

Processed Natural Meats

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Cured Meat Products

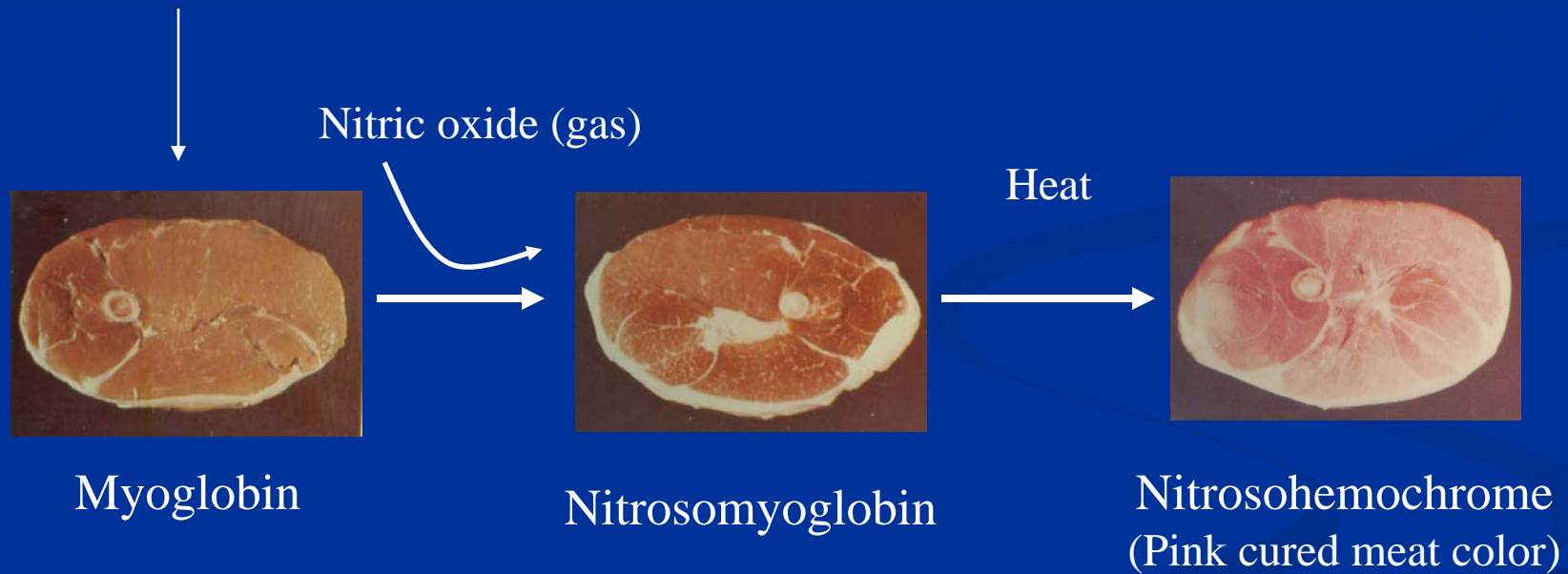
Purpose of Sodium Nitrite/Nitrate

- Cured meat color
- Cured meat flavor
- Preservative properties
 - Growth of *Clostridium botulinum*
- Powerful antioxidant
 - Effective in controlling fat oxidation



Cured Meat Color Development

Addition of sodium nitrite



Uncured Meat Products

Natural, Organic and Conventional Labeling Claims

■ Organic

- 100% organic
- Organic
- Made with organic
- Less than 70% organic

■ Natural

■ Uncured

More Restrictive



Less Restrictive

USDA Definition of Uncured Meat Products

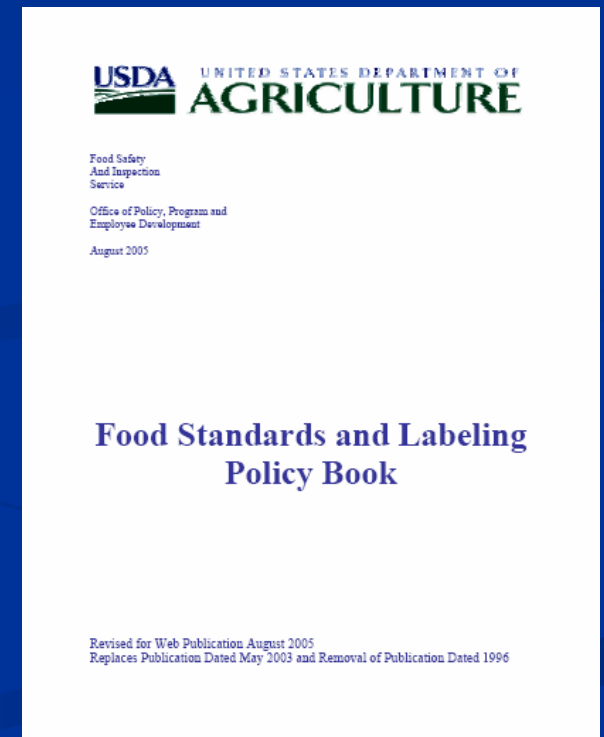
- Definition found in 9 CFR 317.17 and 9 CFR 319.2
 - Normal cured products that can be made without nitrites or nitrates added
 - Regulations effective for products found to be similar in size, flavor, consistency and general appearance to products prepared with nitrate and/or nitrite
 - Other normal ingredients are allowed
 - Dextrose, phosphates, etc...

