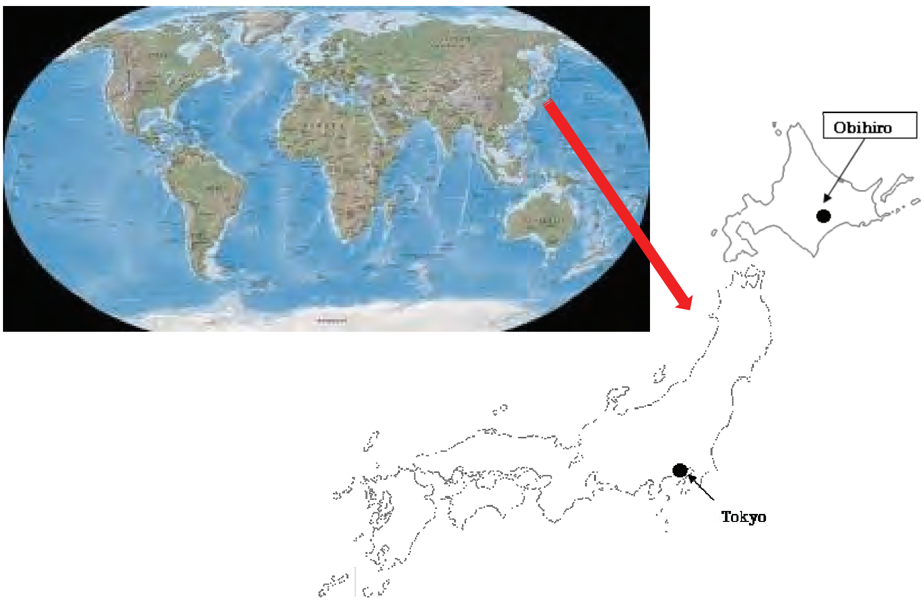

Official Development Assistance of the Government of Japan
Group Training Program
“Utilization and Preservation Techniques for Animal Products for Food Safety”
Japan International Cooperation Agency (JICA)
Obihiro International Center (OBIC)


Obihiro
Tokyo

Thank you very much for your assistance

"Utilization and Preservation Techniques for Animal Products for Food Safety"

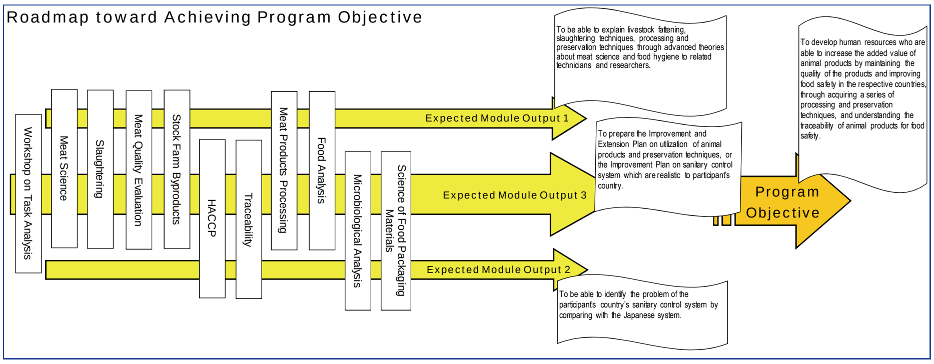
Participants - Rwanda

JFY	Name	Sex	Period		Position / Office
2007	MUSINGUZI Francis	M	2008.02.16	2008.05.23	Professional in Value Addition of Animal Products and By-Products / Rwanda Animal Resources Development Authority ('06)
2007	MUSABWAYIRE Consolee	F	2008.02.16	2008.05.23	Technician Veterinary / Higher Institute of Agriculture and Animal Husbandry(ISAE) ('07)
2008	NDAHURA MUHUMUZA Joy Constance	F	2009.02.15	2009.05.22	Professional/ Small Animal Improvement & Improve Their Products, Livestock, Rwanda Animal Resources Development Authority (RARDA)('04)
2008	MUKABAGORORA Beatrice	F	2009.02.15	2009.05.22	Extensyion/ Livestock, Rwanda Animal Resources Development Authority (RARDA)('06)
2009	BAJENEZA Jean Pierre	M	2010.02.13	2010.05.22	Head Market Surveillance / Quality Assurance, Rwanda Bureau of Standards ('07)

Participants - Malawi

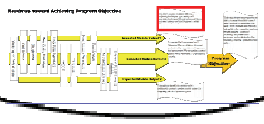
JFY	Name	Sex	Period		Position / Office
1997	MUNTHALI Humphries Donald Travoe John	M	1998.01.12	1998.07.12	Branch Manager, Cold Storage Company
2003	Mazganga Suzanna PHIRI	F	2004.02.21	2004.05.28	Animal Scientist, Ministry of Agriculture, Chitedze Research Station
2003	Taurayi Belo MLEWA	M	2004.02.21	2004.05.28	Animal Health and Livestock Development Officer, Ministry of Agriculture(Blantyre Agricultural Development Division)
2008	MARUWO Golden Bobo	M	2009.02.14	2009.05.21	Animal Health and Livestock Development Officer/ Veterinary Department , Ministry of Agriculture('07)
2009	MPHEPO Ruth Matimati	F	2010.02.13	2010.05.21	Assistant Farm Manager / Farm, Natural Resources College ('09)
2009	CHAPOTA Gabriella	F	2010.02.13	2010.05.21	Lecturer /Training, Natural Resources College ('05)
2009	MASAMBA Kingsley George	M	2010.02.13	2010.05.21	Lecturer/Bunda College of Agriculture, University of Malawi ('04)
2010	KANTIKANA Owen Chipiliro	M	2011.02.12	2011.05.21	Chief Laboratory Technician/Bunda College of Agriculture, University of Malawi ('04)
2010	NKHOMA Clemence Mickeas	M	2011.02.12	2011.05.21	Animal Health and Livestock Development Officer/Department of Animal Health and Livestock Development, Ministry of Agriculture and Food Security ('10)

Curriculum and Objective



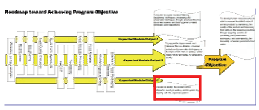
Lecture, Practice, Observation

Output 1



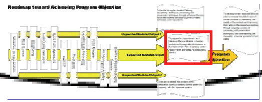
To be able to explain livestock fattening, slaughtering techniques, processing and preservation techniques through advanced theories about meat science and food hygiene to related technicians and researchers.

Output 2



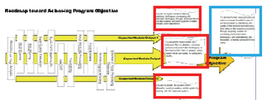
To be able to identify the problem of the participant's country's sanitary control system by comparing with the Japanese system.

Output 3



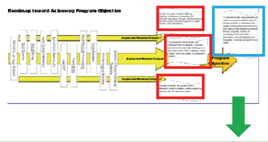
To prepare the Improvement and Extension Plan on utilization of animal products and preservation techniques, or the Improvement Plan on sanitary control system which are realistic to participant's country.

Program Objective



To develop human resources who are able to increase the added value of animal products by maintaining the quality of the products and improving food safety in the respective countries through acquiring a series of processing and preservation techniques, and understanding the traceability of animal products for food safety.

Overall Goal



- Food safety is expected to be improved, by establishing the system which maintains the quality of animal products in participants' countries.

Reports

- Inception Report - Before Training
- Interim Report - End of Training in Japan
- Final Report - Three (3) months after ?


Thank you very much
Japan International Cooperation Agency (JICA)
Obihiro International Center (OBIC)

Microbiology of Meat and Meat Products, and Dry Meat Products

Masayuki Mikami, phD
Emeritus Professor of Obihiro University

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Ⅰ. You should know about microbe

1. Prevalence; Microorganisms exist every where.

To the meat processor, it means that they can be found in the air, in the water supply, in all raw materials of meat and spices, in cartons, on utensils, on the skin and clothing or your employees, and on all of the surfaces of your equipment and buildings.

