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PAPER

The Danish government position on the control of *Listeria monocytogenes* in foods

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INTRODUCTION

The Danish position on *Listeria monocytogenes* in foods has evolved from knowledge of:

- the frequency of listeriosis in Denmark;
- the pathogenicity of *L. monocytogenes*;
- the occurrence of *L. monocytogenes* in foods; and
- scientific data on survival and growth.

A combined evaluation of all these aspects is considered of paramount importance in arriving at a realistic policy on *L.monocytogenes* in foods. Thus, a policy based solely on the seriousness of listeriosis and on the fact that the minimum infectious dose is not known would – quite logically – lead to a strict zero-tolerance policy for all ready-to-eat foods. Experience has shown that such a policy is unrealistic. A zero-tolerance policy does not guarantee food safety and can result in a number of negative consequences:

- needless withdrawal of wholesome foods;
- unnecessary loss of consumer confidence; and
- unjustified losses for the food industry.

In fact, Denmark can endorse the ILSI Europe/WHO statement on zero-tolerance-based food safety policy:

> For many years, food laws have been based on the principle that all pathogenic microorganisms should be absent from all foods. This concept of zero tolerance, however, does not reflect scientific and technical reality. Experience over the last 30 years has clearly shown that the complete elimination of pathogenic microorganisms from the food supply is not achievable. Thus, new approaches are needed to establish scientifically sound regulations on pathogenic microorganisms in foods.

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ESTABLISHING A REALISTIC POLICY

To arrive at a realistic policy on *L. monocytogenes* in foods in Denmark, a risk assessment has been carried out by comparing the frequency of listeriosis with the frequency of exposure to *L. monocytogenes* through contaminated foods. The frequency of listeriosis in Denmark is shown in *Figure 1*. Denmark experienced two outbreaks in the 1980s. However, in recent years the annual rate has been 20–25 cases, corresponding to 4–5 cases per million inhabitants. It can be concluded that listeriosis is a rare disease in Denmark.

The frequency of exposure to *L. monocytogenes* can be estimated from the rate of occurrence in ready-to-eat foods. More detailed calculations can be made when comparing the rate with the amount of food consumed and the level of *L. monocytogenes* in foods (quantitative risk assessment). In fact, such knowledge is necessary to establish realistic criteria for *L. monocytogenes* in foods. Some Danish screening results for *L. monocytogenes* in foods are summarized in *Table 1*.

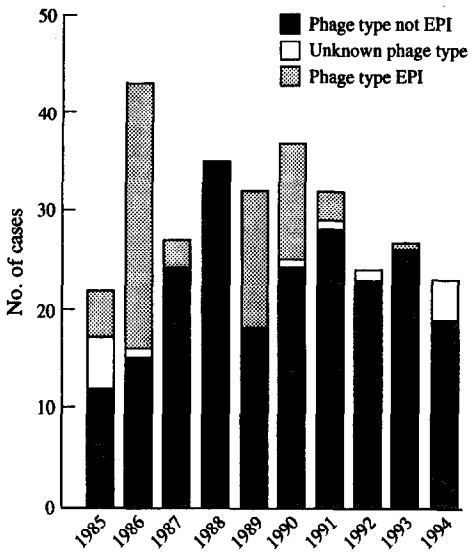

Figure 1 Frequency of listeriosis in Denmark

Table 1 Occurrence of *L. monocytogenes* in ready-to-eat foods

	n	% pos.	% pos. >10 L.m./g	% pos. >100 L.m./g
Ready-to-eat foods with no listericidal treatment[a]				
Meat products	334	20	1	0
Fish products	335	11	5	2
Ready-to-eat foods that undergo further processing after a listericidal treatment[b]				
Meat products	670	10	5	3

[a]Max values: Meat products: 10^1–10^2.
[b]Max values: Meat products: 10^5–10^6.

