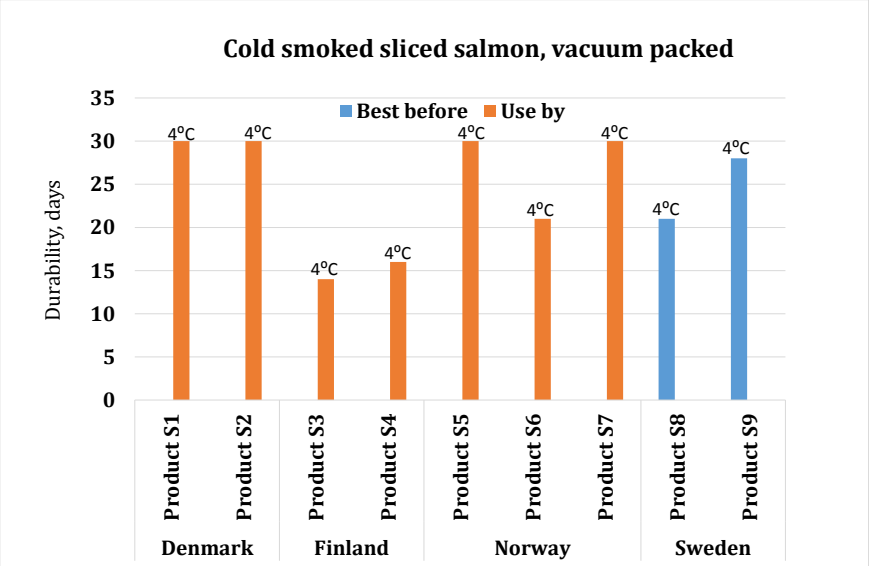
A few years ago, the date labelling on pasteurised fresh milk in Norway was changed from "use by" to "best before". The reason was that pasteurized fresh milk is not considered highly perishable.

In general, all products were equal in terms of product characteristics, processing and packaging. The Swedish milk products had a storage temperature of 8 °C or lower, which was higher than in the other Nordic countries that have 4 °C. Common Nordic storage temperature limits were discussed about 15 years ago, but nothing has happened at that point up to now. Swedish companies estimated that the durability date has a margin of 1–3 days. That means that the products may last 1–3 days longer than the date labelling. Furthermore, some companies claim that the labelling "minimum durable until" would be clearer than "best before" and hence, avoiding unnecessary food wastage.

4.2.2 Cold smoked sliced salmon, vacuum packed

Figure 6 shows date labeling for cold smoked salmon (products S1–S9). Denmark, Finland and Norway used "use by" and Sweden used "best before". The interviews cover two or three products in each country, but even with a limited number of products, the results show different interpretations of the legislation. Shelf life ranged from 14 to 30 days.

Figure 6. Durability in days and type of date marking for vacuum packed cold smoked salmon. Marked storage temperature for each product is shown above each bar



Vacuum packed fish always poses a risk of listeriosis, which is caused by facultative anaerobic Listeria monocytogenes capable of growing in the presence or absence of oxygen. In addition, despite rare cases, there is a risk for botulism associated for fish products improperly prepared and or if the product is stored in too warm conditions. The durability date is established based on durability tests that measure microbiological qualities and for example levels of L. monocytogenes.

One of the Danish companies preserved the products by using organic acids. In all the other countries only salt are added for preservation.

Statements from companies went in opposite directions; one believed that it should be possible to use the “best before” label and another believed that only “use by” label can be used, since these products are considered perishable. It was also stated that it could be complicated to understand the regulations regarding date labelling, because it is referred to terms defined in other regulations, such as “perishable”. It would be easier for the companies if the Food Safety Authorities would give more clear guidance on the labelling of these products.

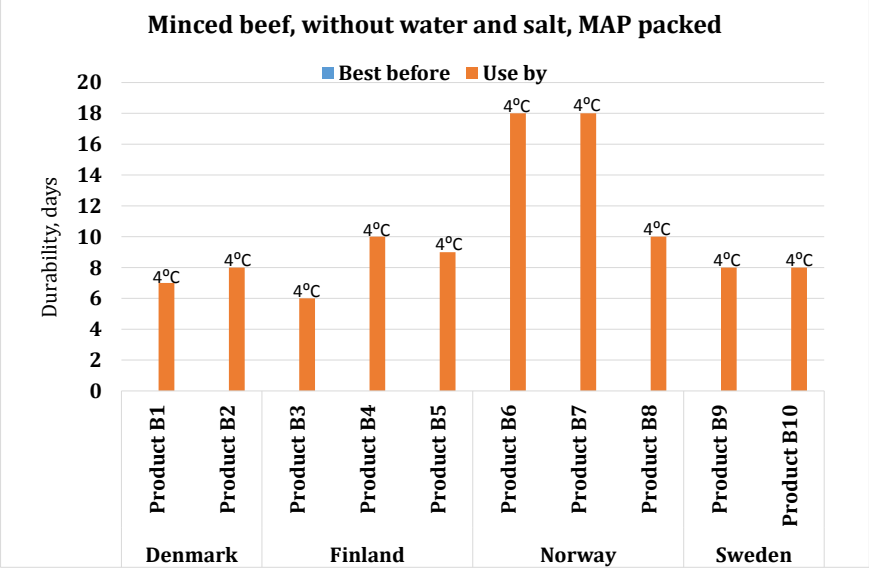
One company reported that when launching new products, the shelf life is calculated as part of the product development. During development, shelf life is proposed to be based on sensory analyses followed by microbiological analyses to confirm the correctness of the suggested

shelf life. New analyses and assessment of durability are conducted every third year or if there are changes in the production process.