Required Label Modifications for Uncured Meat Products

- Statements/words that must be added
 - “Uncured” before common name
 - i.e. *Uncured Frankfurters*
 - “No Nitrate or Nitrite Added” statement must be added
 - “Not Preserved – Keep Refrigerated Below 40°F At All Times” statement must be added

USDA Revised Labeling

- “Uncured” Meat Products (April, 2006)
 - USDA Labeling Division verbally announced changes for new label approvals of uncured meat products
 - Changes take effect with all new label submissions



Reasons for Labeling Revisions

- In response to:
 - Realization that uncured meat products may be found to contain nitrates/nitrites
 - Concern that products and product labels may not be truthful to consumers
 - Emergence of rapid growth of product category

New Labeling Changes for Uncured Meat Products

- When submitting a label for uncured meat products:
 - If USDA Labeling Division notices an ingredient that MAY contain nitrates or nitrites, a disclaimer will have to be added
 - New labeling changes will be reflected in new Food Standards and Labeling Policy Book
 - “No Preservatives” statement claim can no longer be used

Labeling Disclaimer for Uncured Meat Products

- “No nitrates or nitrites added except for naturally occurring nitrates or nitrites found in”
 - Celery juice powder, beet juice powder, carrot juice concentrate, sea salt, or any ingredient determined to contain nitrates or nitrites by USDA.

