

SUPPLEMENTARY MATERIAL

Challenges in the use of natural flavorings and labeling compliance in meat preparations in the Umbria region (central Italy)

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Supplementary Table 1. Questionnaire administered to establishments.

** For some questions it is possible to give more than one answer*

Questions	Answer	Answered/Total	Percentage
1) Do you prepare minced meat?	<input type="radio"/> Yes <input type="radio"/> No	15/15 0/15	100% 0%
2)* If you answer positively to question 1), Which preparation of minced meat preparations do you produce?	<input type="radio"/> Beef burger <input type="radio"/> Sausage stuffer <input type="radio"/> Chicken/turkey burger <input type="radio"/> Meatballs/meatloaf/rolls <input type="radio"/> Meat sandwiches <input type="radio"/> Other _____	12/15 7/15 3/15 6/15 3/15 8/15	80% 47% 20% 40% 20% 53%
3)* How are minced meat preparations sold?	<input type="radio"/> Only unpackaged <input type="radio"/> Prepackaged <input type="radio"/> Both methods	8/15 5/15 1/15 <i>1/15 no answer</i>	53% 33% 7% <i>7% no answer</i>
4)* How many minced meat preparations are made per week?	<input type="radio"/> < 10 kg <input type="radio"/> From 10 kg to 50 kg <input type="radio"/> > 50 kg	3/15 8/15 4/15	20% 53% 27%
5)* How many times a week are meat preparations produced?	<input type="radio"/> 1-2 times <input type="radio"/> 3-4 times <input type="radio"/> Everyday	4/15 5/15 6/15	27% 33% 40%
6) Is there an internal traceability register for meat preparations?	<input type="radio"/> Yes <input type="radio"/> No	12/15 3/15	80% 20%
7) If you answer positively to question 6), are the quantities of all ingredients used and their respective batches reported?	<input type="radio"/> Yes <input type="radio"/> No	11/12 1/12	92% 8%
8) What ingredients do you use in your minced meat preparations?	-	-	-
9)* How did you make the recipe?	<input type="radio"/> According to the traditional recipe of the establishment <input type="radio"/> According to consumer preferences <input type="radio"/> According to suggestions from colleagues, suppliers etc. <input type="radio"/> Other	12/15 5/15 3/15 1/15	80% 33% 20% 7%

10) Did you share the recipe with anyone?	<input type="radio"/> Yes <input type="radio"/> No	8/15 7/15	53% 47%
11)* If you answer positively to question 10), who did you share the recipe with?	<input type="radio"/> Suppliers <input type="radio"/> Colleagues <input type="radio"/> Family/employees <input type="radio"/> HACCP consultant <input type="radio"/> Food agents <input type="radio"/> Other	3/8 0/8 1/8 6/8 2/8 2/8	38% 0% 13% 75% 25% 25%
12) Is the list of ingredients provided in a specific book/label available to the consumer?	<input type="radio"/> Yes <input type="radio"/> No	15/15 0/15	100% 0%
13) Who makes the meat preparations?	<input type="radio"/> Always the same operator <input type="radio"/> All employees	10/15 5/15	67% 33%
14)* When are meat preparations made?	<input type="radio"/> During the opening hours of the butcher's shop, at the same times as the other processes in the establishment <input type="radio"/> During the opening hours of the butcher's shop, but at different times than the other processes of the establishment <input type="radio"/> At specific times <input type="radio"/> During business closing hours	5/15 2/15 2/15 4/15 2/15 no answer	34% 13% 13% 27% 13% no answer
15)* Where are meat preparations stored before sale?	<input type="radio"/> In a specific cold room <input type="radio"/> In the cold room together with other products <input type="radio"/> At the sales counter <input type="radio"/> In the processing room <input type="radio"/> They are not stored because they are prepared at the time of sale <input type="radio"/> Other	8/15 1/15 8/15 0/15 1/15 0/15	53% 7% 53% 0% 7% 0%
16)* Where are the preparations stored during the establishment closing hours?	<input type="radio"/> In a specific cold room <input type="radio"/> In the cold room together with other products <input type="radio"/> At the sales counter <input type="radio"/> In the processing laboratory <input type="radio"/> They are not stored because they are prepared the time of sale <input type="radio"/> Other	4/15 2/15 5/15 0/15 3/15 0/15	27% 13% 33% 0% 20% 0%
17) Is the equipment used dedicated exclusively to meat preparations?	<input type="radio"/> Yes <input type="radio"/> No	9/15 6/15	60% 40%
18) Is there a preparation and	<input type="radio"/> Yes <input type="radio"/> No	12/15 3/15	80% 20%