4.2.3 *Minced beef, without water and salt, MAP*

For minced beef, the companies used "use by" label due to legislation concerning food products that are considered highly perishable. The shelf life varied from 6 to 18 days (products B1–B10), (Figure 7). All companies used MAP-technique, which can have shorter or longer shelf life than vacuum packing, depending on the type of gas mixture used.

Figure 7. Durability in days and type of date marking for MAP packed minced beef. Marked storage temperature for each product is shown above each bar



The "use by" label was chosen since the product has short durability because of fast quality impairment. The interviewed companies assumed that the consumers can not really distinguish between "best before" and "use by" labels. They also believed knowledge of different food products and their durability is about to disappear. It was also pointed out that reduced food waste is an important issue. When using vacuum packaging, the shelf life may double and one of the Danish companies uses the "Best before" label on vacuum packed minced meat.

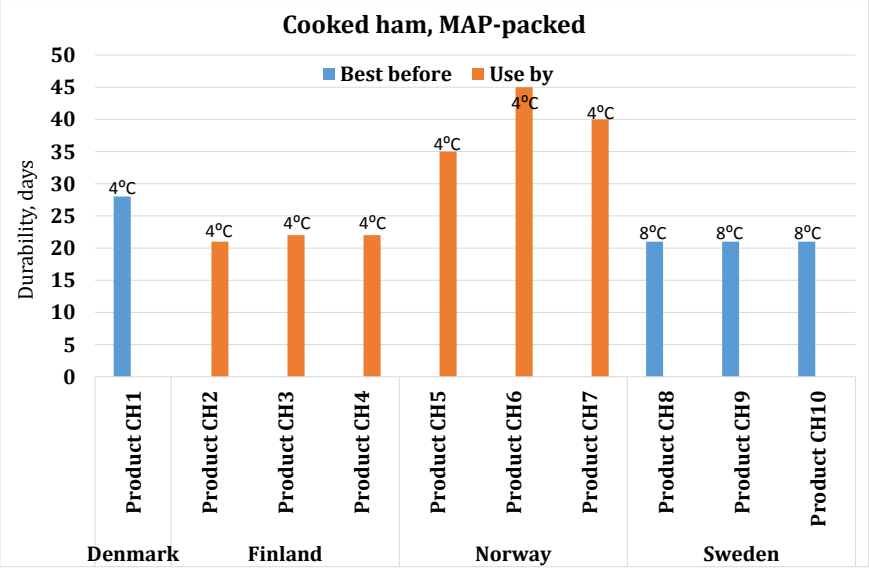
The packaging gas used is of importance for the durability of the product. In the interviews, it was not asked specifically about which packaging gas that was used for the selected products. In Norway, a gas mixture of 60% CO_2 and 40% N_2 is used for most types of raw, fresh meat, i.e. minced meat, hamburgers, pork, lamb, poultry and certain types of beef. This CO_2/N_2 mixture gives long microbiological shelf life. In Sweden and Denmark, it is common to use so-called high-oxygen, which is 70% O_2 and 30% CO_2, for most types of raw, fresh meat. High oxygen is mainly used to give the meat a bright red colour, which is attractive to consumers (Kim *et al.,* 2010). However, it also gives a shorter shelf life compared to the CO_2/N_2 mixture, i.e. 8–9 days for minced meat. Further, high oxygen is known to provide several unwanted properties like rancidity, inhibition of tenderization of the meat, and early browning in the inner portion of the meat at heat treatment. Some pathogenic bacteria grow faster in meat in high oxygen gas mix compared to the 60% CO_2/40% N_2 gas mix (Sørheim, 2014).

The Norwegian companies thought it is strange that the Food Safety Authority imposes requirements for 2 °C for minced meat in production and processing, when the storage temperature during the remaining supply chain is at 4 °C. The processing time is relatively short for the minced meat compared to the rest of the shelf life.

4.2.4 Cooked ham, MAP

The "use by" label was utilised in MAP-packed cooked ham products in Finland and Norway (CH2–CH7), and "best before" labelling was used in Denmark and Sweden (CH1, CH8–CH10), (Figure 8). Microbiological safety, sensory tests and risk management are considered when establishing the shelf life. Durability of MAP-packed cooked ham varied from 21–45 days. Storage temperature was 4 °C for products from Denmark, Finland and Norway, and 8 °C for products from Sweden.

Figure 8. Durability in days and type of date marking for MAP-packed cooked ham. Marked storage temperature for each product is shown above each bar



The durability was established by experience and verified through regular tests. When choosing the "use by" label the justification was that the product was ready to eat and was not intended to be heat treated before being eaten. The reliability of cold chain is very important for the durability. It is desirable to have as long shelf life as possible since it is important for the consumers, but also for wholesalers and retail for logistical reasons.

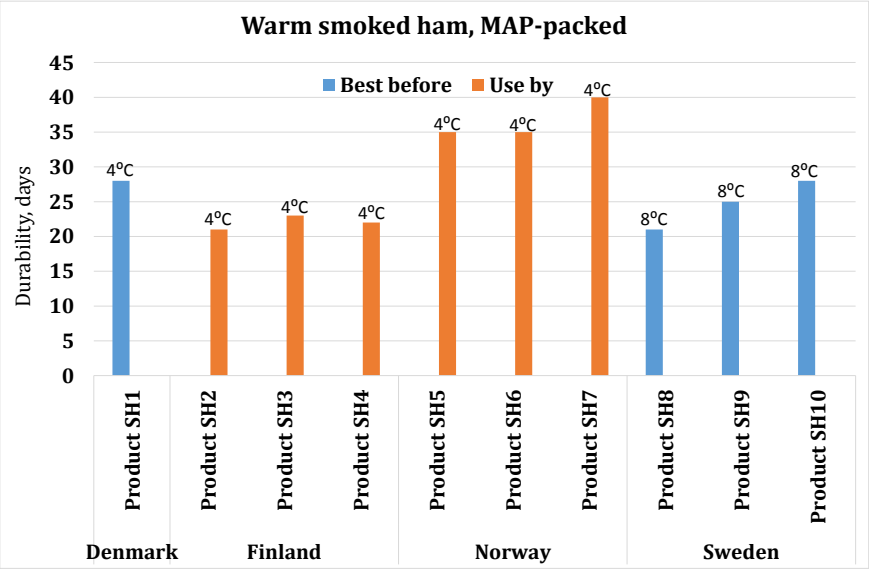
The Swedish companies made both pressed and whole muscle ham. The ham is salted, tumbled, shaped and heat-treated. Durability tests were based on microbiological and sensory analysis. The companies assessed that the shelf life has margin of 1–3 days.