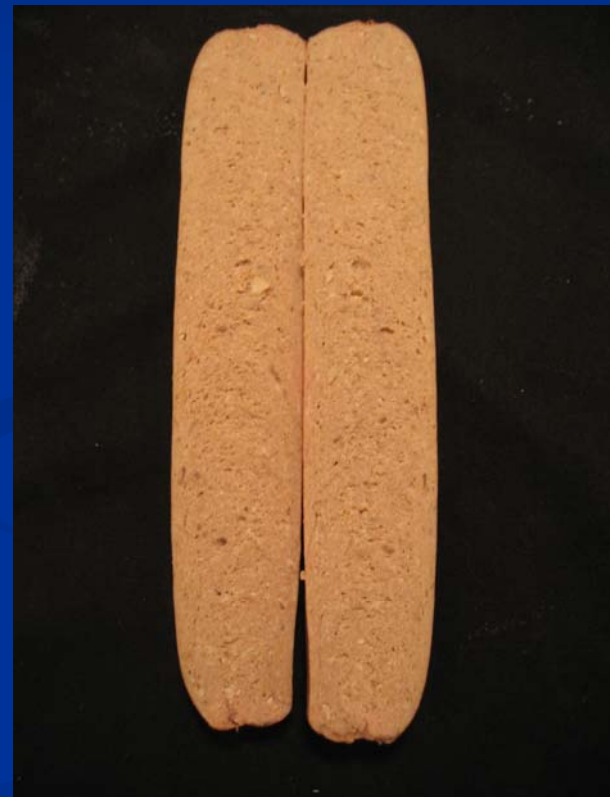
Types of Uncured Meat Products

- No intention of replacing nitrite/nitrate
 - Uncured appearance and flavor

- Intention to replace nitrite/nitrate
 - Cured appearance and flavor

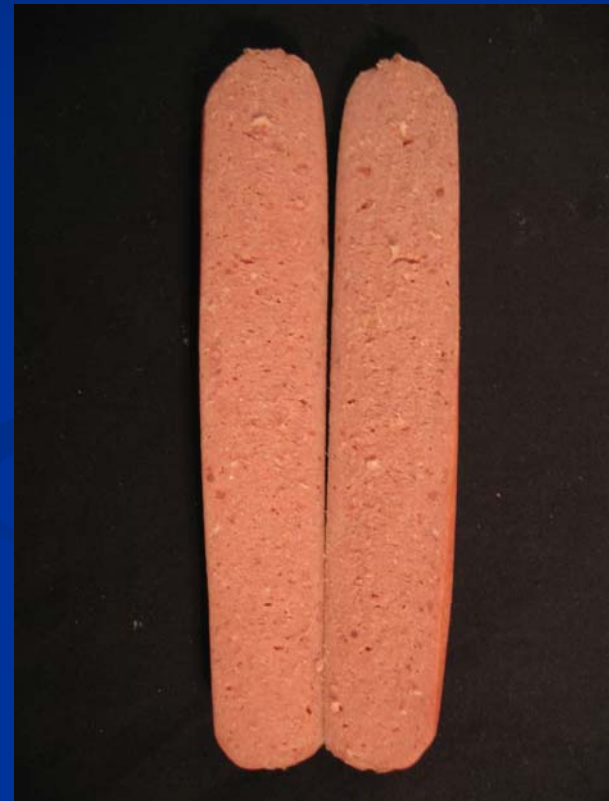
Types of Uncured Meat Products

- No intention of replacing nitrite/nitrate



Types of Uncured Meat Products

- Intention is to replace nitrite/nitrate



Uncured Meat Product Manufacture

Two Approaches to Curing Review

1. Addition of nitrite during product manufacture
2. Cook
3. = Cured meat product

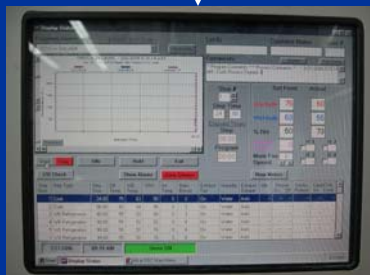
1. Addition of nitrate containing source
2. Incubation –(conversion of nitrate to nitrite)
3. Cook
4. = Cured meat product

Cured Meat Color Development

Addition of nitrate source
and starter culture.



Myoglobin



Incubation reduces
nitrate to nitrite

Nitric oxide (gas)



Nitrosomyoglobin

Heat



Nitrosohemochrome
(Pink cured meat color)

Step # 1:

**Addition of nitrate containing source
&
Nitrate reducing ingredient**

Ingredients Necessary

- Nitrate sources

- Vegetables
 - Juices
 - Powders
- Sea salt
- Raw sugar
- Others...

- Nitrate reducing source

- Lactic acid starter culture

Natural Sources of Nitrate

■ Vegetable sources of “natural” nitrate (avg. ppm):

■ Radishes	2600	■ Tomatoes	80
■ Celery	3151	■ Potatoes	150
■ Lettuce	2330	■ Turnip Greens	9040
■ Spinach	2470	■ Onions	235
■ Carrots	274	■ Melon	4932
■ Beets	3288	■ Rhubarb	2900
■ Cabbage	712	■ Broccoli	1014
■ Beans	466		

Limitations of Ingredients

- Vegetable Juice Powder
 - Minimum of 0.2%
 - Maximum of 0.4% ...?
 - Depends on amount of spices in product
- Starter Culture
 - 25 g per 225 kg

Uncured Sausage Sensory

TRT ^a	<u>Cured Aroma</u>	<u>Cured Flavor</u>
1	8.41	8.10 ^e
2	8.77	8.66 ^e
3	8.12	8.57 ^e
4	8.45	9.01 ^{de}
C	9.33	9.93 ^d
SEM	0.40	0.38

^a TRT: 1 = 0.20% VJP + 30 min incubation
2 = 0.20% VJP + 120 min incubation
3 = 0.40% VJP + 30 min incubation
4 = 0.40% VJP + 120 min incubation
C = 156 ppm (mg/kg) sodium nitrite

^{d-e} Means within same column with different superscripts are different (P<0.05).

Uncured Ham Sensory

TRT ^a	<u>Ham Aroma</u>	<u>Veg Aroma</u>	<u>Ham Flavor</u>	<u>Veg Flavor</u>
1	7.33 ^{df}	3.54 ^f	7.80 ^{de}	2.17 ^f
2	6.01 ^{def}	4.26 ^{df}	7.04 ^{de}	3.78 ^{df}
3	4.82 ^e	6.63 ^d	6.28 ^d	5.05 ^d
4	4.64 ^e	6.15 ^d	6.28 ^d	4.65 ^d
C	7.27 ^f	2.68 ^f	8.19 ^e	1.96 ^f
SEM	0.62	0.64	0.50	0.64

^a TRT: 1 = 0.20% VJP + 0 min incubation
 2 = 0.20% VJP + 120 min incubation
 3 = 0.35% VJP + 0 min incubation
 4 = 0.35% VJP + 120 min incubation
 C = 156 ppm (mg/kg) sodium nitrite

^{d-f} Means within same column with different superscripts are different (P<0.05).

