Import risk analysis: Belovo Egg Powders.

Biosecurity Authority
Ministry of Agriculture and Forestry
Wellington
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Approved for release

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1. EXECUTIVE SUMMARY

This document is a qualitative analysis of the biosecurity risks posed by three egg powders manufactured by a specific European firm[1] working according to GMP rules as established by the EC Council Directive of June 20, 1989 (89/437/EEC) on hygiene and health problems affecting the production and the placing on the market of egg products.

This risk analysis concludes that in view of the processing involved in their preparation (prolonged times at high temperatures), these eggs powders do not pose a biosecurity risk, and that no safeguards are required.

[1] Belovo SA, Industrial Area 1, 6600 Bastogne, Belgium.

2. COMMODITY DEFINITION

2.1 Description of Commodities

The commodities considered in this risk analysis are made by a Belgian company (Belovo), working according to GMP rules as established by the EC Council Directive of June 20, 1989 (89/437/EEC) on hygiene and health problems affecting the production and the placing on the market of egg products. Three commodities are considered, all derived from hens' eggs (*Gallus gallus*):

(1) whole egg powder
(2) egg albumen powder
(3) egg yolk powder

2.2 Processing

Whole egg powder
- pasteurisation at 65.5°C for 3 minutes
- dehydration - inlet 145°C, outlet 60°C
- spray drying
- hot room pasteurisation of final product by holding at 70°C for at least 120 minutes

Egg albumen powder
- dehydration - inlet 160°C, outlet 60°C
- spray drying
- hot room pasteurisation of final product by holding for 14 days at not less than 64°C

Egg yolk powder
- pre-treatment at 60°C and at a pressure of 300 bar, for 36 minutes
- pasteurisation at 65.5 °C for 4-6 minutes
- dehydration - inlet 145°C, outlet 55°C
- spray drying
- pasteurisation of final product by holding at 70°C for at least 120 minutes

The spray drying process commences with the introduction of liquid egg into the drying chamber in the form of a fine spray where it is brought into close contact with a stream of heated air. The small droplet size of the spray (10-200 μm) enables the use of very short drying times. Powdered egg is collected at the bottom of the spray chamber and passed through a system of cooling coils after which it is packaged. The egg material may reach 170°C during the spray drying process, but only for a very short time.

2.3 Post-processing bacteriology

Whole egg powder

Total bacterial count :	< 10,000/g
Bacillus cereus :	< 100/g
Enterobacteria :	0
Salmonella :	0
Moulds and yeasts	< 50/g

Egg albumen powder

Total bacterial count :	< 2,000/g
Bacillus cereus :	< 50/g
Enterobacteria :	0
Salmonella :	0
Moulds and yeasts	< 10/g

Egg yolk powder

Total bacterial count :	< 5,000/g
Bacillus cereus :	< 10/g
Enterobacteria :	0
Salmonella :	0
Moulds and yeasts	< 50/g

2.4 Use Of Imported Commodities

These commodities are used in the food industry, predominantly involving further cooking.

Whole egg powder is used for:

- sauces
- dressings
- pasta manufacture
- omelettes, quiches, soufflés, scrambled eggs

Egg albumen powder is used for:

- baking (mostly biscuit manufacture)
- confectionary where whipping properties are necessary (nougats, meringues, marshmallows, mousses etc)

Egg yolk powder is used for:

- mayonnaises, dressings, sauces, spanish bread, croissants
- 'long eggs'

3. HAZARD IDENTIFICATION

Vertical transmission (i.e. transmission in or on eggs) is a feature of a number of disease agents. These are listed in the following table in the order in which they appear in the reference text used to collate this list (Calnek, 1997).

