

# Is traceability enough to prevent the decrease of meat consumption?

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## Key Words

Meat consumption reduction, health consciousness, animal welfare concern, environmental concern, traceability

## Abstract

Over the last few decades, European meat consumers have had to deal with sanitary scares, with a notable impact on the bovine meat perception, which is the one facing the most public negativity (1), with nutritional acknowledgments on the role of meat in some chronic diseases, with environmental concern regarding cattle breeding, and with concerns regarding animal welfare. At the same time, a reduction of meat consumption can be observed in France (*e.g.* -9% in daily consumption in 2013 vs 2010<sup>2</sup>), as well as the increase and success of new food habits, such as vegetarianism or “flexitarianism”.

Recent researches have observed that food-safety perceptions do not significantly affect people's meat consumption in normal food situations, *i.e.* when not facing a major crisis (1, 2). Meat consumption has been associated with eating pleasure (3), nutritional knowledge (4) and, moreover, it is an important component of the European diet (5). Animal welfare

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<sup>2</sup> Source Crédoc study, CCAF 2013, <http://www.la-viande.fr/nutrition-sante/consommation-viande-france> (last accessed 3<sup>rd</sup> September 2015)

concern, environmental concern and health-related attitudes have also been found to have a significant effect on meat consumption (6, 3).

To cope with this decrease in consumption, the whole meat chain (from producers to retailers, as well as public authorities) made the assumption that food safety was the major concern and engaged in improving traceability and labeling, and communicating on these subjects in order to restore consumer trust (9). But experts' risk assessments and lay people's risk perceptions can deeply differ (10). Specifically, traceability – which doesn't guarantee, in its official definition, anything except the ability to go back up the supply chain in case of health hazard – can be questioned as a good answer to consumers' expectations.

Therefore, our research questions are:

*RQ1: Which mechanisms influence meat consumption variations from a consumer point of view?*

*RQ2: What are the reasons why French consumers reduced or are willing to reduce their meat consumption?*

According to the literature, we take on three major causes of low consumption or consumption decrease: health concern (HC), animal welfare concern (AWC), environmental concern (EC). These three reasons can lead to perceived risk associated with meat consumption (PR), and therefore influence consumption frequency (CF), past reduction of (PRED) or intention to reduce (IREDD) meat consumption.

Therefore, our first secondary research question is: *How do Health Concern (HC), Environmental Concern (EC) and Animal Welfare Concern (AWC) influence meat consumption variations directly or indirectly through Perceived Risk (PR)?*

Traceability is a tool set up by public authorities and reinforced as a consequence of the various crises the meat sector has known. As mentioned earlier, its purpose is, mainly in case of a sanitary crisis, to enable the authorities to trace back the supply chain to precisely identify the origin of the problem. Actually, consumers seem to consider traceability as a given and are little attracted by information on this subject available on the products. However, they expect more quality indicators but do not want to be overwhelmed by information (9).

Therefore, our last secondary research question is: *Does importance of traceability have a moderating effect on the relationships between meat consumption variations, and perceived risk and its antecedents?*

Our results show that risk perception is central for explaining past, present and intended meat consumption behavior, even out of a scare period. Among the dimensions of environmental concern, the only explanatory one is environmental concern about possible damages on biosphere (plants, animals, birds and marine life). That animal welfare concern doesn't impact risk perception but impact directly meat consumption frequency is consistent with others scholars' works (28, 29, 10); thus meat consumption frequency has now an ethical driver independent from the perception of potential health risks coming from intensive livestock farming (30). Finally, we show that traceability is perceived as important for a large part of the population. But our results show that the guarantees currently offered by traceability are not sufficient in the consumers' mind. Therefore, we suggest two routes for the meat sector: first, to continue their productivity and food safety efforts to deliver meat to consumers concerned about their budget but nevertheless willing to keep eating meat; second, to promote new ways of labeling in order to restore trust in the production stage regarding animal welfare and environmental issues for the consumers of meat who wish to consume less but better.

# Is traceability enough to prevent the decrease of meat consumption?

## Introduction

Over the last few decades, European meat consumers have had to deal with sanitary scares, with a notable impact on the bovine meat perception, which is the one facing the most public negativity (1), with nutritional acknowledgments on the role of meat in some chronic diseases, with environmental concern regarding cattle breeding, and with concerns regarding animal welfare. At the same time, a reduction of meat consumption can be observed in France (e.g. -9% in daily consumption in 2013 vs 2010<sup>3</sup>), as well as the increase and success of new food habits, such as vegetarianism or “flexitarianism”.