Meat is contaminated too much bacteria

2. Size; Extremely small → 1-8 μm in bacteria

3. Shape; Microbes exists in wide variety of forms, shapes and even colours.

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Bacteria, the smallest of the microbes, occur in various shapes and are usually the most difficult to identify.

4. Growth; Bacteria multiply by fission, by splitting into two or more parts, and this process is continued over and over again. Yeast reproduces by budding. Molds elongate, and as this process continues, the molds branch out much like the growth of a tree. Molds are also capable of producing large numbers of spores (seeds).

3

5. Nutrient; Proteins, carbohydrates, fat, water, inorganic compounds (salt, nitrite, etc.), and even vitamins are found in all meat products.

6. pH (acidity-alkalinity); Normally, most organisms prefer a near neutral pH (6.8-7.2). However, the organisms peculiar to meats and meat products are able to grow within a very wide pH range (4.0-9.0). Fresh meat will normally have pH values in the range of 5.3 to 6.0. Processed meats can have widely divergent pH values; for example, fermented sausages will be quite acid (pH 4.2-4.7).

4

7. Air; Science has divided microorganisms into the following categories depending on their oxygen requirements.

ⅰ. Aerobes require oxygen for growth , and there are many species of bacteria, yeasts and molds. Vacuum packaging was conceived primarily to inhibit the growth of these organisms. → Almost bacteria

ⅱ. Anaerobes do not require oxygen for growth. Actually, it can be very toxic to them. Most of the anaerobes important to meats are bacterial species, as the canned meats division can verify. → Clostridium

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ⅲ. Facultative anaerobes are organisms that will grow either with or without air. For all practical purposes, the interiors of fresh meats, hams, sausages, etc. do not contain free oxygen and therefore will only favor the growth of anaerobes or facultative anaerobes.

Some of the Lactobacilli, Pediococci, Streptococci and Coliform bacilli, as well as some yeasts, possess the ability to adapt themselves to the presence or absence of oxygen.

→ Escherichia, Lactic acid bacteria -----

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8. Moisture; Moisture is an important requirement for growth, as organisms can only utilize their food by assimilation, and the nutrients must therefore be in solution. The relative humidity (moisture in the air) can also affect the development of organisms.

In general, bacteria require more moisture than do yeasts and molds, and this explains, in part, why molds and yeasts are found on the surface of dry and semidry meat products. A dry surface coupled with a dry atmosphere is not very conducive to bacterial growth.

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Water is divided into free water and bound water. Relative humidity is depend on the free water. Bacteria can use only free water.

Water activity (Aw) = P / P_0

P : relative humidity of food,

P_0 : relative humidity of water = 100 %.

Example; meat = 98 % RH → Aw of meat = 98 /100 = 0.98

So, water activity is the range of $0 \leqq Aw \leqq 1.0$.

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Relation to growth of bacteria and Aw

Species	Aw
Pseudomonas	0.97
Escherichia	0.96
Bacillus	0.95
Clostridium	0.95
Salmonella	0.945
Micrococcus	0.905
Staphylococcus (anarobic)	0.86
Common bacteria	0.91

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Relation to growth of yeast & mold and Aw

Species	Aw
Beer yeast	0.94
Candida	0.94
Bread yeast	0.905
Saccharomyces	0.895
Common yeast	0.88
Mucor	0.92
Penicillium	0.80
Aspergillus	0.75
Common mold	0.80

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Aw of several foods

Foods	Aw
Animal meat, fish meat, fruit, vegetable	0.99-0.98
Semidried fish	0.96
Ham, sausage, beacon	0.935-0.89
Salted cod egg (7.9% NaCl)	0.915
Salted salmon (11.3% NaCl)	0.886
Dried fish (12.7% NaCl)	0.866
Jam	0.79
Salted cod (15.4% NaCl)	0.785
Wheat powder	0.61
Biscuit	0.33

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Non-heated meat products are sold at room temperature even in summer in Spain

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Non-heated meat products in Italy

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9. Temperature; The temperature at which microorganisms will live or die is undoubtedly the most important factor that decides their fate.

Each microorganism has an optimum temperature at which it best develops, and the bacteria that are important to meat can flourish over a wide range of temperatures.

We are able to classify the microorganisms into three main groups relative to temperature.

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ⅰ. Psychrophiles; Those that like the cold and grow well at temperatures below 20 ℃. Many species thrive at refrigerator temperatures (3-7 ℃) and are all to common in the packing house. → slime on the surface of meat and meat products. →

Pseudomonas, Achromobactor, Vibrio, Escherichia, some kinds of Bacillus –

ⅱ. Mesophiles; Those that prefer warmer temperatures (21-38 ℃) . The majority of bacteria fall into this classification. Body temperature is ideal for their growth. → Almost bacteria

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ⅲ. Thermophiles; Those that prefer it hot, in temperatures around 54-60 ℃ or even higher.

By controlling temperatures we can often eliminate a great many problems.

Therefore, to know when a meat product becomes contaminated and to know what temperatures will control it, is the big job

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Ⅱ. Putrefaction (spoilage or decay)

1837; Schwan reported that fermentation and putrefaction cased by microbe.

1863; Pasteur reported that putrefaction was mainly caused by microbe in his reports; On the studies of putrefaction.

Putrefaction; The foods spoiled by microbe from the foods containing proteins → production of poison (amine, etc), bad taste and off-odor

Fermentation; The edible foods digested by microbe.
→ fermented sausages, cheese, natto, kusaya ---

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1. In generally, proteins in food are damaged by microbe and their enzyme (protease or lipase).
Putrefaction begin from $10^{7\text{-}8}$ CFU/g.

2.Proteins are changed to lower molecular substances;

protein → peptide → amino acid →
↑ proteinase ↑ peptidase ↑ deaminase, decarboxylase

→ putrefaction products

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3. Putrefaction products

Off-odor; ammonia, methylamine, trimethylamine, ethylamine, methane gas, methyl alcohol, ethyl alcohol, organic acid (formic acid, acetic acid, propionic acid, ketonic acid, pyruvic acid etc.), aldehyde, methylmercaptan, ethylmercaptan, cresol, phenol, skatol, indole, hydrogen sulfide etc.

Bad taste; amine, organic acid, bitter peptides, bitter amino acids (Val, Ile, Leu)

So, putrefaction is to disappear the value as foods and produces poisons.

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4. Bacteria concerning with putrefaction

ⅰ. Soil born bacteria

Bacillus; gram positive, rod, aerobes, heat resistance spore

B. subtitles, B. coagulans, B. megaterium

Clostridium; gram positive, rod, anaerobes, heat resistance spore ***C. butyricum, C. spogenes***

Brevibacterium; gram positive, short rod, yellow colour

Brevi. linens,

Micrococcus; gram positive, cocci, white, yellow, pink, red, orange colour

M. luteus, M. flavus, M. freudenreichii

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Lactobacillus; gram positive, rod, catarase negative

L. plantarum,

Lactococcus; gram positive, cocci, catarase negative

La. Lactis

Streptococcus; gram positive, cocci, catarase negative

Leuconostoc; gram positive, cocci, catarase negative

Leu. mesenteroides, Leu. Dextranicum

Pediococcus; gram positive, cocci, catarase negative

Pe. Pentosaceus, Pe. Acidilactici

ⅱ. Air borne bacteria

Bacillus: **Micrococcus:** **Mold:**

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ⅲ. Water borne bacteria

Pseudomonas; gram negative, rod, psychrophilic bacteria

Ps. fluoresces, Ps. fragi, Ps. putrefacien

Flavobacterium; gram negative, rod, psychrophilic bacteria

Alcaligenes; gram negative, rod, psychrophilic bacteria

Chromobacterium; gram negative, rod

Enterobacteriaceae; gram negative, rod

E. aerogenes, E. coli, P. morganii

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Ⅲ. Food poisoning

1.Microbial food poisoning

ⅰ. *Salmonella* food poisoning; infection type, gram negative rod

1885; Salmon and Smith found in pig cholera.

There are many species (1720).