Disease	Agent	In egg	On or in shell	Page # in Calnek (1997)
Pullorum disease	Salmonella pullorum	yes	yes	82
Fowl typhoid	Salmonella gallinarum	yes	yes	82
Paratyphoid salmonellae	Salmonella enteritidis (vertical), and many other serotypes (by shell contamination)	yes	yes	98, 103
Arizonosis	Salmonella arizonae serovar $18Z_4Z_{32}$	yes	yes	124
Colibacillosis	Escherichia coli 0111, 0157H7 and others	no	yes	134
Mycoplasmosis	M. gallisepticum M. meleagridis M. synoviae M. iowae	yes yes yes yes	no no no yes	197 209 222 229
Avian leukosis/sarcoma	Alpharetrovirus (Retroviridae)	yes	no	430
Reticuloendotheliosis	Gammaretrovirus (Retroviridae)	yes	yes	472
Infectious bronchitis	Coronavirus (Coronaviridae)	yes	no	516
Newcastle disease, APMV-1	Rubulavirus (Paramyxoviridae)	yes	yes	550
Avian paramyxovirus types 2 & 3	Rubulavirus (Paramyxoviridae)	yes?	yes?	552
Turkey rhinotracheitis	Avian pneumovirus (Paramyxoviridae)	yes?	yes?	553
Avian encephalomyelitis	unassigned (Picornaviridae)	yes	yes	573
Avian influenza	Influenzavirus A (Orthomyxoviridae)	no?	yes	593
Group 1 adenovirus infections	Aviadenovirus (Adenoviridae)	yes	yes	613
Haemorrhagic enteritis, Group 2 adenovirus splenomegaly	Aviadenovirus (Adenoviridae)	no	yes?	626
Egg drop syndrome 76	Aviadenovirus (Adenoviridae)	yes	yes	636
Duck hepatitis types 1 & 3	unassigned (Picornaviridae)	no	yes?	664, 669
Duck hepatitis type 2	Astrovirus (Astroviridae)	no?	yes?	668
Duck viral enteritis (duck plague)	unassigned (Herpesviridae)	yes?	yes?	678
Rotavirus infections	Rotavirus (Reoviridae)	no	yes?	696
Viral arthritis	unassigned (Reoviridae)	yes	yes?	713
Infectious bursal disease	Avibirnavirus (Birnaviridae)	no	yes?	726
Chicken infectious anaemia	Gyrovirus (Circoviridae)	yes	yes	742
Avian nephritis types 1-3	unassigned (Picornaviridae)	yes?	yes?	762
Turkey viral hepatitis	unidentified (Picornaviridae)	yes?	yes?	774
Derzsy's disease (goose parvovirus infection)	Parvovirus (Parvoviridae)	yes?	yes?	779
Ornithobacteriosis	Ornithobacterium rhinotracheale	yes?	no	1013
Angara disease	Aviadenovirus (Adenoviridae)	yes	yes	1020
Muskovy duck virus	Parvovirus (Parvoviridae)	yes?	yes?	1033

Key: "yes?" and "no?" indicate that there is significant uncertainty surrounding whether the agent is associated with a particular transmission route. "Yes?" indicates that the balance of probabilities suggests that transmission does occur by that route, and "no?" indicates that although it is unlikely transmission cannot be discounted.

The above table of agents represents the list of potential hazards that may be associated with eggs. It is assumed that any agent transmitted *in* eggs is likely to be present in the egg pulp that is processed into egg powders. Further, it is assumed that there is a low likelihood for agents that are transmissible *on* or *in* egg shells to be present in the egg pulp at the time of processing.

In view of its recognised heat-resistance, it is important to note that there is no evidence that infectious bursal disease (IBD) virus is transmitted *in* eggs, and the only way that egg pulp could contain the virus is via faecal contamination of egg shells (Calnek, 1997, p 726).

4. RISK ASSESSMENT

4.1 Release Assessment

The release assessment examines the likelihood of the imported commodity carrying agents when imported into New Zealand. In the case of the three egg powders that are the focus of this analysis, the release assessment first considers the likelihood of the potential hazards surviving the various time/temperature regimes that are used during the production processes described under the commodity definition. Then, for any potential hazards that are considered likely to survive processing, the likelihood of their being present in the commodity is examined. At that stage, agents that are endemic to New Zealand are not considered further.