Step #2:

**Incubation - conversion of nitrate
to nitrite**

Requirements for Nitrate Conversion

- Proper incubation of product
 - Internal temperature held
 - 50-113 °F (86 °F optimum)
 - ~ 1-2 hours
 - Depends on product diameter
 - Frankfurters = 2 hours
 - Ham = 1 hour
 - Optimum time for starter culture function
 - Nitrate reductase enzymes reduce nitrate to nitrite
 - Longer time = more nitrate to nitrite conversion



Uncured Sausage Nitrate and Nitrite

TRT ^a	PPM Residual Nitrite		PPM Residual Nitrate	
	Pre-Incubate	Post-Incubate	Pre-Incubate	Post-Incubate
1	0 ^h	5.6 ^{ij}	51.2 ⁱ	38.5 ^h
2	0 ^h	24.5 ^h	52.0 ⁱ	14.0 ^j
3	0 ^h	7.7 ⁱ	99.2 ^g	89.7 ^g
4	0 ^h	46.0 ^g	99.6 ^g	26.3 ⁱ
C	59.1 ^g	NA	34.8 ^h	NA
SEM	0.62	1.22	1.35	2.02

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 4 = 0.40% VJP + 120 min incubation
 C = 156 ppm (mg/kg) sodium nitrite

^{g-j} Means within same column with different superscripts are different (P<0.05).

Uncured Ham Nitrate and Nitrite

TRT ^a	PPM Residual Nitrite		PPM Residual Nitrate	
	Pre-Incubate	Post-Incubate	Pre-Incubate	Post-Incubate
1	0.00 ^h	NA	40.8 ^{jk}	NA
2	0.00 ^h	19.5 ^h	46.6 ^{ij}	10.4
3	0.00 ^h	NA	78.2 ^g	NA
4	0.00 ^h	36.1 ^g	81.0 ^g	14.6
C	61.1 ^g	NA	22.5 ^{hk}	NA
SEM	1.16	0.97	4.59	1.30

^a TRT: 1 = 0.20% VJP + 0 min incubation
 2 = 0.20% VJP + 120 min incubation
 3 = 0.35% VJP + 0 min incubation
 4 = 0.35% VJP + 120 min incubation
 C = 200 ppm (mg/kg) sodium nitrite

^{g-k} Means within same column with different superscripts are different (P<0.05).

Step #3:

Cooking

Cooking Requirements

- Besides the addition of an incubation step, no other changes are necessary



Uncured Frankfurter Smokehouse Schedule

Step	Step Type	Time	Dry Bulb (°F)	Wet Bulb (°F)	RH (%)
1	Cook	IT: 100 F	105	103	93
2	Cook	2:00	105	103	93
3	Cook	00:20	140	0	0
4	Smoke Cook	00:30	150	118	38
5	Cook	00:20	160	145	67
6	Cook	IT: 160 F	185	178	85

*** Step 2 is where conversion of nitrate to nitrite will occur.

Uncured Smoked Sausage Smokehouse Schedule

Step	Step Type	Time	Dry Bulb (°F)	Wet Bulb (°F)	RH (%)
1	Cook	IT: 100 F	105	103	93
2	Cook	1:30	105	103	93
3	Cook	00:45	120	0	0
4	Smoke Cook	00:30	120	0	0
5	Smoke Cook	00:30	145	120	47
6	Smoke Cook	00:30	165	140	50
7	Cook	IT: 160 F	170	160	78

*** Step 2 is where conversion of nitrate to nitrite will occur.

Uncured Ham Smokehouse Schedule

Step	Step Type	Time	Dry Bulb (°F)	Wet Bulb (°F)	RH (%)
1	Cook	IT: 100 F	105	103	93
2	Cook	1:00	105	103	93
3	Cook	00:30	160	110	21
4	Cook	00:30	165	115	22
5	Cook	01:00	170	120	24
6	Cook	00:45	170	0	0
7	Cook	00:30	170	150	60
8	Cook	IT: 160 F	180	180	100

*** Step 2 is where conversion of nitrate to nitrite will occur.

Processing Considerations

Emulsion/Meat Batter Visual Differences



- Expect a different appearance between cured and uncured, no nitrate or nitrite added emulsions/batters

Whole Muscle Processing Requirements

- Starter culture must be injected into whole muscle cuts
 - Not water soluble
 - Will not penetrate meat during tumbling or immersion curing



Injection Calculations

- Amount of nitrate containing ingredient and starter culture needed to add to brine is calculated from total injected weight basis
- Calculation factors needed to know:
 - lbs of non-injected meat weight
 - Injection percentage
 - % nitrate containing ingredient desired
 - % starter culture desired