Animal disease cause the *Salmonella* food poisoning.

These exist in animal intestine (cattle, pig, chicken, dog, rat, snake, green tortoise).

S. enteritidis, S. typhimurium, S. thompson, S. infantis

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ⅱ. Campylobacter food poisoning; infection type, gram negative rod

Animal disease cause the Campylobacter food poisoning like a *Salmonella*. *Ca. jejuni, Ca. coli*

These exist in animal intestine (cattle, pig, chicken).

ⅲ. Pathogenic *E. coli*; gram negative rod

Entero pathogenic *E. coli* (EPEC) O26, O111

Entero invasive *E. coli* (EIEC) O28, O112

Entero toxigenic *E. coli* (ETEC) O6, O7, O8

Entero hemorrhagic *E. coli* (EHEC) O157:H7

Entero adherent *E. coli* (EAEC)

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ⅳ. Staphylococcus food poisoning;

toxin type, gram positive coccuc

Sta. aureus

Poison is enterotoxin, and heat tolerant (218-248℃, 30 min).

Enterotoxin is composed of amino acid, but it is not digested by proteases (pepsin, trypsin).

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Ⅳ. Pasteurization or sterilization

1.Extinction of bacteria by heating

ⅰ. There is liner relationship between the heating temperature and the logarithm of extinction time. In other words, with a higher heating temperature, the time required to attain the same extinction rate decreases logarithmically.

62-65 ℃, 30 min (LTLT) → 72-75 ℃, 15 sec (HTST)

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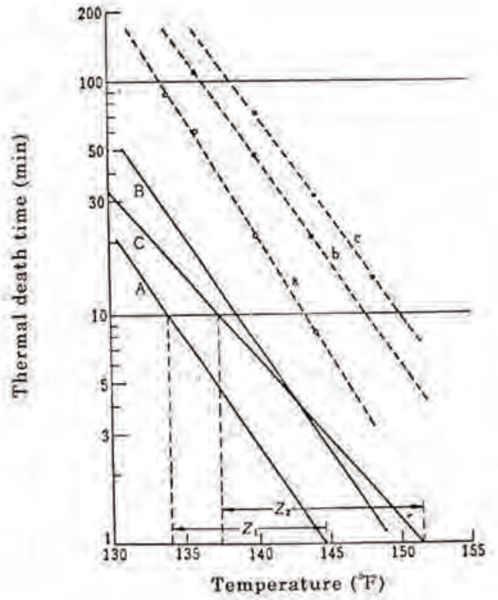

Fig. Liner curve of thermal death time and example of *E. coli* incubated at 3 temperature

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★ TDR (thermal death rate); This is calculated by using the following formula.

TDR(%) = (initial bacterial No. - final bacterial No.)/(initial bacterial No.) X 100

This expression is often used with pasteurization at low temperature, or with HTST pasteurization. In generally, the value of TDR is 99.99 %.

★ TDT (thermal death time); This is the time required to attain a given TDR (generally 99.99 %) at certain temperature.

★ D (decimal reduction time) value; The time which become to 90 % TDR at certain temperature

The relation between TDT (TDR = 99.99 %) and D value is 4D = TDT.

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★ Z value; This is an expression for the increases in temperature (℉) required to reduce TDT to 1/10.

ⅱ. There is liner relationship tbetween heating ime and logarithm of residual bacterial rate.

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Table 1 Comparison of heat resistance of *Micrococcus* sp. and-*Streptococcus* sp. on the medium

Temperature	D values *Micrococcus* sp.	D values *Streptococcus* sp.
55℃	76 (min)	120 (min)
60℃	23	9
63℃	11	2
65℃	5	1
70℃	0.5	0.5
Z values	6.9 (℃)	6.3 (℃)

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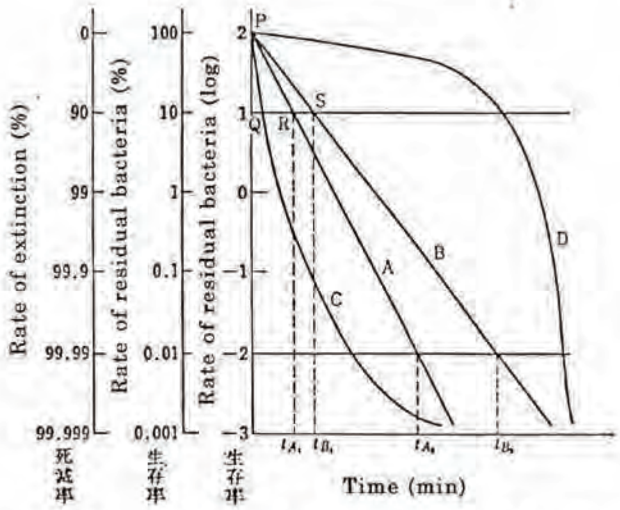

Fig. Relation between thermal death time and rate of residual bacteria

A and B: different temperature, c; high number of bacteria, D; case of agregatin of bacteria

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2. Heat resistance of microbiology

In general, psychrotrophs and pathogenic bacteria are extinguished at a low temperature. However, spore formed by bacteria has high resistance, and therefor, sterilization by heating is often necessary to extinguish them. Among spore forming bacteria, normal cell bacteria have a low heat resistance, compared with the spore, and they can be easily extinguished, if heated at 80 ℃ for about 30 min.

The table shows thermal death conditions of main bacteria that can contaminate food in different domains of food industry.

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Table 3. Heat tolerance of non-sporeforming bacteria

Species	Thermal death time (min., 4D)*		Note
Vibrio marinus	25 °C	80	Psychrotroph, waterborne bacteria
Serratia spp.	30 °C	30	Waterborne bacteria
Pseudomonas fragi	50 °C	7.4 (D)**	Psychrotroph
Ps. fluoresens	53 °C	4 (D)	Waterborne bacteria
Flavobacterium ferrugineum	52 °C	10	Waterborne bacteria
Brevibacterium ammoniagenes	55 °C	10	Short rod
Yersinia enterocolitica	62.8 °C	0.7-17.8 (D)	
Serratia marcescens	60 °C	0.17 (D)	Red color
Escherichila coli	60 °C	0.3-3.6 (D)	
Salmonella typhimurium	55 °C	10 (D)	
Klebsiella pneumonia	47 °C	60	Coliform group
Propionibacterium acnes	60 °C	0.18 (D)	
Acetobacter aceti	60 °C	10	
Staphylococcus aureus	60 °C	0.43-2.5 (D)	Yellow color
Streptococcus faecalis	60 °C	0.83-13 (D)	Enterococcus
Strept. lactis	60 °C	0.11-0.35	Lactic acid bacteria
Lactobacillus bulgaricus	71 °C	30	Thermophilic lactic acid bacteria
Pediococcus cerevisiae	60 °C	8	Halophobic lactic acid bacteria
B. subutilis (cell)	50 °C	1.93 (D)	Sporeforming bacteria

* The time required for 99.99 % extinction
** The time required for 90 % extinction

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Table 4. Heat tolerance of bacterial spores

Species of Bacterial Spore	Thermal death time (min., 4D)*	
Bacillus (aerobic rod)	100 °C	2-1, 200 (D)**
B. megaterium	100 °C	1-2.1
	121 °C	0.02-0.04
B. cereus	100 °C	0.8-14.2
	121 °C	0.0065
B. subtilis	100 °C	11.3
	121 °C	0.08-5.1
B. coagulans	121 °C	0.4-3
	100 °C	30-270 (D)
B. sterothermophilus	100 °C	714
	121 °C	0.1-14
Clostridium (anaerobic rod)	100 °C	5-800 (D)
C. butyricum	85 °C	18
C. sporogenes	90 °C	34.2
	121 °C	0.15

* The time required for 99.99 % extinction
** The time required for 90 % extinction0

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3. Method of heating

ⅰ. **Pasteurization (low temperature long time, LTLT)**

63℃, 30 min. Position of measurement is the center of meat products. Extinction effects are 81-99 %.