Recent researches have observed that food-safety perceptions do not significantly affect people’s meat consumption in normal food situations, *i.e.* when not facing a major crisis (1, 2). Meat consumption has been associated with eating pleasure (3), nutritional knowledge (4) and, moreover, it is an important component of the European diet (5). Animal welfare concern, environmental concern and health-related attitudes have also been found to have a significant effect on meat consumption (6,3).

To cope with this decrease in consumption, the whole meat chain (from producers to retailers, as well as public authorities) made the assumption that food safety was the major concern and engaged in improving traceability and labeling, and communicating on these subjects in order to restore consumer trust (9). But experts’ risk assessments and lay people’s risk perceptions can deeply differ (10). Specifically, traceability – which doesn’t guarantee, in its official definition, anything except the ability to go back up the supply chain in case of health hazard – can be questioned as a good answer to consumers’ expectations.

Therefore, our research questions are:

*RQ1: Which mechanisms influence meat consumption variations from a consumer point of view?*

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## Literature review and conceptual framework

### Meat consumption and its past and future variations in France

Meat consumption can vary among consumers and individually through time. According to the French eating habits, meat may be consumed raw or transformed (including into ready-to-eat products), cold (e.g. deli-meat from pork or poultry) or hot (generally as a main course). A lot of species are culturally considered as eatable by French people but the most consumed are pigs, bovines, poultry, and, far behind, ovines, rabbits and very few horses<sup>4</sup>.

Meat is in France considered as an important part of a typical lunch or dinner. Nevertheless, the decrease of consumption has been observed like in other developed countries since the last quarter of the 20<sup>th</sup> century, simultaneously with the rise of concerns about the various risks meat consumption can carry.

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<sup>3</sup>Source Crédoc study, CCAF 2013, <http://www.la-viande.fr/nutrition-sante/consommation-viande-france> (last accessed 3<sup>rd</sup> September 2015)

<sup>4</sup>Source: FranceAgrimer, 2010.

This decrease does not refer to complete meat abstention: vegetarians and vegans are estimated together about 2 and 3% of the French population (18). The most observed behavior is to lower meat consumption frequency, what is now named “flexitarianism”, although this recently observed behavior is not yet clearly defined in the academic literature: ranging from “light” to “heavy” flexitarians, from “conscious” to “unconscious” ones (22). The only clearly established point is that the so-called flexitarians avoid eating meat once a week or more for reasons other than financial ones.

### **Factors explaining perceived risk about meat consumption**

Meat is of great nutritional (16) and social (17) interest, which explain that its consumption increases as the economic situation of a country improves and among population reaching a higher income. Yet, in the past decade, its consumption decreased in developed countries after culminating at the end of 20<sup>th</sup> century, particularly among high social classes (18). Three major causes of low consumption or consumption decrease were identified (19). Firstly, health concern: since the last decade of 20<sup>th</sup> century, media and internet have warned people about potential or confirmed links between high meat consumption and illnesses such as cancers and cardiovascular diseases. Secondly, environmental concern: livestock farming, particularly ruminants would contribute to greenhouse gases emissions. The waste of vegetal proteins to produce animal ones has also been highlighted by media and experts. More recently in France than elsewhere in Europe, animal welfare concern came in the public debate as a relevant theme, including both living and dying conditions of livestock and bringing into opposition intensive and extensive farming.

These three types of concerns, separately or mixed together, were identified as meat reducing motivations (20) and as vegetarians’ motivations for adopting their diet (21). Health reasons seem less important and enduring than ethical ones (environment and animal welfare).

Therefore, our first secondary research question is: *How do Health Concern (HC), Environmental Concern (EC) and Animal Welfare Concern (AWC) influence meat consumption variations directly or indirectly through Perceived Risk (PR)?*