In view of the difficulty evaluating the various different steps — pasteurisation, dehydration and spray drying — this analysis will concentrate only on the final pasteurisation process, which for whole egg and egg yolk powders is at 70°C for at least 120 minutes, and for egg albumen powder is at a temperature of at least 64°C for 14 days.

With the exception of a few distinctively thermo-resistant strains, salmonellae are generally considered to be quite sensitive to heat (Calnek, 1997, p 99). Survival times at 56°C are typically 10-20 minutes and salmonellae are considered to be unable to survive temperatures above 70°C (Mitscherlich & Marth, 1984, p 639).

E. coli growth stops above 44°C (Calnek, 1997, p 131), and the organism is inactivated at temperatures above 65°C (D'Aoust et al, 1988). At 70°C, 2 minutes delivers a 6D reduction in cell numbers, which is considered adequate for food safety (Stringer et al, 2000).

The post-processing bacteriological testing of the commodities confirms their freedom from *E.coli* and salmonellae.

Mycoplasmas are considered to be not particularly resistant to physical and chemical influences. Sealed cultures of *Mycoplasma agalacticae* subsp. *agalacticae* have been shown to survive less than 8 minutes at 53°C (Mitscherlich & Marth, 1984, p 266). *M. gallisepticum* culture, exposed to different temperatures in an incubator, showed an exponential decrease in viability of the organism as temperature increased over 40°C (Mitscherlich & Marth, 1984, p 270), and the organism is inactivated after 20 minutes at 50°C (Calnek, 1997, p 195), while *M. meleagridis* was inactivated at 47°C after between 40 and 120 minutes (Calnek, 1997, p 209).

Ornithobacterium rhinotracheale will grow at temperatures up to 42°C (Calnek, 1997, p 1012), and it is likely that, as with most other vegetative forms of bacteria, it is quickly inactivated at temperatures much higher than that. A closely related bacterium, *Haemophilus paragallinarum,* is destroyed at 50°C in 2 minutes (Mitscherlich & Marth, 1984, p 194).

Retroviruses are relatively heat labile, and at 60°C the half life of avian sarcoma and leukosis viruses is less than a minute (Calnek, 1997, p 424). Similarly, reticuloendotheliosis virus is rapidly inactivated by heat; even at 50°C, 99% of infectivity is lost within an hour (Calnek, 1997, p 468).

Coronaviruses are sensitive to heat (van Regenmortel et al, 2000, p 835) and most strains of infectious bronchitis are destroyed after only 15 minutes at 56°C (Calnek, 1997, p 512).

Avian paramyxoviruses are recognised as being very heat labile (Alexander, 1993, p 321), and at 70°C they are inactivated in around 40 seconds (Christensen et al, 1999, p 88). Modelling carried out in the context of MAF's 1999 chicken meat risk analysis demonstrated that for Newcastle disease virus a target titre of -6 $\log_{10}$ CID_{50}/g was likely to be reached in less than 25 minutes at 70°C (Christensen et al, 1999, p 191).

Picornaviruses vary in their thermostability (van Regenmortel, 2000, p 658). Duck hepatitis 1 virus is inactivated after 30 minutes at 62°C (Calnek, 1997, p 662), while the closely related human hepatitis A virus is inactivated after 4 minutes at 70°C (Fields et al, 1996, p 748). Enteroviruses are rapidly destroyed at 50°C (Fields et al, 1996, p 658). Avian encephalomyelitis virus is inactivated in 10 minutes at 60°C (van Regenmortel et al, 2000, p 671), while avian nephritis virus has a similar heat lability to avian encephalomyelitis virus (Imada, 1993, p 479).