Table 2 Growth suppression of *Listeria monocytogenes* in Bologna sausage

	pH	Growth at: 5°C 35 days	10°C 35 days
Standard formulation	6.6	Rapid growth	Rapid growth
2% Na-lactate	6.6	Late growth	Rapid growth
2% Na-lactate + 0.25% GDL[a]	6.3	No growth	No growth
2% Na-lactate + 0.5% GDL[a]	6.0	No growth	No growth

[a]Glucuno–Delta–Lactone.

From statistics on amounts of foods produced, it can be concluded that millions of packages with foods containing low levels of *L. monocytogenes* are sold on the Danish market every year without evidence of causing listeriosis. It should be noticed that this frequent intake of *Listeria*-contaminated foods holds true also for the so-called YOPIs (young, old, pregnant, immunocompromised). This is not considered to be in contradiction to the Danish policy, that all foods should be safe to consume, even for the vulnerable part of the population, which constitutes a large and growing part of the population (perhaps 20%). In fact, when establishing a policy on *L. monocytogenes*, it must be taken into consideration that we are dealing with an ubiquitous pathogen which rarely causes human illness.

HACCP AND HURDLE TECHNOLOGY

Application of the 'General Principles of Food Hygiene' and in particular the HACCP principles 'from farm to fork' (1) are the most effective means to control *L. monocytogenes* and hence prevent listeriosis. Timely action, taken in case of a deviation at a Critical Control Point, will effectively minimize the risk that defective products reach the consumer. Analysing samples of end-products may provide some additional information concerning the microbiological status of the product, but will not guarantee safety (Codex Alimentarius Commission).

Thus, health authorities and industry should base control of *L. monocytogenes* on the proper application and verification of HACCP. If microbiological criteria are elaborated, this should be done according to the 'Principles for the Establishment and Application of Microbiological Criteria for Foods' (Codex Alimentarius Commission).

Many of the foods on the market (such as those containing raw ingredients, or which are subject to some form of portioning or maturation process after processing) will, irrespective of a good HACCP-programme, from time to time contain low numbers of *L. monocytogenes*. However, epidemiological evidence indicates that the ingestion of low numbers

Table 3 Sampling plans for foods for the control of *Listeria monocytogenes*

Food category	Product examples	*n*	*c*	Limit per gram *m*	*M*
I[a]	Foods heat treated in the final package	5	0	0[b]	—
II	Heat treated meat products, soft cheese	5	0	0[b]	—
III	Heat treated meat products stabilized by hurdle technology	5	1	10	100
IV	Smoked salmon, smoked salted meats, raw vegetables	5	2	10	100
V[c]	Raw meat and fish, minced meat	5	2	10	100

[a]No testing is required for food category I if the listericidal treatment is well documented and verified in a HACCP-system, which assures total elimination of *L. monocytogenes*.
[b]Denotes absence in 25 g.
[c]Since histories exist of high numbers of *L. monocytogenes* in this category, these criteria should be used for surveillance purposes. No testing is required for food category V if the food is intended to receive a listericidal treatment immediately before consumption, and when the food is produced under a system for control based on HACCP. However, for minced meat, testing is required since experience shows that this item is frequently undercooked.

of *L. monocytogenes* does not pose a significant health risk even to susceptible individuals.

For products supportive of growth of *L. monocytogenes* there are various options:

- zero-tolerance
- re-pasteurization
- reduced shelf-life
- HACCP
- hurdle technology
- consumer information

Introducing a zero-tolerance to such foods would result in their disappearance from the market place. However, it should be borne in mind that some of these products are highly desired by consumers, and in spite of frequent occurrence of *L. monocytogenes* they in fact have excellent safety records. This knowledge, combined with the knowledge that known outbreaks of listeriosis have occurred with foods which support growth of *L. monocytogenes*, has in Denmark led to the conclusion that satisfactory safety of foods can be obtained by HACCP, hurdle technology where appropriate combined with a reduced shelf life.