### **Perceived risk and traceability**

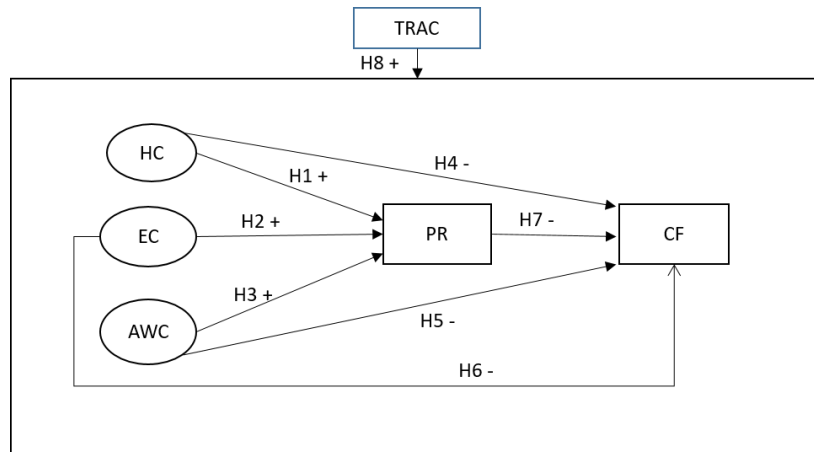
Perceived risk has been widely used by scholars to understand and explain consumer behavior (11, 12), especially meat consumption (7,8). Regarding meat consumption, this variable appears as particularly powerful in a crisis context (13) but seems not to operate out of it (2). Perceived risk leads to risk reduction strategies, such as consumers’ trust in traceability to reduce risk. Gellynck and Verbeke (14) studied this point in Belgium, distinguishing functional attributes of traceability (ability to identify a problem and its origins and, to solve it, to identify the person or firm responsible of it) and process attributes of traceability (ability to give information about the animal’s condition of production, including its health and medical treatments). At the time of the study (June 2001), most consumers seemed little interested by the process attributes. The current rise of environmental and ethical concerns about livestock production could lead to an evolution of these findings.

Several research studies have been conducted on meat traceability, in other countries than France (23), but they did not specify consumers’ expectations. Traceability is a tool set up by public authorities and reinforced as a consequence of the various crises the meat sector has known. As mentioned earlier, its purpose is, mainly in case of a sanitary crisis, to enable the authorities to trace back the supply chain to precisely identify the origin of the problem. Actually, consumers seem to consider traceability as a given and are little attracted by information on this subject available on the products. However, they expect more quality indicators but do not want to be overwhelmed by information (9).

Therefore, our last secondary research question is: *Does importance of traceability have a moderating effect on the relationships between meat consumption variations, and perceived risk and its antecedents?*

### Research model

In order to answer our research questions we developed 8 hypotheses that are summarized in the research model presented in figure 1. We hypothesized that the perceived importance of traceability (TRAC) acts as a moderating variable of the model:



(HC = Health Consciousness; EC = Environmental Concern; AWC = Animal Welfare Concern; TRAC = Perceived Importance of Traceability, PR = Perceived Risk, CF = Consumption Frequency)

Figure 1: Research model

In addition, as meat consumption has been steadily decreasing and could continue to, we investigate our model not only on current meat consumption frequency (CF) but also on past (PRED) and intended (IRED) reduction of consumption frequency with similar hypotheses patterns.

### Method

#### Sample

Data collection was conducted online (Toluna Access Panel), between the 29<sup>th</sup> May and the 1<sup>st</sup> of June 2015. We targeted a final sample of 500 subjects, representative of the French population over 15 years old in terms of age, gender and head of household's socio-professional category.

#### Measures

Meat consumption frequency (CF) was measured in general<sup>5</sup> with the following scale: “at least once a day”, “every day or almost every day”, “at least once a week”, “at least once a month”, “at least once a year”, “less frequently”, “never”. Then we asked for modifications in meat consumption frequency (reduction, no change or increase) during the past 3 years (PRED) and what they intend to do in the next 3 years (IRED).

<sup>5</sup>Instructions to the respondents stated that they should “understand by meat consumption products that they would consume: cooked or raw; hot or cold; as an appetizer or as a main dish; in small or big quantities. It includes beef, veal, poultry, etc... and also pieces of bacon, deli meats (including pork and poultry cooked ham), game and any meat in small or big amounts that can be part of home-made or store-bought dishes (e.g.: quiches, pizzas...)”

Risk perception (PR) was measured first in a general sense and then in its dimensions: health risk due to contamination and to nutritional content of meat, environmental risk, ethical risk, aesthetic risk, risk of disappointment on the taste, risk of fraud. For each type of risk, subjects had to choose along a 5-points scale ranging from “no risk at all” to “major risk”.

The most appropriate scale for health concern appeared to be the Health Consciousness (HC) scale by Michaelidou and Hassan (24). We translated in French the 6-items scale of Michaelidou and Hassan (24) through a 5-points scale ranging from “I strongly disagree” to “I strongly agree” (see appendix 1).