Though heating process varies depending on the kinds of meat products, boiling in 70 ℃to 78 ℃ of water in most common with ordinary types of meat products. Even within this range of temperature, 72℃ to 75 ℃ is the ideal temperature if uneven distribution of temperature is the boiling tank is taken into account. To raise the temperature of the product quickly without heating its surface too much, boiling at 76 ℃ to 78 ℃ in the first half, and at 72 ℃ to 74 ℃ in

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the second half of the time is ideal, should facilities and preceding and following processes permit.

ⅱ. **Sterilization; 120 ℃ (1.2 kg/cm^2, 15 lb/in^2), 15-20 min**

All microbes and spore are destroyed.

for canned meat or retort foods

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V. Production of clean meat

In the slaughter house;

Before slaughter, animal body must be washed, it is dirty on the body surface.

Stress to the animal does not obtained good quality of meat.

After slaughter, blood must be removed as soon as possible by hanging.

After skinning, carcass mast be washed with clean water.

Handling and transportation of carcass must be used clean container, sheet or clothes etc.

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Surface bacterial number of beef carcass (1980)

	Common	Coliform	Lactic
a. After skinning and washing with hand	5.6×10^4	7.1×10^3	6.8×10^3
b. After skinning and washing with machine	2.4×10^3	< 30	7.2×10^2
c. After skinning and washing with machine	3.3×10^1	< 30	< 30
d. Just after skinning and washing with machine	< 30	< 30	< 30

Common : Common bacteria
Coliform: Coliform group
Lactic : Lactic acid bacteria

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Ⅵ. Dry sausage

Dry sausages is not cooked, and only with some products is smoked applied. Fermentation is common to the production of dry sausages. The manufacture of dry sausages is more difficult to control than conventional sausages. Overall processing time may require 30-90 days. However, when prepared properly, the finished sausages are usually stable and can be held with little or no refrigeration.

The raw materials and the sequence of event must be carefully controlled. The initial dry-sausage mixes are held under specified conditions of refrigeration to establish a medium for bacterial culture.

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After this, the mixture is stuffed into casings of suitable size. During the drying cycle the products will lose about 25-40%of their weight. The temperature, relative humidity, and air flow must be controlled so that drying proceeds properly.

If drying is slow the texture may be soft, the surface may discolor, and some molds or yeast may develop on the product.

If drying is too fast, a surface crust develops and a brown or dark ring appears under the surface and at times marked ridges or invaginations occur at the sausage surface.

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Non-heated meat products are sold at room temperature even in summer in Spain 41

The manufacture of dry sausages is steep art.

Dry sausages are fermented products. Glucose added to provide a substrate for the desirable bacteria, which use it to produce acid and lower the pH. Fermentation is accomplished either by the naturally occurring microbial population or by adding starter cultures of selected bacteria. The starter cultures generally contain Lactobacillus, Leuconostoc, Micrococcus organisms. The sausage mixtures are held in a ripening room (20℃) or "green room" during the fermentation process. After fermentation, dry sausages are moved into drying room held at temperature of 10-15℃ and relative humidity from 95 to 80%. 42

Dry sausages commonly have a moisture content of below 35% when finished.

Molds often develops in dry sausages during drying. They are easily removed by rubbing with a clean cloth soaked 70% alcohol.

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Slame Tokachi

Ingredients	kg	g
Lean pork	7.5	
Pork back fat	2.5	
Salt		200
Glucose		50
Onion powder		30
Garlic powder		20
Nitrite		1

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Spiced and frozen lean pork and pork back fat

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Bacterial composition of starter culture

P2M120:

- *Pediococcus acidilactici* P120
- *Staphylococcus carnosus* M72
- *Staphylococcus xylosus* M86

Lyo2M:

- *Lactobacillus sake* L110
- *Staphylococcus carnosus* M72
- *Staphylococcus xylosus* M86

PLM230:

- *Pediococcus acidilactici* P120
- *Lactobacillus sake* L110
- *Staphylococcus carnosus* M72
- *Staphylococcus xylosus* M86

SP318:

- *Pediococcus pentosaceus* P208
- *Lactobacillus sake* L110
- *Staphylococcus carnosus* M72
- *Staphylococcus xylosus* M86

S51:

- *Pediococcus pentosaceus* P132
- *Staphylococcus carnosus* M72

Yeast

- *Debaryomyces hansenii*

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Cutting of semi-frozen lean pork and pork back fat with starter culture

Temperature of mixture; -7 to -5℃,

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Dry sausage during drying and ripening

Temperature; 20℃, 3 days and 15℃, 32days, relative humidity; 95 → 80%

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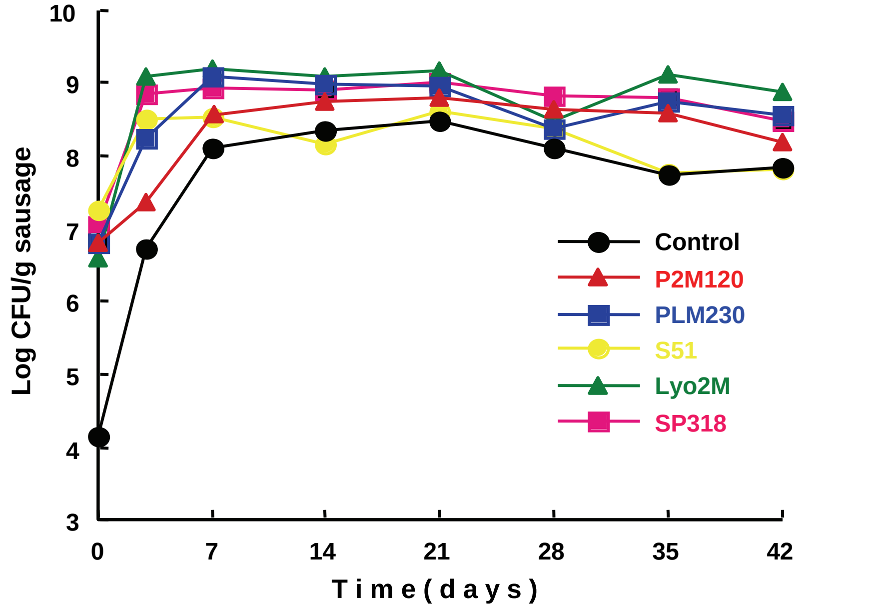
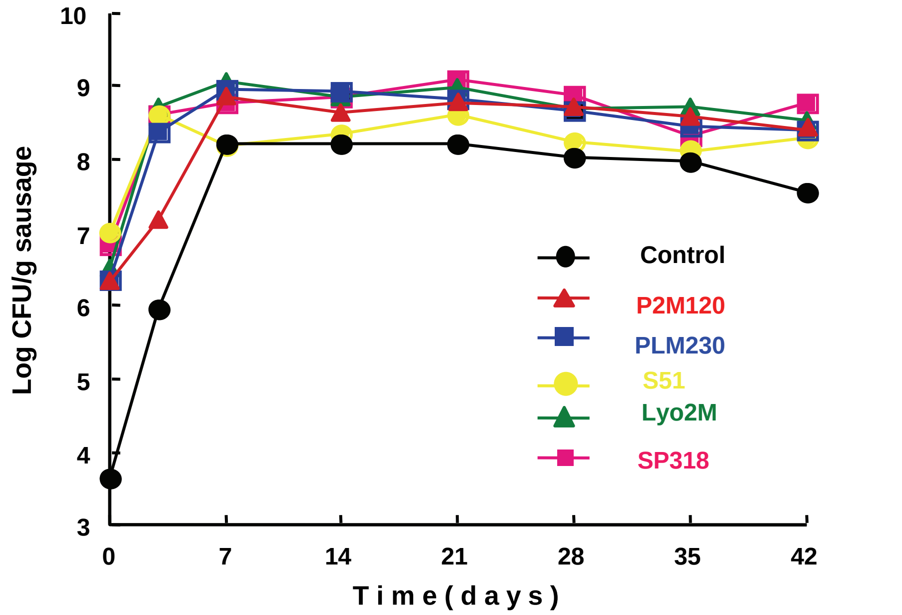
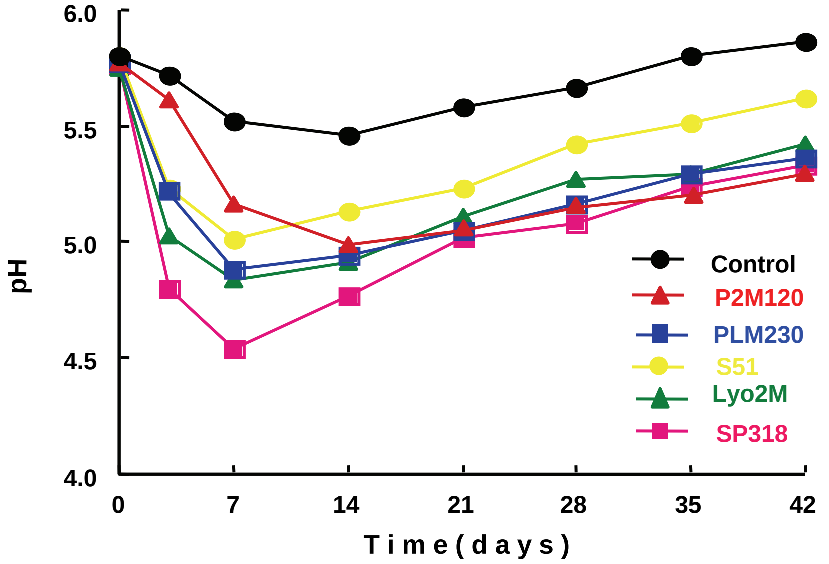