management procedure for meat preparations in your manual?			
19) If you answer positively to question 18), is it adequate?	<input type="radio"/> Yes <input type="radio"/> No	12/12 0/12	100% 0%
20) Do you use flavorings in your minced meat preparations?	<input type="radio"/> Yes <input type="radio"/> No	13/15 2/15	87% 13%
21) If you answer positively to question 20), what flavorings do you use?	-	-	-
22) Is there a scale to weigh flavorings?	<input type="radio"/> Yes <input type="radio"/> No	13/15 2/15	87% 13%
23) If you answer positively to question 22), has the scale ever been calibrated?	<input type="radio"/> Yes <input type="radio"/> No	12/13 1/13	92% 8%
24)* If you use answer positively to question 20), why did you decide to use flavorings?	<input type="radio"/> Without any particular reason <input type="radio"/> To improve meat preparation flavor <input type="radio"/> To extend the shelf life of the product <input type="radio"/> To improve meat preparation appearance <input type="radio"/> Other	3/13 7/13 7/13 5/13 0/13	23% 54% 54% 38% 0%
25) If you answer positively to question 20), do you know the composition of the flavors you use?	<input type="radio"/> Yes <input type="radio"/> No	7/13 6/13	54% 46%
26) If you answer positively to question 20), are there technical data sheets for the flavors?	<input type="radio"/> Yes <input type="radio"/> No	9/13 4/13	69% 31%
27) If you answer positively to question 20), is adding flavors a CCP?	<input type="radio"/> Yes <input type="radio"/> No	1/13 12/13	8% 92%

28) Do you have a recipe for adding flavorings to meat preparations? (if so, indicate the quantity in grams of flavoring per 100 g of minced meat)	-	-	-
29) What is the shelf life of meat preparations? How was it assessed?	-	-	-

Supplementary Table 2. Experimental burger recipes.

Recipes	Ingredients	% flavoring mix
Recipes 1	Minced meat + MIX 1	0.5
Recipes 2	Minced meat + MIX 2	20
Recipes 3	Minced meat + MIX 3	10
Recipes 4	Minced meat + MIX 4	2
Recipes 5	Minced meat + MIX 5	1
Recipes 6	Minced meat + MIX 6	1.2

MIX, commercial natural flavoring mixture; minced meat, beef minced meat.

Supplementary Table 3. Natural flavoring composition declared in the technical sheet.

Natural flavoring mix	Composition
MIX 1	E262 sodium acetate, E331 sodium citrate, sodium chloride, E301 sodium l-ascorbate
MIX 2	dextrose, salt, dried whole egg, milk powder, rice flour, natural flavors, spices
MIX 3	dehydrated potato flakes, dextrose, sodium chloride, natural flavors, E551 silicon dioxide, sunflower oil
MIX 4	dextrose, sodium chloride, natural flavors supported on dietary fiber (legumes), E262 sodium acetate, E331 sodium citrate, E301 sodium ascorbate, E504ii magnesium carbonate
MIX 5	dextrose, sodium chloride, natural flavors
MIX 6	dextrose, sodium chloride, E262 sodium acetate, E331 sodium citrate, E300 ascorbic acid, natural flavors, E504ii magnesium carbonate, sunflower oil

MIX, commercial natural flavoring mixture.