Environmental concern (EC) was measured with a French translation of the 12-items 7-points scale of Schultz (25) (see appendix 1). This EC 12-items scale is expected to be tridimensional with three types of concerns: Biospheric concerns (concerns about damages on biosphere – EC\_bio), Altruistic concerns (concerns about damages impacting other people and future generations – EC\_alt) and Egoistic concerns (concerns about damages to one’s comfort – EC\_ego). Because of some doubts about the real altruistic dimension of “my children” item (which sounded quite personal and egoistic when translated in French), we added a 13<sup>th</sup> item, generally associated with altruistic motives: the concern about “future generations”.

Animal welfare concern (AWC) was measured with an adaptation of the 7 dimensions of animal welfare concern founded by Vanhonacker *et al.* (26). We nevertheless distinguished the “transport and slaughter” one into two, to measure these two dimensions separately as the authors suggested it in their discussion. For each of the 8 dimensions, we asked respondents to say if it was “not important at all” to “extremely important” (7-points scale) for the welfare of farm animals (see appendix 1).

For each scale, the items were presented in random order to avoid order effects.

Perceptions about traceability were studied in multiple ways. First an open answer was asked to assess what lay persons imagine upon reading the word “traceability”. Then the official definition of traceability was given and a question measured with a 5-points scale the perceived importance of meat traceability (TRAC). Finally respondents were asked which elements they wish to know about meat: animals’ origin, path from producer to consumer, type of farming (intensive or free range), type of transformation (artisanal or industrial), animals’ diet, treatments (antibiotic or not), presence of a quality label. They had to answer on a 5-points scale about the importance of each of these items.

### **Procedures and analysis**

Data were analyzed with SPSS 19, confirmatory factor analyses and structural analyses were performed with AMOS 22.

The quality of Health Consciousness, Environmental Concern and Animal Welfare Concern scales was controlled with an exploratory factor analysis.

The HC 6-items scale had worse results than a 5-items one, excluding the item “I take responsibility for the state of my health”. So we kept this 5-items unidimensional scale which explains 63.3% of variance with a .849 Cronbach’s  $\alpha$  (see appendix 1).

The AWC 8-items scale is unidimensional and explains 82.20% of variance with a .969 Cronbach’s  $\alpha$ .

The EC 13-items scale was expected to be tridimensional. The exploratory factor analysis revealed a better percentage of explained variance (78.6% vs 74.5%) when excluding 2 items (“the French people” and “my children”): with the remaining 11 items Cronbach’s  $\alpha$  is .946. This analysis also showed a clear bi-dimensionality with a first dimension including Biospheric and Altruistic concerns and a second dimension including Egoistic concerns. A confirmatory analysis with AMOS 22 was computed for a bi-dimensional solution and for Schultz’s original tri-dimensional structure of Environmental Concern. A better model fit was obtained with the tri-dimensional solution ( $\chi^2/df$  3.785 vs 9.937, TLI .971 vs .908, CFI .979 vs .928, GFI .945 vs .841, RMSEA .075 vs 13.4). Thus we decided to work with this tri-dimensional 11-items scale of environmental concern (see appendix 1).

Expressed respondents’ meat consumption frequency was weighed into a score in order to reflect frequencies per year: “at least once a day” was estimated as 600 times per year, “every day or almost every day” as 300 times per year, “at least once a week” as 100 per year, “at least once a month” as 24 times a year and never as zero time a year (the possible answers “at least once a year” and “less frequently” were not used by respondents).

A past consumption reduction of meat (PRED) score was computed by translating past changes of frequency onto scores: -2 when a vegetarian declared now eating meat, -1 when a meat-eater declared eating more frequently, 0 when both declared no change, +1 when a meat-eater declared eating less frequently, +2 when a meat eater declared being now vegetarian. The intended meat consumption reduction (IRED) score was computed from the intended change of frequency with the same logic.

In order to test the model as a whole (instead of pairwise relations between variables), we chose to use the well-established technique of structural equations. Three path analyses were performed with the basic model described above, one with consumption frequency as dependent variable, another with past consumption reduction and the last with intended consumption reduction. Then we introduced the importance of traceability as a moderating variable. The models’ fit indicators are the same with and without the moderating variable. RMSEAs are good. All other indicators are close to the standards (Table 1).

| Fit indicators | Dependent variable |       |       |
|----------------|--------------------|-------|-------|
|                | CF                 | PRED  | IRED  |
| $\chi^2/df$    | 3.429              | 3.352 | 3.439 |
| TLI            | .871               | .860  | .871  |
| CFI            | .886               | .876  | .886  |
| GFI            | .770               | .777  | .770  |
| RMSEA          | .070               | .070  | .070  |

Table 1: Fit indicators of the three path models

## Findings

### Sample

As expected, our sample is made of 500 respondents, representative of the French population over 15 years old in terms of age, gender and head of household’s socio-professional category<sup>6</sup>.