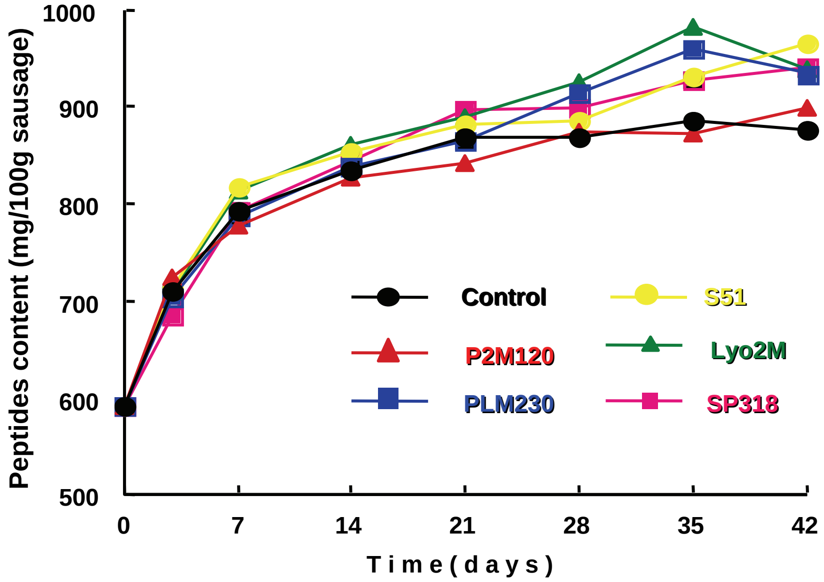
Changes in total bacterial count in the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=3. 49



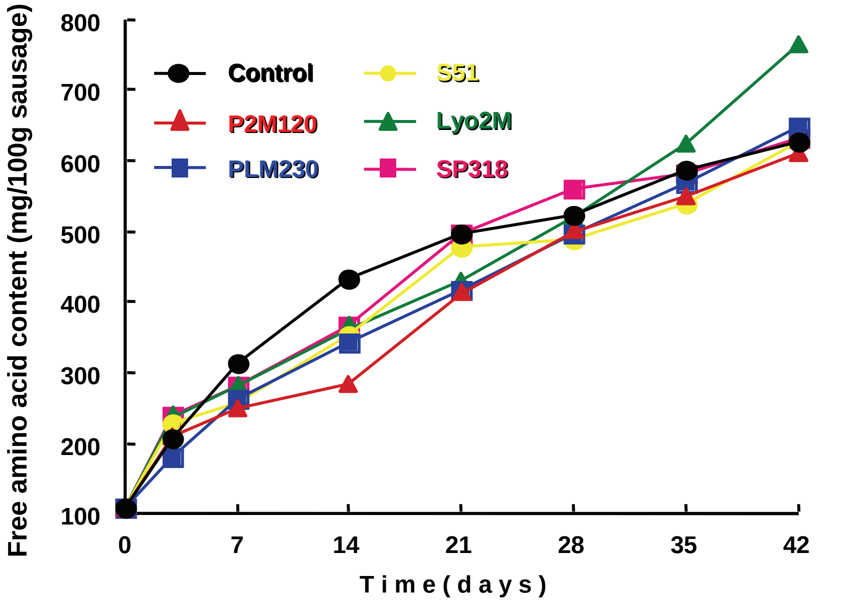
Changes in Lactic acid bacterial count in the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=5. 50



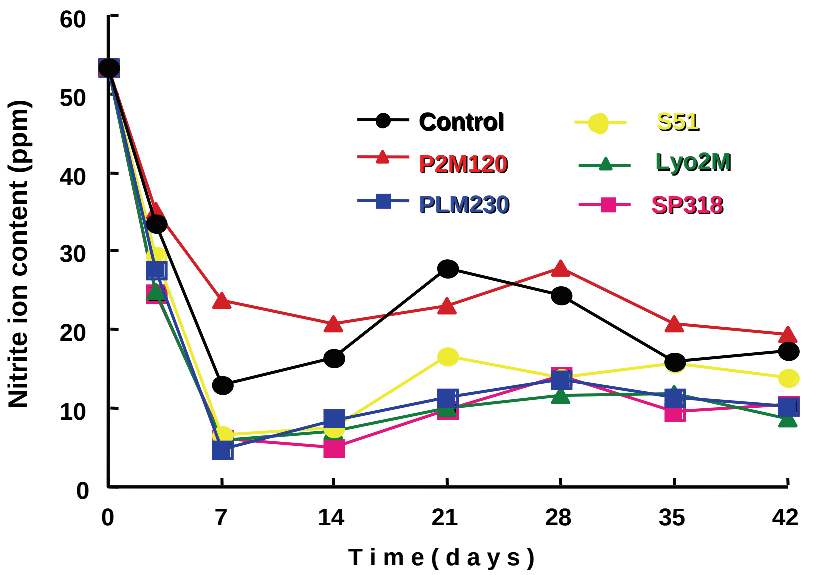
pH values of the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=5. 51



Peptides content of the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=6. 52



Free amino acids content of the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=3. 53



Nitrite ion content of the dry fermented sausages inoculated with *Debaryomyces hansenii*. n=4. 54

Ⅶ. Dry-cured ham

Dry-cured ham originated as a meat preservation process for times of scarcity. The process has experienced different modifications and improvements in order to obtain a flavorful and attractive meat product. Numerous biochemical reactions, mainly affecting proteins and lipids, take place during the dry-curing process, especially along the ripening period contributing to the development of an adequate texture and a characteristic flavor. There are many factors affecting the quality of dry-cured hams. The raw materials and ripening conditions have a special influence on the final texture and flavor

55

Commonly, the ripening of dry-cured ham takes about 1-2 years.

There are many types of dry-cured ham. Spanish Iberian and Serrano hams, Italian Parma and San Daniele prosciuttos and French Bayonne ham. These hams are usually consumed raw with no further smoking or cooking.

Other smoked dry-cured hams are cooked before consumption and produced in other areas such as the country-style ham in the USA and the Westphalia ham in Germany.