In Denmark, we have been looking at a solution to the problem of growth in foods by introducing combined technologies which prevent the outgrowth of *L. monocytogenes* – so-called hurdle technology. Definition of hurdles and hurdle technology is as follows:

> Hurdles are substances or processes, which prevent or inhibit microbial, chemical or physical deterioration of foods. Hurdle technology allows improvements in the safety, stability and quality of foods by an intelligent combination of hurdles.

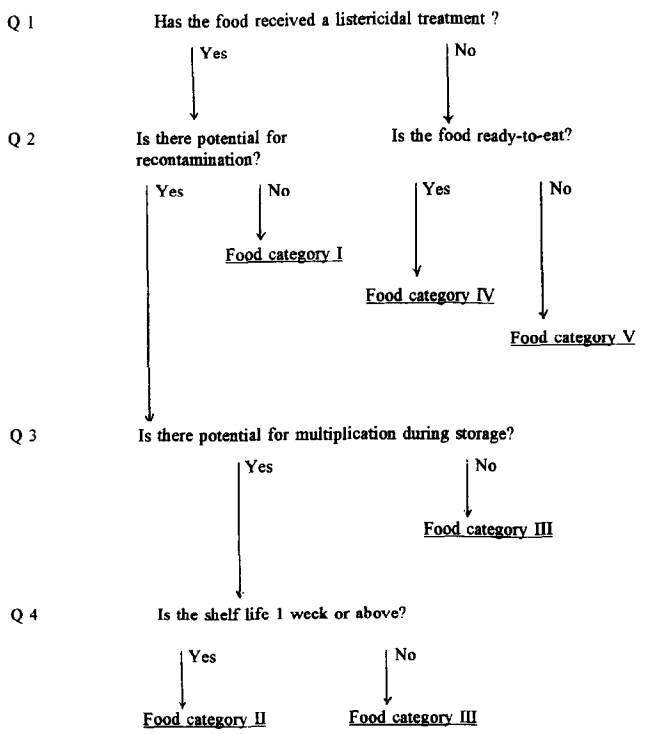

Figure 2 Decision tree for the establishment of food groups for the control of *Listeria monocytogenes*

Table 2 shows some recent results on hurdle technology obtained in our laboratory. These results are used by the food industry in Denmark and are expected to influence food legislation in Denmark. This position is in accordance with the following WHO Statement on Listeriosis.

> The critical issue is not how to prevent *L. monocytogenes* in foods, but how to control its survival and growth in order to minimize the levels in foods.

CONTROL

Based on these considerations, a concentration of *L. monocytogenes* not exceeding 10/g of food at the point of consumption is considered acceptable for a food to be consumed by all consumers. However, for foods supportive of growth and with prolonged shelf lives and for foods specifically intended for high risk groups, absence in 25 g in a certain number of sample units should be achieved.

In order to determine the number of sample units within a lot that should comply with these critera, a risk assessment should be applied. This should recognize the major elements of risk. These are the ability of the food to support growth of a particular pathogen during storage and distribution and whether or not the organism would be killed during the process of preparation for consumption.

These factors have been used to construct the decision tree (*Figure 2*) and the sampling plan (*Figure 3*). The criteria proposed are achievable by products produced according to Good Hygienic Practices (GHP) and under a system for control based on HACCP. However, they are not intended to be a substitute for GHP and HACCP, which will always give a higher degree of safety assurance than that achievable by meeting a microbiological criterion.

If the number of *L. monocytogenes* exceeds **m** in number of samples in excess of **c**, steps to improve the situation must be taken by an evaluation based on HACCP-principle, and an assessment of the shelf life is carried out. If the number of *L. monocytogenes* exceeds **M**, a sales prohibition is prescribed. If the food is specifically intended for highly susceptible individuals, absence in 25 g is required and the number of samples may need to be increased. Such consumers should be informed about the need to take particular precautions as regards the foods to eat and how these should be prepared.

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