<sup>6</sup>  $\chi^2_{gender}=0.00894 < \chi^2_{(0.05; 1)}=3.841$  /  $\chi^2_{age}=05.298 < \chi^2_{(0.05; 5)}=11.070$  /  $\chi^2_{socio-pro. category}=16.584 < \chi^2_{(0.01; 7)}=18.475$



**General results**

Our results confirm the French taste for meat: 57.8% eat it every day or nearly, only 2.4% declare themselves to be vegetarians, which is consistent with previous findings. The mean estimation of meat consumption frequency is 278.68 times a year (r=203.66). They also show a reduction in consumption frequency in the 3 years prior to the study: 44.8% state a consumption frequency reduction and only 6.8% an increase. As for the 3 future years, 33.2% intend to reduce their consumption frequency of meat and 3.8% to stop it altogether versus 4.6% who intend to increase their consumption and 1% who intend to stop being vegetarian.

Contrasts appears in the scores of explanatory variables: they are high on the importance of traceability (m=4.49 on a 5-points scale), health consciousness (m=3.94 on a 5-points scale), animal welfare concern (m=5.86 on a 7-points scale), and environmental concern (m=5.43 on a 7-points scale); and medium on perceived risk (m=2.64 on a 5-points scale).

The high score of traceability importance must be nuanced by the facts that it was measured after giving its real definition and that its usefulness was recently proved in 2014 during the “horsegate”. The relatively low mean of perceived risk confirms the results from the previous cited works, the period of the study not being one of crisis even if the “horsegate” was recent. For the meat-reducers and new vegetarians the reasons, possibly multiple, were first financial (45.6%), then sanitary (40.8%), environmental (27.2%), esthetic (control of weight 25.2%), because of scandals (22.8%) and finally ethic (by pity for animals 21.8%).

**Path analyses results**

Tables 2 to 4 present the estimates of links between variables in our three models, first on the global sample and then among subgroups for the moderating variable. Perceived importance of traceability (TRAC) separates the sample in two groups: 60 subjects who think that traceability is of low importance (scores from 1 to 3 on the 5-points scale) and 428 subjects who think that it is of great importance (scores of 4 or 5). 12 didn’t answer this question.

Structural equation reveals that consumption frequency (CF) is directly influenced by animal welfare concern (AWC) and indirectly by the ecological dimension of environmental concern (EC\_bio) via risk perception (PR) (see Figure 2 and Table 3). Perceived importance of traceability acts as a moderating variable: the large group who considers traceability as important acts like the total sample, the minority who doesn’t care about traceability consume meat without clear structure except the strong influence (see table 2) of the egocentric dimension of environmental concern on a decrease of their consumption frequency.