One of the Norwegian companies stated that the "use by" label is chosen because of the risk of L. monocytogenes. There is a risk for the bacterium although much has been done to minimize both prevalence and its ability to grow in the product. The product has a long shelf life and there might be temperature fluctuations in the consumer refrigerator and when the product is kept at room temperature during meals. To ensure that consumers do not eat the product after the expiry date has passed, the "use by" label is chosen.

4.2.5 *Warm smoked ham, MAP*

The "use by" label was utilised for MAP-packed warm smoked ham products in Finland and Norway (SH2–SH7), and the "best before" label was used in Denmark and Sweden (SH1, SH8–SH10), the same as for cocked ham (Figure 9). The durability varied from 21 to 40 days. The storage temperature was 4 °C for Danish, Finnish and Norwegian products from Denmark, Finland and Norway whereas products from Sweden had a storage temperature of 8 °C. The analysis and viewpoints for warm smoked ham is the same as for cooked ham.

Figure 9. Durability in days and type of date marking for MAP-packed smoked ham. Marked storage temperature for each product is shown above each bar



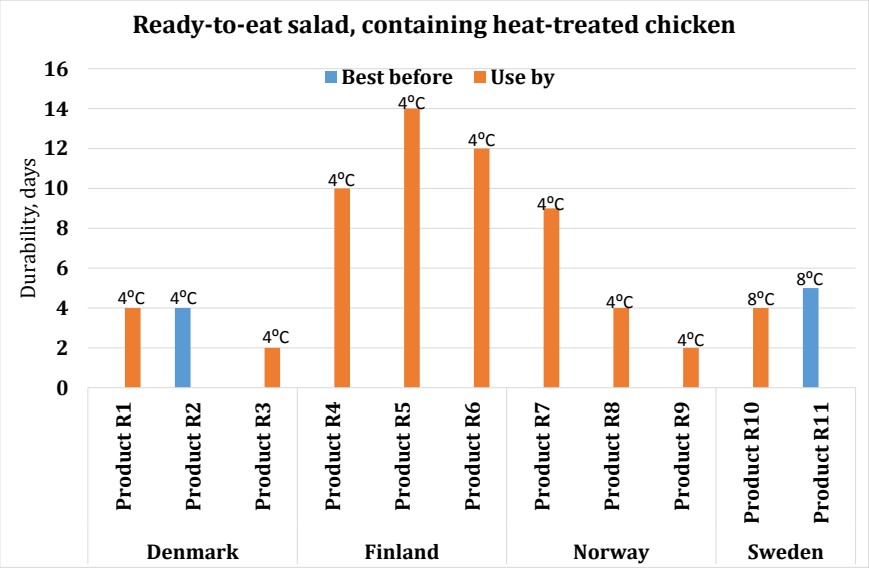
4.2.6 *Ready-to-eat salad, containing heat-treated chicken*

For ready-to-eat salads, the "use by" label is being utilised in all countries (R1, R3–R10), but "best before" is also used in Denmark and Sweden (R2, R11), (Figure 10). The durability varied from 2 to 14 days. The storage temperature was 4 °C for products from Denmark, Finland and Norway, and 8 °C for Swedish products.

The two companies that used "best before" label stated that the product does not spoil after a certain date, but it loses quality due to wilted vegetables. Even though Food safety authorities' guidelines do not point out this type of product of being highly perishable, companies used "use by". Either they had been advised by the National Food Agency

to use this label or that the reason was that the vegetables have lost quality after expiration date.

Figure 10. Durability in days and type of date marking for ready-to-eat salad. Marked storage temperature for each product is shown above each bar

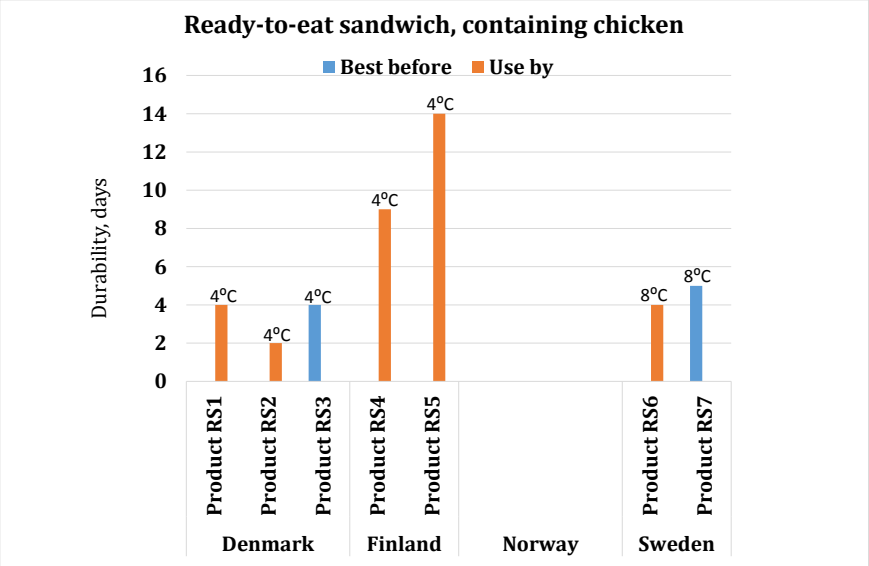


The packaging method is important for the shelf life. Not all companies have specified what type of packaging they use. The products with short shelf life used a simple container with lid and no MAP, but some of the products with longer shelf life used MAP. Another important factor for the shelf life was the quality of raw materials. This can vary and makes it difficult to determine the shelf life.