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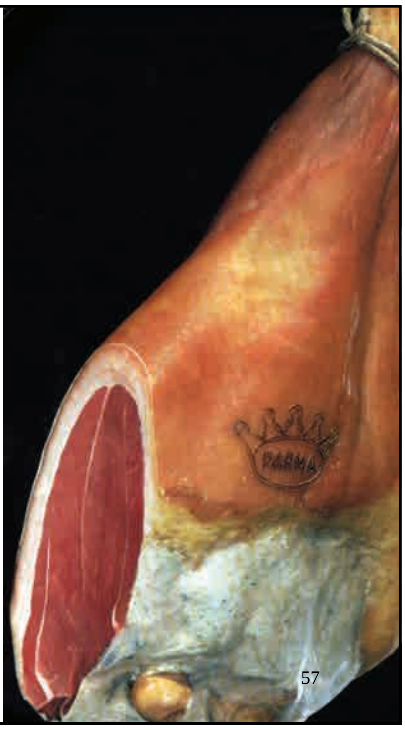
Dry-cured hams in Europe

In Europe, dry-cured ham has been produced since before the birth of Christ. The practice of raising pigs in summer, slaughtering them in winter when feed becomes unavailable, and preserving their meat by means of salting is part of European food culture.

The Parma ham production area is located in an environment favorable to ham production, with air blowing from mountains 900 m in height and humidity that is ideal. In the area, hams are dried and cured over a period of at least one year in natural breezes.



57

Rural landscape in November – December in medieval Italy

58

Spain leads the world in the production of dry-cured ham, with an annual production of 30 to 40 million legs, of which approx. 90% is Serrano ham made from white pigs and the remaining approx. 10% is Iberian ham made from Iberian pigs (black pigs indigenous the Iberian Peninsula).

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Iberian ham is a premium quality dry-cured ham made from Iberian pigs. The pigs are free ranged in forests where oaks grow in the wild. Like Japanese cattle, their meat is marbled with fat and has a distinguishing flavor and aroma. They are characterized by black hooves.
Iberico de bellota are pigs finished on plenty of acorns in the last period of grazing.
Iberico de recebo are pigs that are unable to reach a specified weight during the grazing period. Iberico de cebo are fed grain and mixed feed. These techniques have 400 years of tradition.

60

61

Jamón de Teruel DOP

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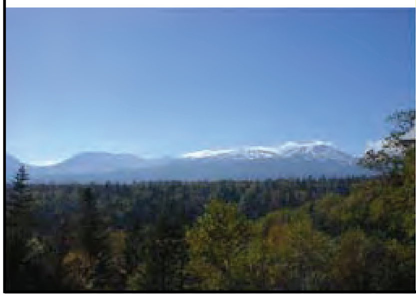
Study on dry-cured ham

In Japan, "dry-cured ham" is popular; however, it has not been defined as a meat product in the specifications and standards provided by the JAS and the Food Sanitation Act. In Japan, dry-cured ham is made from pork loin and produced in a short period of time; whereas, in Europe, it is traditionally made from pork hind leg .



Tokachi is blessed with natural surroundings and boasts clean air and water. The dry air throughout the year is suitable for the production of dried food. Dry-cured ham can be made by salting and drying pork hind leg for approximately 2 year.

63

Processes of producing dry-cured ham

Salting is carried out for approx. two weeks (1kg/1day) with the use of salt (day 0, 3%, day 3, 1.5%, day 7, 1.5%) at 2℃.

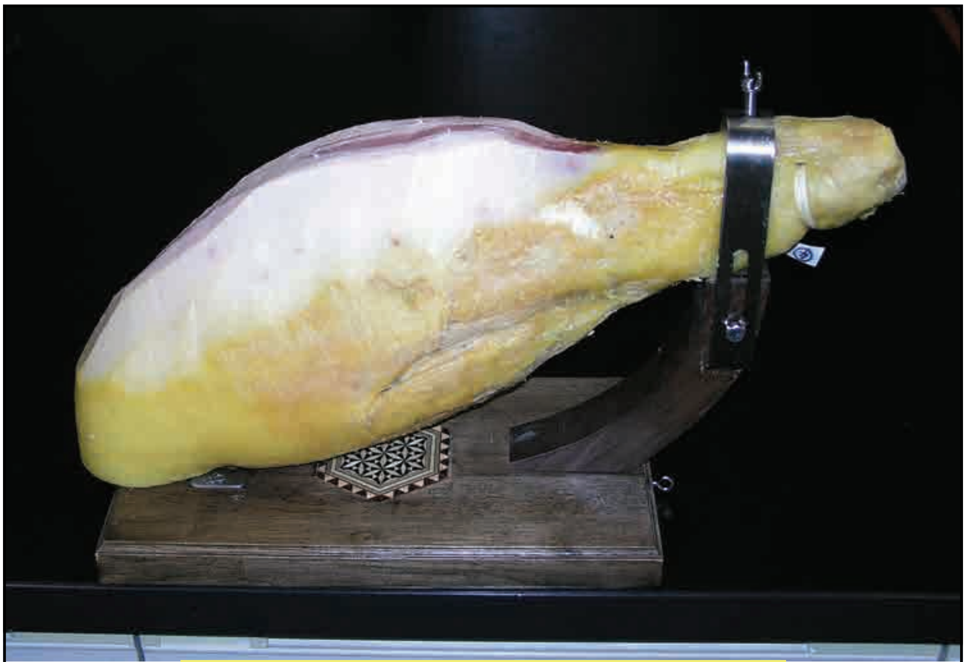
64

Drying after desalting. **Temperature; below 5 ℃, term; over 30days.** 65

After three months, the surface is washed with slightly warm water and dressing or trimming of lean meat surface. 66

After being washed and drying. **Temperature; below 20 ℃.** 67

After five months, the lean meat portions are coated with pig back fat, and are dried and ripened. 68



Urikarippu ham cured for two years

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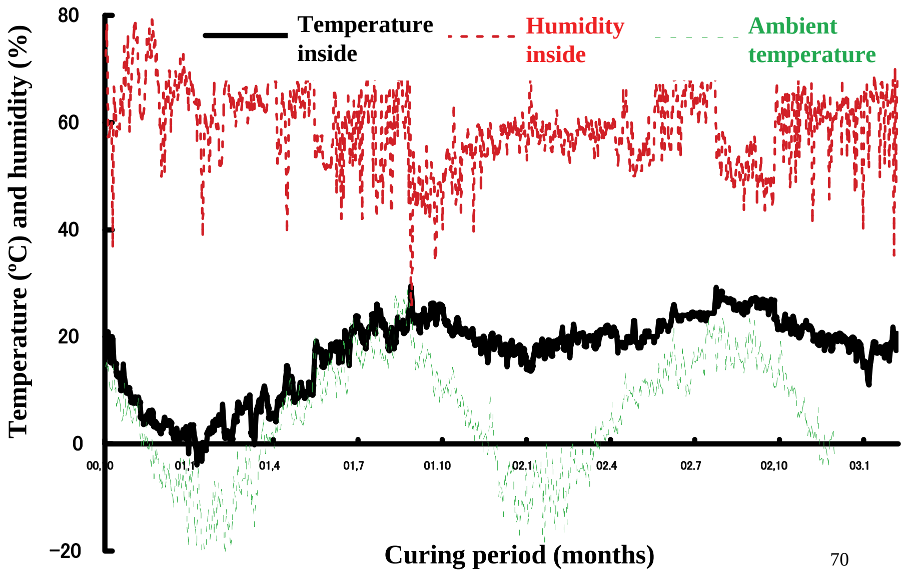
Changes in temperature and relative humidity during curing period



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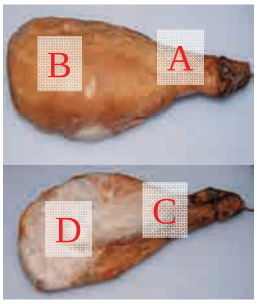
Microbial counts on the dry-cured ham surface