Orthomyxoviruses are readily inactivated by heat (Calnek, 1997, p 590), and avian influenza virus is destroyed in less than 5 minutes at 64°C (Moses et al, 1948).

Group I adenoviruses are generally inactivated in about 30 minutes at temperatures from 56°C (Calnek, 1997, p 611). Although group II adenoviruses (haemorrhagic enteritis, marble spleen disease, splenomegaly) are more resistant, they are destroyed at 70°C in about an hour (Calnek, 1997, p 625). Egg drop syndrome 76 virus is inactivated after 30 minutes at 60°C (Calnek, 1997, p 634).

Although duck hepatitis virus type 2 has been shown to be resistant to heating at 50°C for an hour, like other astroviruses it is generally considered to be inactivated after 5-10 minutes at 60°C (Fields et al, 1996, p 813; van Regenmortel et al, 2000, p 741).

The herpesvirus that causes duck viral enteritis is destroyed after 10 minutes at 56°C (Calnek, 1997, p 677).

Reoviruses in general are moderately resistant to heat (van Regenmortel et al, 2000, p 396) and infectivity of bovine and simian rotaviruses remains stable at 45°C to 50°C (Fields et al, 1996, p 1632). However, above 50°C they are inactivated relatively rapidly; titres of two turkey rotaviruses were reduced 100 fold by heating for 30 minutes at 56°C (Calnek, 1997, p 693).

Avibirnaviruses are renowned for their heat stability, and IBD virus is recognised as one of the most heat-resistant agents affecting poultry (Christensen et al, 1999, p 75-76). Although trials carried out in the late 1960s indicated that IBD virus was inactivated in 30 minutes at 70°C (McFerran, 1993, p 213), further trials commissioned by MAF in the late 1990s suggested that there was a significant heat-resistant fraction of virus that took considerably longer to inactivate. This heat-resistance appeared to vary with different strains of IBD virus. The time required at 70°C to reduce the titre by one log, for two different pathogenic strains of IBD virus, varied from 19 minutes to 63 minutes (Christensen et al, 1999, p 170). Using this information it can be concluded that 120 minutes at 70°C could be expected to reduce the titre of IBD virus by between 2 and 6 logs.

Chicken anaemia virus is relatively heat-resistant, and is only partially inactivated after 1 hour at 70°C (Calnek, 1997, p 741).

Most parvoviruses can survive incubation at 56°C for at least 60 minutes (van Regenmortel et al, 2000, p 312), and goose parvovirus showed no loss of titre when heated at 65°C for 30 minutes (Calnek, 1997, p 778).

4.1.1 Conclusion

Of the potential hazards examined, only three agents are considered to withstand heating at 70°C to any significant extent : IBD virus, chicken anaemia virus and the parvoviruses causing derzsy's disease of geese and disease in young muscovy ducklings.

Since IBD virus is not transmitted in eggs, the only source of IBD virus as far as these commodities are concerned would be faecal contamination of egg shells (Calnek, 1997, p 726). In view of the manufacturing processes involved, such contamination would be minimal, and therefore the amount of IBD virus likely to be present in the egg pulp prior to the powder preparation process would be negligible.

Vertical transmission of chicken anaemia virus through the hatching egg is considered to be the most important means of dissemination of this agent (Calnek, 1997, p 742). However, as this virus is present in New Zealand (Stanislawek & Howell, 1994) it is not considered further in this risk analysis.

Only muscovy ducks are susceptible to muscovy duck disease (Calnek, 1997, p 1033), and goose parvovirus affects only geese and muscovy ducks (Calnek, 1997, p 777). Therefore, the likelihood of these agents being present in egg pulp of commercial chickens is negligible.

Considering the several heat treatments used in the preparation of these commodities, it can be concluded that none of the agents that are likely to be transmitted in eggs would survive in the final products.

4.2 Risk Estimation

As the commodities are not considered to be a vehicle for agents of concern, the biosecurity risk posed by their importation is negligible.

No safeguards are necessary.

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