4.2.7 Ready-to-eat sandwich, containing chicken

Norway was not included when compiling data for this product type since the product is not available in the retail in Norway. The “use by” labelling is being utilised for ready-to-eat sandwich containing chicken in all countries (RS1, RS2, RS4–RS6), but also “best before” is used in Denmark and Sweden (RS3, RS7), see (Figure 11). The durability varied from 2 to 14 days. The storage temperature was 4 °C for Danish, Finish and Norwegian products and 8 °C for Swedish products.

Figure 11. Durability in days and type of date marking for ready-to-eat sandwich. Norway does not have this type of product. Marked storage temperature for each product is shown above each bar



Product safety is the reason for the choice of "use by" label. Shelf life was determined by microbiological analyses and sensory analyses are used to evaluate taste.

As for the ready-to-eat salad, the packaging method is important for the shelf life. The products with short shelf life did not use MAP. In addition, the quality of incoming raw materials is a very important factor for the shelf life and variations can make it difficult to determine the length of the shelf life.

4.3 Main findings and comments from the in-depth interviews

For all the products, there was a major difference in the shelf life. Fresh milk, cold smoked salmon, cooked ham and warm smoked ham had a doubling of the shelf life in days from the shortest to the longest and minced beef had a threefold increase. The ready-to-eat salad and sandwich had even larger difference, but it must be emphasized that different packing methods were used for the ready-to-eat products. Therefore, the shelf life is not completely comparable for these products. The other product groups had the same type of processing and packaging methods and hence, they provide a good basis for comparison. The only differ-

ence is a higher storage temperature for the Swedish milk and ham. However, Swedish products did not generally have a shorter shelf life compared to products in the other countries. Norway had the longest shelf life for all product groups, with the exception of ready-to-eat products, which are not comparable.

Regarding the type of labelling, there was also a difference for some of the products, *i.e.* smoked salmon, cooked ham, smoked ham and ready-to-eat products. Swedish food manufactures use the "best before" label much more often than manufacturers in the other countries. One reason for this may be that the manufactures only use "use by" if the product is included in the current guidance document of the National Food Agency, *i.e.* minced meat, fresh fish, fresh poultry, organs, raw sausages, and bakery products with cream.

The interviews covered only some selected product groups represented by a few manufacturers. It may also be of interest to obtain corresponding information on other product groups.

For some of meat products, food companies in Norway have conducted a thorough assessment concerning which date label should be used. Steaks and fillets of a certain brand, which earlier were labelled "use by" are now labelled "best before". Traditionally, the assessment of perishability has been done according to criteria as pH and water activity. Packaging and storage has not been highly emphasized. Vacuum packed filets of meat are stored for maturation for a relatively long period, and are considered to keep for additional days/weeks. Due to this, it may seem illogical that such a product is not edible from one day to another, such as "use by" marking implies. New techniques for production and packaging are developed and the Norwegian Food Safety Authority takes this into consideration regarding the labelling of durability. On this background, many Norwegian food businesses have reconsidered the use of "use by" and "best before" labelling. However, it is emphasized that it is the companies themselves who are responsiblefor the quality of their products.

5. Discussion

5.1 Nordic differences in practice of the food legislation

The aim of this project was to identify how food labelling legislations are practiced in four of the Nordic countries and to find out if there are any differences in how the food safety authorities practice the legislations and give guidelines to the food producing companies. This may contribute to identify how current practice of the food legislation is generating unnecessary food waste and how this practice can be modified to reduce the amount of food waste.

Both the survey and the in-depth interviews have shown that there are different ways to interpret legislation regarding choosing the date labelling and there are major differences in the assessment of shelf life for similar food products. In essence, the question is why there is such a difference in shelf life between different manufacturers of similar products and between countries. Are there real differences in for example legislation, processing, packaging and refrigeration or is the difference only based on different interpretation of the food legislation? Further studies should focus on underlying causes of the different shelf lives of similar food products.

5.1.1 Differences in using date label

The practical interpretation of the legislation is decided by the manufactures. The "use by" label clearly identifies the durability of the product and is to be used on highly perishable products that also constitute danger to human health. However, it can be difficult to define clearly, when a product is highly perishable, and the manufacturer will ensure that consumers receive products that are of high quality and are safe to eat. The "use by" label refers to both product safety and quality (microbiological), but the "best before" label refers only to product quality. Results indicate that there is a need for a better understanding and guidance on food labelling terms, since the companies has interpreted the legislation differently.

One clear difference in legislation between the countries was found. Until now, it has not been allowed to sell the "best before" products after

expiry date in Denmark, but this is allowed in the other investigated Nordic countries. After FIC was implemented in December 2014, it is allowed to sell products marked "best before" after the expiry date also in Denmark. In Sweden and Norway, the responsibility for the quality of the "best before" product after the expiry date is the seller and not the manufacturer.

The project has not identified other differences in the legislations, but it appears that there are differences in the way it is communicated to producers and how this is practiced. One of these different practices is that Swedish manufactures utilise the "best before" label much more often than manufacturers in the other countries. This is probably because there has been an established practise of the Swedish manufactures to only use the label "use by" if the product is included in the guidance document to Swedish labelling legislation (LIVSFS 2004:27).