Spot	Viable bacteria count	Lactic acid bacterial count	Mold and yeast
A	0 – 1.2×10^3	0 – 4.7×10^1	0 – 3.9×10^2
B	0 – < 30	0 – < 30	0 – 2.6×10^2
C	0 – 1.6×10^2	0 – 4.8×10^1	0 – < 30
D	0 – 8.5×10^2	0 – 4.7×10^2	0 – 2.6×10^2

(cfu/cm^2)

Spot	Coliform group
A	−
B	−
C	−
D	−

(cfu/cm^2)



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Microbial counts in the interior of dry-cured ham

Muscle	Viable bacteria count	Lactic acid bacterial count	Mold and yeast
BF	0 – < 300	0 – 8.0×10^1	−
QF	0 – < 300	0 – < 300	−
SM	0 – < 300	0 – < 300	−
ST	0 – < 300	0 – < 300	−

(cfu/g)

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Dry-cured ham characteristics

Muscle	Water content (%)	pH	Salt (%)	Water activity	NO_2^- (ppm)
BF	61.7 ± 1.8	5.9 ± 0.1	8.6 ± 1.5	0.87 ± 0.03	0.1 ± 0.2
QF	60.7 ± 1.8	6.0 ± 0.1	8.5 ± 1.4	0.87 ± 0.03	0.2 ± 0.0
SM	59.0 ± 3.5	5.9 ± 0.1	7.9 ± 1.4	0.87 ± 0.03	0.2 ± 0.1
ST	59.2 ± 1.3	5.9 ± 0.1	7.9 ± 1.6	0.87 ± 0.03	0.1 ± 0.0

Sample: 1.0 year, n: 7, Average ± SD

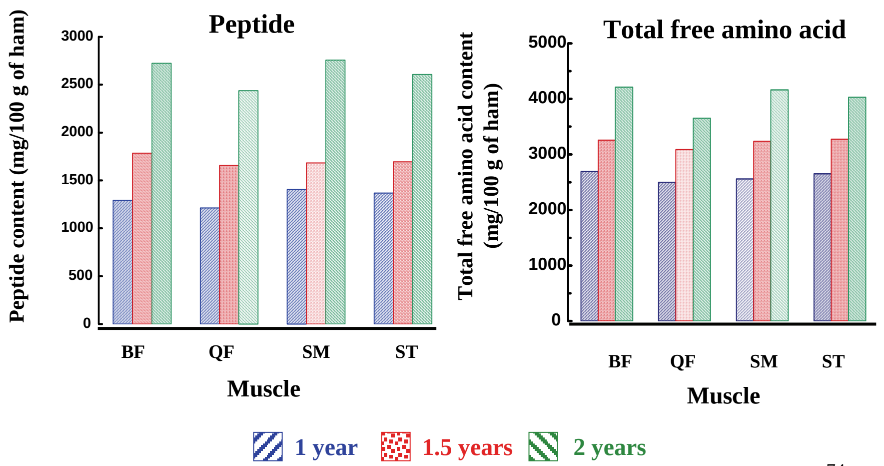
Muscle	Water content (%)	pH	Salt (%)	Water activity	NO_2^- (ppm)
BF	59.8 ± 3.1	5.9 ± 0.2	9.5 ± 1.2	0.84 ± 0.03	0.3 ± 0.4
QF	58.3 ± 2.4	5.9 ± 0.1	9.5 ± 1.1	0.84 ± 0.03	0.3 ± 0.4
SM	56.5 ± 3.2	5.9 ± 0.1	9.3 ± 1.0	0.85 ± 0.03	0.3 ± 0.4
ST	56.1 ± 2.6	5.8 ± 0.1	8.6 ± 1.6	0.84 ± 0.03	0.3 ± 0.3

Sample: 1.5 years, n: 7, Average ± SD

Muscle	Water content (%)	pH	Salt (%)	Water activity	NO_2^- (ppm)
BF	58.7 ± 3.5	5.8 ± 0.2	9.5 ± 1.5	0.84 ± 0.02	0.1 ± 0.2
QF	57.8 ± 3.1	5.8 ± 0.2	9.6 ± 1.8	0.84 ± 0.03	0.3 ± 0.3
SM	53.8 ± 4.6	5.7 ± 0.1	8.9 ± 2.4	0.83 ± 0.03	0.2 ± 0.1
ST	51.7 ± 4.5	5.7 ± 0.1	8.6 ± 2.3	0.84 ± 0.03	0.1 ±30.1

Sample: 2.0 years, n: 7, Average ± SD

Peptide content and total free amino acid content of dry-cured ham for each muscle region in association with curing time



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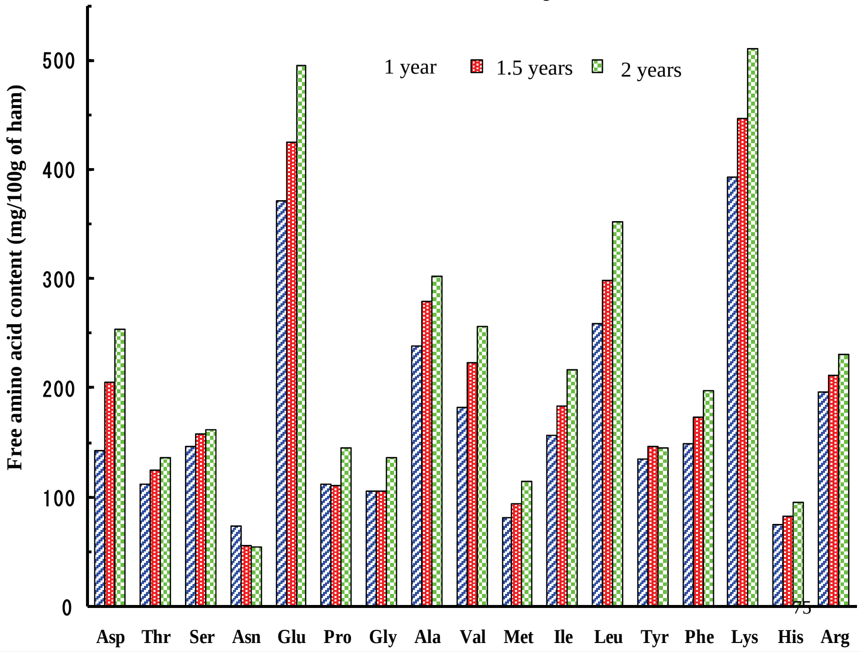
Free amino acid content of dry-cured ham



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Summary

Dry-cured ham with bone was produced with long curing periods of 1 year, 1.5 years and 2 years. Salting was started from September to October, when the temperature dropped. The use of salt and a drying process enabled the production of microbiologically-safe hams.

The microbial counts on the ham surface were mostly between 0 and 30, and all of the sampled spots were coliform group negative.

For the interior of the ham, the microbial counts were between 0 and 300 at all spots, with the salt content from 7.9% to 9.6%, water activity from 0.83 to 0.87, water content from 51.7% to 61.7%, and NO_2^- from 0.1 to 0.3 ppm.

Both the peptide content and total free amino acid content increased with curing time. After two years of curing, they were 2,278.6 mg and 3,913.2 mg per 100 g of ham, respectively. With respect to individual free amino acids, Lys was the highest, followed by Glu, Leu, Ala, Arg, in this order.

Hams cured for two years were high in salt content but tasted better.

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Newtimes 紙（ルワンダ唯一の英字新聞）

Regulator to enforce hygiene standards in meat business

- By Dias Nyesiga
- March 09, 2012
-
-

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Butchery attendants. RBS wants to reduce contamination of meat. The New Times / File.

Health:Sellers to account for contaminated meat

> They will either cooperate or we use force to ensure proper hygiene because it impacts negatively on our economy as people may fall sick from contaminated meat

Rwanda Bureau of Standards (RBS), the national standards regulator, will step up the enforcement of standards in meat business, following numerous public concerns over poor hygiene.

Mark Cyubahiro Bagabe, the Director General of RBS, said yesterday that every business engaged in meat processing must observe minimum quality standards.