Example Calculation

- 25 lb of meat to inject
- 25% injection level
- 0.25% nitrate containing ingredient

Step 1

25 lb meat x 1.25% injection = 31.25 lb total injected weight

Step 2

31.25 lb x 0.25% (nitrate containing desired) = 0.0781

Step 3

0.0781 / 6.25 lb of brine added to 25 lb of meat

= 0.0125 = 1.25% of brine should be nitrate containing ingredient

Processing Concerns

“Natural Curing” Quality

- Water and protein binding
 - Control of raw materials
 - Modifications to processing
 - Control of pH
 - Ingredient choices

“Natural Curing” Quality

- Antioxidant protection
 - ~ 50 ppm nitrite
 - Dependent on amount of unsaturated lipids
 - Natural alternatives?
- Maintaining cured color
 - 2-14 ppm nitrite induces cured color
 - 40-50 ppm nitrite generally considered adequate
 - pH considerations
- Antimicrobial protection
 - Ingredients?
 - Processes?

“Natural Curing” Safety

- Clostridium Botulinum inhibition
 - 50-60 ppm ingoing nitrite?
 - Difficult to assess without challenge studies
 - Difficult to quantify true amount of nitrite generated
 - Currently being investigated

Uncured Sausage - Residual Nitrite

TRT ^a	DAY				
	0	14	28	56	90
1	r16.1 ^e	r10.6 ^f	r 8.8 ^{fh}	r4.9 ^{gh}	r4.9 ^{gh}
2	pq24.7 ^e	pq21.7 ^e	pq17.2 ^f	pq12.0 ^{gh}	pqr9.1 ^h
3	qr21.3 ^e	q16.6 ^f	qr 12.9 ^{fh}	qr 9.9 ^{gh}	qr 8.5 ^g
4	n 58.5 ^e	n44.3 ^f	n33.1 ^g	n22.3 ^h	n16.3 ⁱ
C	o 46.9 ^e	o31.4 ^f	op22.0 ^g	opq12.4 ^{hi}	opqr8.7 ⁱ

SEM = 1.02

^a TRT: 1 = 0.20% VJP + 30 min incubation
 2 = 0.20% VJP + 120 min incubation
 3 = 0.40% VJP + 30 min incubation
 4 = 0.40% VJP + 120 min incubation
 C = 156 ppm (mg/kg) sodium nitrite

^{e-i} Means within same row with different superscripts are different (P<0.05).
^{n-r} Means within same column with different superscripts are different (P<0.05).

Uncured Ham - Residual Nitrite

TRT ^a	DAY				
	0	14	28	56	90
1	ⁿ 21.0 ^e	ⁿ 14.6 ^{ef}	ⁿ 18.4 ^e	ⁿ 13.4 ^{ef}	ⁿ 7.2 ^f
2	ⁿ 19.3 ^e	ⁿ 15.6 ^{ef}	ⁿ 18.3 ^e	ⁿ 11.7 ^{ef}	ⁿ 8.8 ^f
3	^{nq} 27.7 ^e	^{nq} 23.6 ^{eh}	^{nq} 25.4 ^{eg}	^{nq} 19.4 ^{fgh}	ⁿ 11.7 ^f
4	^{oq} 36.0 ^e	^{oq} 32.6 ^{eh}	^{oq} 32.8 ^{eg}	^{oq} 25.4 ^{fgh}	^o 21.3 ^f
C	^p 63.4 ^e	^p 61.1 ^e	^p 56.0 ^e	^p 45.0 ^f	^p 34.1 ^g

SEM= 1.72

^a TRT: 1 = 0.20% VJP + 0 min incubation
 2 = 0.20% VJP + 120 min incubation
 3 = 0.35% VJP + 0 min incubation
 4 = 0.35% VJP + 120 min incubation
 C = 200 ppm (mg/kg) sodium nitrite

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^{n-q} Means within same column with different superscripts are different (P<0.05).

Finished Product Considerations

- Shorter shelf life?
 - Vacuum packaging
 - Gas flushing and high oxygen-barrier films
- Store product in cold refrigeration temperatures
 - $< 40^{\circ}\text{F}$



Organic and Natural Claim Resources

- USDA Food Standards and Labeling Policy Book
 - www.usda.fsis.gov (then use “Search FSIS”)
- USDA 21 CFR 101.22
 - www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=200721
 - Foods; labeling of spices, flavorings, colorings and chemical preservatives
- National Organic Program (NOP)
 - www.ams.usda.gov/nop/NOP/standards/ListReg.html

Questions?