5.1.2 Differences of shelf life and storage temperature

The results from the in-depth interviews showed a major difference in the shelf life set by the manufacturers. For many product groups, the shelf life was twice as long for the products with the longest shelf life compared to products with the shortest. Most of the products were similar, processed and packed in a similar way and therefore, provided a good basis for comparison. For minced beef there is a difference in the use of packaging gas. In Norway, a gas mix of 60% CO_2/40% N_2 is used. This gives longer microbiological durability than the packaging gas consisting of 70% O_2/30% CO_2, which is commonly used in Sweden and Denmark. This is shown in the shelf life of minced beef, which has an average of 18 days for the Norwegian products, and correspondingly eight days for the other countries. Another difference was that Swedish milk and ham products were labelled with a storage temperature of 8 °C instead of 4 °C. However, the milk and ham did not have a shorter shelf life than products from the other countries.

In general, Norwegian products had the longest shelf life for many of the selected product groups. Ready-to-eat products were not included in the comparison since these products had different packaging methods and hence, were not completely comparable. It is not clear why Norway has longer shelf life and whether this affects the amount of food waste. This is important to investigate further in future work.

A review of the national regulations and guidelines may give the impression that the National Food Agencies in Denmark, Finland and Sweden provide more guidance to manufacturers, while in Norway this is left more to the manufacturers. The reason to this is unclear.

5.2 Experiences from other studies

Date labelling is one of the reasons for returns and rejections by actors in the food chain. About one third of Swedish household food waste can be connected to date labelling (Andersson 2012, KfS 2009). Many consumers state that they are afraid of getting ill from food whose durability date has expired. This contributes to the discard of foods that has passed the durability date regardless of whether it is edible or not. To address the quality of food products at expiration date, a study was carried out to measure the quality by using microbiological and sensory tests. The study showed that most of the tested products were edible at expiration date of durability, although some of them contained high concentrations of spoilage and natural microorganisms (Rosengren, 2014).

Another Swedish survey examined consumer awareness by asking about the "best before" labelling. A vast majority of the respondents agreed with that the food could be edible even after the best before date is passed. A small share of the consumers disagreed with this (Gulled & Västå, 2013). A similar survey was conducted on food waste in Norway (Hanssen & Møller, 2013). The most common reason for throwing away food was that the food had "passed its expiry date". This shows that many consumers do not relate rationally to the date label. Firstly, the expiry date was by far the most important reason for disposing of yoghurt and sour cream, which are products labelled with "best before" and which last well beyond the expiry date. Secondly, the expiry date was given as an important reason for both fresh bakery products and fresh fruit and vegetables, which are products without date labels in most cases. The results revealed not only the effects of poor planning and shopping routines, but also lack of understanding of date label when the consumer decides whether a product can be eaten or not (Hanssen & Møller, 2013).

5.3 What are the impacts of date labelling for the amount of food waste?

Many retail shops do not sell products where the "best before" date has expired, even if this is allowed under the regulations. The retail should work more systematically to avoid discarding of foods that are about to expire. Food that despite efforts in some cases could be donated to charity,to so called food banks or taken care of in on-site food preparations.

There is a lack of empirical data where food waste is directly linked to date labelling. By following the product flows of specific products, the

food waste can be measured throughout the supply chain. It is also discussed whether to label the packaging with shelf life after opening a pack, but the legislation only require information of this if it is nessesary. This is mainly because that when the package is opened, the manufacturer looses control of the product and is no longer responsible of the product. However, it is often unclear to the consumer how long durability the product has after opening of the packaging. If possible, guidelines to help the consumer may be considered.

6. Conclusion

The study has shown that there are different ways to interpret legislation regarding choosing the date labelling in the Nordic countries. The differences were observed between countries but also between similar food products of different brands within each country. There were also major differences in the length of shelf life for similar products and general storage temperatures. It is not clear, why the shelf life set by the manufactures varies as much as the results show. It is also unclear how much this affects the amount of food waste. This is important to investigate further in future work.

The project has not identified differences in the legislations concerning the choice of date label, but it appears that there are differences in the way it is communicated to producers and how this is practiced. The project has identified a clear difference in legislations concerning the "best before" label. In contrast to Sweden, Norway and Finland, it has until now not been allowed to sell the "best before" products after expiry date in Denmark. This changed when the legislation on food information to consumers (FIC) was applicable from December 2014.

Common guidelines could be usefull in order to harmonize practise and interpretation of the food legislation regarding date labelling and shelf life in EU. Experience has shown that it is difficult to make common Nordic guidelines. However, common Nordic positions can be developed and each country can then make its guidelines basis of this. Common practise in the Nordic countries would hopefully also reduce food waste to a lower level than today.

7. Further work

The project has revealed are some interesting results. However, it still lacks answers to some of the issues it raises:

- Identify underlying causes to different labelling and shelf-life between the food companies in the four Nordic countries.
- Map and investigate empirical data for food waste directly linked to date labelling.
- How much does the length of the shelf life affect the amount of food waste?
- Do manufacturers want to shorten the shelf life of the product to make it seem fresher?
- Do consumers prefer products with shorter shelf life?
- Why do companies in Norway in general set a longer shelf life of their products?
- Would it be possible to harmonize of date labelling and storage temperature in the Nordic countries?
- What is the durability of a product after opening of the packaging?
- Develop common Nordic positions for guidance of choosning type of date labelling.