"We will put in place a system where anyone who is primarily engaged in meat trade will be liable when a consumer is affected by the meat in question," he warned.

Contaminated meat, one of the major sources of food poisoning among humans, is caused by an increase in bacteria due to high temperatures that facilitate their growth.

"They will either cooperate or we use force to ensure proper hygiene because it impacts negatively on our economy as people may fall sick from contaminated meat," Cyubahiro said during a food standards sensitisation meeting.

He noted that most abattoirs and meat transporters had constantly failed to meet proper hygiene which leads to contamination of meat, which ends up affecting consumer's life.

Cyubahiro observed that the system will have a traceability approach in the meat chain in order to identify the exact source of the problem.

“An animal can be tagged from the farm and that number be transferred to the abattoir…then to the butchery and supermarkets; this helps us to know where the problem originated,” he said.

The RBS chief asked all the abattoirs to ensure automation in the entire meat processing to reduce human contact, thus improving food safety.

The move will help address the challenges of poor hygiene in slaughter houses, the regulator says.

Patrick R Manzi, a veterinary officer, observed that a sensitisation campaign among abattoirs on the need to meet minimum standards had been conducted.

Dirty carriers and slaughter tools as well as blood stains in abattoirs have reduced, he said.

Prof. Masayuki Mikami Emeritus, a lecturer at Obihiro University in Japan, reckoned the country can enhance meat safety by opting for vacuum packaging and chlorine washing which are good at reducing bacterial increase in the product.

Contact email: dias.nyesiga[at]newtimes.co.rw

igihe. com (ルワンダで最も人気のあるウェブメディア)

Akajagari mu bucuruzi bw'inyama kagomba gucika

Yanditswe kuya 8-03-2012 - Saa 18:02' na Fiacre Igihozo

Like 1 Send Tweet 1 0

Ibikorwa byose bijyana n'ibikomoka ku matungo mu Rwanda cyane cyane inyama, uburyo bikorwamo kuri ubu ntibuhwitse, bityo hakaba hagiye kurebwa uburyo hacibwa akajagari mu bucuruzi bw'inyama, kugira ngo harwanywe ingaruka zishobora gnterwa n'inyama.

Ibi bikaba ari ibyavuzwe na Marc Cyubahiro Bagabe, Umuyobozi w'Ikigo cy'igihugu Gishinzwe Ubuziranenge RBS mu nama y'amahugurwa RBS ifatanyije na Minisiteri y'ubuhinzi n'Umuryango Mpuzamahanga w'Abayapani ushinzwe ubufatanye JICA, yabaye kuri uyu wa kane tariki ya 08 Werurwe, aho bahuguraga abakora ibikorwa by'ubucuruzi bw'inyama ndetse n'abakozi ba RBS, ku buryo bwiza bwo gufata inyama.

Aya mahugurwa akaba yibanze ku buryo inyama zishobora guteza ikibazo ahanini biturutse ku buryo zabazwemo ndetse n'ubundi buryo bwinshi butandukanye zitunganywamo.

Ibisobanuro kubibera ku nyama n'uburyo zangirikamo bikaba byatanzwe na Professor Namasayuki Mikami, umwarimu wo muri Kaminuza y'ubuhinzi ya Obihiru mu Buyapani, aho yatanze isomo ku bijyanye n'ibibera ku nyama ndetse n'uburyo umusaruro w'inyama utunganywamo ukanabikwa ku buryo burambye.

Cyubahiro Bagabe, avuga ku kibazo cy'imitunganyirizwe y'inyama kuva ziva mu ibagiro kugera zigaburwa mu ngo no muri za resitora, yavuze ko ubundi nibura umuntu ugiye kwinjira mu bucuruzi bw'inyama agomba kumenya ko yinjiye mu kazi gakomeye ku buryo agomba kuba afite imashini itanga amashanyarazi kuko mu Rwanda nta mashanyarazi, kandi kudafata neza inyama bigira ingaruka zikomeye ku buzima.

Yagize ati : "Birababaje kuba abantu batanga amafaranga yabo ku byo kurya barangiza bakarwara cyangwa bakaba banapfa, ni ikintu gikwiye guhinduka".

Yakomeje agira ati : "Kugira ngo winjire muri iyi mikorere ugomba kuba ufite ubumenyi muri byo. Birakwiye ko duca akajagari mu bucuruzi bw'inyama, hakore ababifitiye ubushobozi. Ikindi ni uko tugiye gukora ku buryo hajyaho ibintu bizajya bimenyekana aho byaturutse kuva mu ntangiriro kuko birababaje kuba tujya mu mahoteli tukarya inyama tutazi aho zavuye n'aho zakorewe, ikindi ni uko bigira n'ingaruka ku bukungu bw'igihugu kuko umunyamahanga naza akaryamo yarangiza akarwara urumva ubuhamya azagenda atanga iwabo ?"

Mu byo abari bitabiriye aya mahugurwa basabye ni uko hashyirwaho amabagiro y'inyama z'ingurube kuko kugeza ubu ibagiro ry'ingurube riba mu Karere ka Rulindo gusa, nyamara icyitwa akabenzi (inyama z'ingurube) ziribwa cyane mu Mujyi wa Kigali mu tubari twinshi kandi ntawe umenya aho izo nyama ziba zabagiwe, niba na muganga w'amatungo aba yazipimye.

Mu rwego rwo kurwanya ingaruka zituruka ku bikomoka ku matungo RBS iherutse guhagarika icuruzwa rya fromage/cheese mu ma 'supermarket' yose y'i Kigali kubera ko hakozwe igenzura basanga zidakwije ubuziranenge.

Ahakorerwa ibikorwa byo gucuruza inyama hakunze kugawa ko nta suku ihagije iharangwa

Uko inyama zikunze gucuruzwa henshi mu Rwanda binengwa kuba bidahuye n'amahame y'ubuziranenge

Jacques Bihozagara umwe mu bafite ibikorwa bijyanye n'ibikomoka ku matungo yari yitabiriye amahugurwa

Marc Cyubahiro bagabe ari kumwe n'inzobere z'Abayapani mu itunganywa n'ibungwabungwa ry'inyama

Professor Masayuki Mikami atanga inyigisho ku bijyanye n'ikoreshwa ry'inyama

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ルワンダ国「農業収益向上プログラム」(2011-2017)〈201112 案〉－ JICA ルワンダ事務所
Seminar Attendance List（電子データ）
ORGANIZATIONAL CHART FOR RWANDA AGRICULTURE BOARD（電子データ）
DEVELOPMENT OF THE DAIRY INDUSTRY（電子データ）
Catalogue of Rwanda Standards 2011 – Rwanda Bureau of Standards
RWANDA STANDERDS Sausages – RWANDA BUREAU OF STANDARDS (以下 RBS)
RWANDA STANDERDS Cattle Feeds – RBS
RWANDA STANDERDS Compounded Poultry Feeds – RBS
RWANDA STANDERDS Named Animal Fats – RWANDA RBS
RWANDA STANDERDS Code of hygienic practice for processed meat products – RBS
RWANDA STANDERDS Code of practice for animal feed production, processing, storage and distribution – RBS
RWANDA STANDERDS Methods for the Chemical Analysis of Meats and Meats Products – RBS
RWANDA STANDERDS Fresh Fin Fish – RBS
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RBS Newsletter Issue 7 - RBS
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地図２　BURUNDI ＆ RWANDA
地図３　KIGALI CITY TOURIST MAP

[マラウイ]

Breed of livestock, Number of farm households for livestock. Population of animals, Imports and exports of livestock and livestock products – Department of Animal Health and Livestock Development（以下 DAHLD）
Strategy Plan Development – DAHLD
Veterinary Legislation in Malawi – DAHLD
Course Outline Course Code NSF321 – Bunda College of Agriculture, University of Malawi
Course Outline Course Code NSF422 – Bunda College of Agriculture, University of Malawi
STRATEGIC BUSINESS PLAN 2011-2016 - Bvumbwe Dairy Farmers Cooperative Society