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9. Glossary

Term	Explanation
Use by Date	In the case of foods which, from a microbiological point of view, are highly perishable and are therefore likely after a short period to constitute an immediate danger to human health, the date of minimum durability shall be replaced by the "use by" date. After the "use by" date, a food shall be deemed to be unsafe in accordance with Article 14(2) to (5) of Regulation (EC) No 178/2002.[14]
Best Before Date	Best before date is the "minimum durability date" and means the date until which the food retains its specific properties when properly stored.[15]
Vacuum packaging	Method of packaging that removes air from the package prior to sealing. The food is placed in a plastic film package, removing air from inside, and sealing the package.
MAP packaging	Modified atmosphere is the practice of modifying the composition of the internal atmosphere of a package in order to improve the shelf life.
Processing	Any action that substantially alters the initial product, including heating, smoking, curing, maturing, drying, marinating, extraction, extrusion or a combination of those processes.[16]
Unprocessed products	Foodstuffs that have not undergone processing, and includes products that have been divided, parted, severed, sliced, boned, minced, skinned, ground, cut, cleaned, trimmed, husked, milled, chilled, frozen, deep-frozen or thawed.[17]
Meat products	Processed products resulting from the processing of meat or from the further processing of such processed products, so that the cut surface shows that the product no longer has the characteristics of fresh meat.[18]
Meat preparations	Fresh meat, including meat that has been reduced to fragments, which has had foodstuffs, seasonings or a additives added to it or which has undergone processes insufficient to modify the internal muscle fibre structure of the meat and thus to eliminate the characteristics of fresh meat.[19]
Food waste	Food losses occurring at the end of the retail and final consumption are called "food waste", which relates to retailers' and consumers' behaviour. Food waste is measured only for products that are directed to human consumption, excluding feed and parts of products that are not edible (FAO 2011).

[14]Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, article 24.

[15] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 .

[16] Regulation No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, article 2, paragraph 1, litra m).

[17] Regulation No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, article 2, paragraph 1, litra n).

[18] Regulation No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin, annex I, point 7.1.

[19] Regulation No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin, annex 1, point 1.15.

10. Sammendrag

Som del av de nordiske statsministrenes initiativ for grønn vekst, Norden – ledende i grønn vekst, har Nordisk ministerråd inititert et projekt hvor formålet er å redusere matsvinn i hele verdikjeden. Det overordnede målet har vært å redusere svinnet uten at det går ut over mattryggheten. Prosjektet besto av tre deler: 1) Utvikle metoder for å måle matsvinn i primærproduksjon, 2) Datomerking og 3) Matbanker. Denne rapporten oppsummerer resultatene fra delprosjekt 2 om datomerking og praktisering av lovgivningen i de nordiske landene, fase 1.

Prosjektgruppen har bestått av representanter fra Fødevarestyrelsen i Danmark, Livsmedelverket i Sverige, Livsmedelssäkerhetsverket Evira i Finland og Mattilsynet, Nofima og Østfoldforskning i Norge. Prosjektet hadde en prosjektleder fra Evira fra starten i august 2013 til april 2014 og ble deretter overtatt av en norsk prosjektleder fra Østfoldforskning.

Målet med prosjektet var å identifisere hvordan dagens regelverk for holdbarhetsmerking av næringsmidler blir praktisert i fire av de nordiske landene og finne ut om det er forskjeller i hvordan regelverket tolkes og hvordan næringsmiddelforetak veiledes. For å avklare ovenstående problemstillinger ble følgende aktiviteter gjennomført:

- Sammenstilling av gjeldende lover og retningslinjer.
- Spørreundersøkelse om hvordan næringsmiddelindustrien bestemmer dato merkingen og holdbarhetstiden av produktene.
- Intervjuer med oppfølgingsspørsmål av utvalgte bedrifter.

Det er en felles lovgivning for holdbarhetsmerking som gjelder i hele EU og landene i EØS (Norge, Island og Liechtenstein). Lovgivningen om merking av mat- og drikkevarer er nå slått sammen til en felles lovgivning om matinformasjon til forbrukere (forordning (EF) nr. 1169/2011). Matinformasjonsforordningen trer i kraft i alle medlemsland i desember 2014.

Spørreundersøkelsen har vist at det er forskjeller i de nordiske landenes retningslinjer og hvordan regelverket praktiseres. Spørreundersøkelsen var web-basert og ble utformet slik at bedriftene kunne legge til flere produkter i samme svar. 64 bedrifter svarte på undersøkelsen, og de representerte 87 produkter.

Et av de viktigste spørsmålene var hvordan holdbarheten blir fastlagt. De fleste bedriftene svarte at holdbarheten av produktene bestemmes ut fra "lagringsforsøk i kombinasjon med mikrobiologiske og sensoriske analyser" (58 %). Noen bedrifter svarte også at "Erfaringer fra andre produkter" (20 %) og "Produktegenskaper" (16 %) er viktige.

Etter å ha analysert svarene fra spørreundersøkelsen var det behov for å få mer utdypende svar på problemstillingen. Det ble gjennomført en rekke dybdeintervjuer med utvalgte bedrifter. Intervjuene fokuserte på bruken av datomerking "best før" eller "siste forbruksdag". Datomerking med "Siste forbruksdag" refererer til både mattrygghet og produktkvalitet (mikrobiologisk), mens "best før" kun er rettet mot produktkvalitet. Intervjuene ble gjennomført for følgende produkttyper:

- Fersk melk, pasteurisert.
- Kaldt røkt laks i skiver, vakuumpakket.
- Kjøttdeig, uten vann og salt, MAP-pakket
- Kokt skinke, MAP-pakket.
- Varmrøkt skinke, MAP-pakket.
- Ferdig salat med varmebehandlet kylling.
- Ferdigsmurt sandwich med kylling (ikke Norge).

For hver produkttype ble det gjennomført 2–3 intervjuer i hvert land. Sammenlagt ble det gjennomført 67 intervjuer.

Resultatene fra intervjuene ble utarbeidet og dokumentert i egne rapporter for hvert land. Intervjuene fokuserte på anvendelsen av lovverket, type datomerking "best før" eller "siste forbruksdag" og holdbarhetstiden.

- Valg av type datomerking ("best før" eller "siste forbruksdag")?
- Hvorfor er denne datomerkingen valgt?
- Hvor lang er holdbarhetstiden på produktet i dager og hvordan er den fastlagt?
- Prosessering og emballasjeløsning?
- Andre relevante punkter angående datomerking (holdbarhet / kvalitet / konserveringsmidler)?

Resultatene viste at det var stor forskjell på holdbarhetstiden for alle produktene. Variasjonen i holdbarhetstiden viste at det fra den korteste til den lengste holdbarhetstiden var fordobling for melk, kaldrøkt laks, kokt skinke og varmrøkt skinke. Tilsvarende var det for kjøttdeig en tredobling fra den korteste til den lengste holdbarhetstid. Ferdigsalatene

og sandwichene hadde enda større forskjell, men det må understrekes at disse produktene ble pakket i ulike emballasjetyper og derfor er holdbarhetstiden ikke sammenlignbar for disse produktene.

Når det gjelder valg av type datomerking viste intervjuene ulik bruk av datomerking for røkt laks, kokt skinke, røkt skinke og ferdigsalatene/sandwichene. Svensk næringsmiddelindustri bruker "best før" merking mye oftere enn produsenter i de andre landene. Dette er sannsynligvis fordi det har vært en etablert praksis for svenske produsenter å bare bruke merket "siste forbruksdag" hvis produktet er inkludert i veiledningsdokument til Livsmedelverket (LIVSFS 2004:27). Både spørreundersøkelsen og dybdeintervjuene har vist at det finnes ulike måter å tolke lovverket på ved valg av type datomerking. Resultatene indikerer at det er behov for bedre forståelse og veiledning om datomerking av næringsmidler, siden bedriftene har tolket lovgivningen forskjellig.

Prosjektet vil bli videreført og resultatene fra denne første fasen har kartlagt følgende punkter som kan være relevante for videre forskning:

- Hva er de bakenforliggende årsakene til forskjellig holdbarhet for produkter i de fire landene?
- Det mangler empiri på matavfall som er direkte knyttet til datomerking.
- Hvordan påvirker holdbarhetstiden mengden av matavfall?
- Ønsker produsentene å forkorte holdbarheten på produktet for at det skal virke ferskere?
- Foretrekker forbrukerne produkter med kortere holdbarhet?
- Hvorfor har produsenter i Norge generelt en lengre holdbarhet på sine produkter?
- Vil det være mulig å harmonisere praktiseringen av datomerking og oppbeveringstemperatur i de nordiske landene og bruke det som innspill til EU?
- Hva er holdbarheten av et produkt etter åpning av emballasjen?

Denne rapporten er del av de nordiske statsministrenes initiativ for grønn vekst: "Norden – ledende i grønn vekst". Les mer i nettmagasinet "Green Growth the Nordic Way" på www.nordicway.org eller på www.norden.org/greengrowth

11. Appendix

Country specific results from survey

11.1 Results of the Danish companies

Table 9. Date label of the product

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
”use-by”	0	1	1	0
”best before”	0	0	4	20

What is the basis of choosing “use-by”?

- Experience and industry coutume.

Table 10. Why is the product considered as easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated foods	0	0	1	1
Pre-cut	0	1	0	0
Minced	0	0	0	0
Sliced	0	0	0	0
High water content	0	1	1	0
High nutritional value	0	0	0	0
Low salt	0	1	1	0
No preservatives	0	1	0	0
Air-packaging	0	0	0	0
Other, what?	0	0	4	2

What product characteristics make the product easily perishable?

- Not stabilized against the growth of Listeria.
- Neutral pH and water content.

Table 11. Why the product is considered not easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Dried food	0	0	0	4
Frozen	0	0	0	2
UHT	0	0	0	0
Canned food	0	0	0	1
Other	0	0	0	12

Other, Ready-to-eat-foods:

- The product is heat-treated and contains very little water.
- Consisting essentially of sugar.
- Low water content, high sugar.
- Heat-treated, preserved, low pH, mid-high sugar, vacuum, etc.
- Baked bread.
- Water content of less than 1% and low water activity makes the product durable.
- The products are dried in the oven and has low water content, low fat.

Table 12. How is microbial growth prevented in the product?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated storage	0	0	0	2
Cooking	0	0	0	6
Preservatives	0	0	0	2
Modified atmosphere	0	0	0	0
Vacuum packaging	0	0	0	2
High salt content	0	0	0	1
High acid content	0	0	0	4
High sugar content	0	0	0	6
Other	0	0	0	8

Other, ready-to-eat foods and ready meals:

- Drying down to the low water content. Also contains salt / sugar in moderation.
- The product is fried (dried).
- Low water activity.
- Different cooking methods that ensure long life.
- Baked products gets dry in the oven.
- Cleaning and hygiene procedures to prevent contamination with fungal spores.
- Natural preservation.

11.2 Results of the Norwegian companies

Table 13. Date label of the product

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
”use-by”	0	1	3	1
”best before”	4	0	2	0

What is the basis of choosing “use-by”?

- Sensory and microbiology, overall assessment of the durability tests.
- Possibility of cross-contamination in the slice / packaging process.
- Products require storage at refrigerated temperature with “Use by”.
- Protection of vulnerable groups (immunosuppressed, pregnant ...).

Table 14. Why is the product considered as easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated foods	0	1	1	1
Pre-cut	0	0	2	0
Minced	0	0	1	0
Sliced	0	0	2	0
High water content	0	0	1	0
High nutritional value	0	0	1	0
Low salt	0	0	1	0
No preservatives	0	1	1	0
Air-packaging	0	0	1	0
Other	0	0	0	0

What product characteristics make the product easily perishable?

- Sliced on slicemachine. Handled manually.
- Product sold chilled and not dried.
- Pre-cut ready-to-eat food.
- Ready-to-eat product with opportunity for growth of Listeria monocyto-genes.

Table 15. Why the product is considered not easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Dried food	0	0	1	0
Frozen	0	0	1	0
UHT	0	0	0	0
Canned food	0	0	0	0
Other	4	0	1	0

Other, dairy products:

- pasteurized and packed under strict hygienic conditions
- pasteurized and fermented
- heat treated, acidified product
- semi-solid ripened cheese produced from pasteurized milk and bactufugert.

Other, meat products:

- raw meat should be heat treated by the end user, this heat treatment will remove possibly pathogenic bacteria.

Table 16. How is microbial growth prevented in the product?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated storage	4	0	2	0
Cooking	0	0	1	0
Preservatives	0	0	1	0
Modified atmosphere	0	0	1	0
Vacuum packaging	1	0	2	0
High salt content	0	0	1	0
High acid content	0	0	0	0
High sugar content	0	0	0	0
Other	0	0	0	0

11.3 Results of the Finnish companies

Table 17. Date label of the product

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
”use-by”	1	0	4	8
”best before”	1	1	2	0

What is the basis of choosing “use-by”?

- Product is microbiologically easily perishable and requires low temperature storage.
- Based on producers durability study.
- The microbiological quality of the product can not be verified without opening the can after the use-by date.
- Easily perishable product.
- Product keeps for very short time, basically only 1+1 (day of preparing and the next day), max 3–4 days.
- Spores are not destroyed in heating. Thus, this type of product must definitely be labelled with use-by date. Pathogens don’t have an effect on the perceivable properties of the product.
- The possible growth of the spores has been estimated through risk evaluation.
- Mandatory based on law.
- Growth of such bacteria will cause food poisoning.
- Spoilage of the product can not be detected sensorial after the use-by date. Therefore we have determined the optimal keeping time with laboratory and sensory analyses.
- Spoilage can not be detected by sensory analysis, hence best to have use-by-date.
- Heat-treatment will not destroy all the spoilage microbes, some will remain in the core and slowly start to grow.

Table 18. Why is the product considered as easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated foods	1	0	2	5
Pre-cut	0	0	0	1
Minced	0	0	2	0
Sliced	0	0	1	1
High water content	1	0	2	4
High nutritional value	1	0	1	0
Low salt	1	0	1	1
No preservatives	1	0	1	3
Air-packaging	2	0	0	3
Other	1	0	0	3

What product characteristics make the product easily perishable?

- Moisture and combination of different raw-material.
- Contains fish and no preservatives.
- Milk is easily perishable, temperature, light etc.
- Minced meat has high water activity, is nutrient rich, no salt or no preservatives have been added to the product.
- Cut lettuce is prone to changes, Cesar-dressing “kills” the lettuce rather quickly.
- Raw-material might contain spore forming microbes.
- Meat product, sliced.
- Bacillus cereus in rice which heating does not destroy.
- Product contains sauce and mashed potatoes with high water content, which means that the perishability is more probable.
- High water content and low cooking temperature.
- Meat product.
- Lactic acid bacteria.

Table 19. Why the product is considered not easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Dried food	0	0	1	0
Frozen	0	0	0	0
UHT	0	0	0	0
Canned food	0	1	0	0
Other	0	0	1	0

Other, meat products:

- Fried.

Table 20. How is microbial growth prevented in the product?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated storage	0	1	0	0
Cooking	0	0	0	0
Preservatives	0	1	0	0
Modified atmosphere	0	0	2	0
Vacuum packaging	0	1	1	0
High salt content	0	1	2	0
High acid content	0	1	0	0
High sugar content	0	0	0	0
Other	0	0	1	0

Other, meat product:

- Drying, adding the Starter (mh-bact.).

11.4 Result of the Swedish companies

Table 21. Date label of the product

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
”use-by”	2	3	2	0
”best before”	11	2	10	3

Table 22. Why is the product considered as easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated foods	9	2	9	1
Pre-cut	0	0	2	0
Minced	0	0	1	1
Sliced	0	0	1	0
High water content	3	0	5	0
High nutritional value	3	1	5	0
Low salt	2	0	0	0
No preservatives	5	3	1	1
Air-packaging	0	0	1	0
Other	1	1	0	0

What product characteristics make the product easily perishable?

Table 23. Why the product is considered not easily perishable?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Dried food	0	0	0	0
Frozen	0	1	1	2
UHT	0	0	0	0
Canned food	0	0	0	0
Other	4	1	2	0

Other, dairy products: Steeped, heat-treated and hot fill in packaging.

Other, fish products: Dried and slanted, PH-regulating, vacuum packed.

Other, meat products: It has added antioxidants, salt and sugar.

Table 24. How is microbial growth prevented in the product?

	Dairy product	Fish product	Meat product	Ready-to-eat foods and ready meals
Refrigerated storage	3	1	2	0
Cooking	1	0	3	1
Preservatives	1	0	0	0
Modified atmosphere	0	0	1	0
Vacuum packaging	0	1	2	0
High salt content	0	0	0	0
High acid content	1	0	0	0
High sugar content	0	0	0	0
Other	0	0	0	1

Other, ready-to-eat foods and ready meals:

- Frozen.

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Date labelling in the Nordic countries

The report addresses how date labels are determined and applied with focus on reducing food waste in the Nordic countries. This was assessed through a survey and selected interviews with Nordic food manufacturers about their considerations when deciding the date label. Another objective has been to distinguish if there are differences in the way food safety authorities interpret legislation. The results from the study indicate that there are differences between the countries in terms of both the practice of guidelines and the shelf life of food.

The report is part of the Nordic Prime Ministers' overall green growth initiative: "The Nordic Region – leading in green growth" – read more in the web magazine "Green Growth the Nordic Way" at www.nordicway.org or at www.norden.org/greengrowth

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