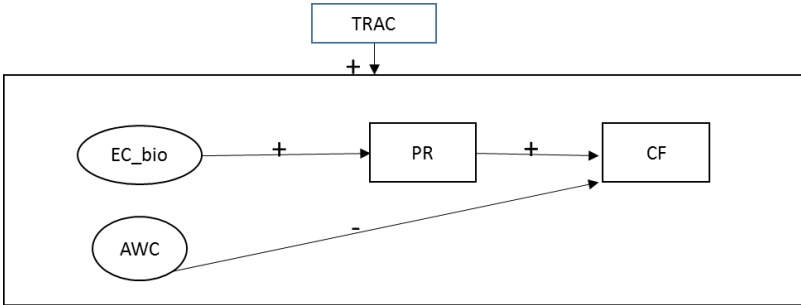


Fig.2: Meat Consumption Frequency Moral Model



|    |     |        | Global sample |      | TRAC not important |      | TRAC very important |      |
|----|-----|--------|---------------|------|--------------------|------|---------------------|------|
|    |     |        | Est.          | P    | Est.               | P    | Est.                | P    |
| PR | <-- | EC_BIO | .248          | .012 | -.075              | ns   | .207                | .044 |
| PR | <-- | EC_EGO | .019          | ns   | .063               | ns   | .031                | ns   |
| PR | <-- | EC_ALT | -.183         | ns   | .198               | ns   | -.152               | ns   |
| PR | <-- | AWC    | -.028         | ns   | .057               | ns   | -.042               | ns   |
| PR | <-- | HC     | .010          | ns   | -.211              | ns   | .042                | ns   |
| CF | <-- | PR     | -27.614       | ***  | 17.347             | ns   | -23.454             | .006 |
| CF | <-- | EC_BIO | 7.794         | ns   | 180.306            | ns   | 6.639               | ns   |
| CF | <-- | EC_EGO | -3.861        | ns   | -100.469           | .008 | 6.967               | ns   |
| CF | <-- | EC_ALT | 1.588         | ns   | -103.049           | ns   | -4.552              | ns   |
| CF | <-- | AWC    | -22.221       | .012 | -17.039            | ns   | -24.119             | .047 |
| CF | <-- | HC     | 11.304        | ns   | 41.148             | ns   | 3.777               | ns   |

Table 2: structural analyses about CF, meat consumption frequency

Concerning past consumption reduction and intended one structural equations reveal that they are indirectly influenced by the “biosphere” dimension of environmental concern via risk perception (see Figure 3 and Table 3 and 4). Importance of traceability acts as a moderating variable similarly in both cases: the large group who considers traceability as important will reduce its consumption because of the “biosphere” dimension of environmental concern via risk perception while we were not able to find any structure in the minority who doesn’t care about traceability. We can notice that animal welfare concern completely disappeared from results as far as past and future meat consumption reduction are concerned.

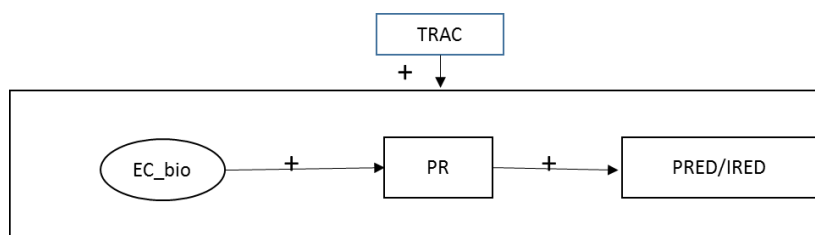


Fig.3: Meat Consumption Reduction Ecological Model

|      |      |        | Global sample |      | TRAC not important |    | TRAC very important |      |
|------|------|--------|---------------|------|--------------------|----|---------------------|------|
|      |      |        | Est.          | P    | Est.               | P  | Est.                | P    |
| PR   | <--- | EC_BIO | .249          | .012 | -.072              | ns | .207                | .044 |
| PR   | <--- | EC_EGO | .019          | ns   | .064               | ns | .031                | ns   |
| PR   | <--- | EC_ALT | -.183         | ns   | .196               | ns | -.152               | ns   |
| PR   | <--- | AWC    | -.028         | ns   | .058               | ns | -.042               | ns   |
| PR   | <--- | HC     | .010          | ns   | -.219              | ns | .042                | ns   |
| PRED | <--- | PR     | .077          | .006 | .079               | ns | .079                | .007 |
| PRED | <--- | EC_BIO | .019          | ns   | -.190              | ns | .032                | ns   |
| PRED | <--- | EC_EGO | -.001         | ns   | .051               | ns | -.008               | ns   |
| PRED | <--- | EC_ALT | .008          | ns   | .148               | ns | .004                | ns   |
| PRED | <--- | AWC    | .053          | ns   | .068               | ns | .066                | ns   |
| PRED | <--- | HC     | .090          | ns   | .200               | ns | .073                | ns   |

Table 3: structural analyses about PRED, meat consumption reduction in the past 3 years

|      |      |        | Global sample |      | TRAC not important |      | TRAC very important |      |
|------|------|--------|---------------|------|--------------------|------|---------------------|------|
|      |      |        | Est.          | P    | Est.               | P    | Est.                | P    |
| PR   | <--- | EC_BIO | .248          | .012 | -.078              | ns   | .207                | .044 |
| PR   | <--- | EC_EGO | .019          | ns   | .066               | ns   | .031                | ns   |
| PR   | <--- | EC_ALT | -.183         | ns   | .199               | ns   | -.152               | ns   |
| PR   | <--- | AWC    | -.028         | ns   | .058               | ns   | -.042               | ns   |
| PR   | <--- | HC     | .010          | ns   | -.217              | ns   | .042                | ns   |
| IRED | <--- | PR     | .154          | ***  | .211               | .044 | .170                | ***  |
| IRED | <--- | EC_BIO | .038          | ns   | .168               | ns   | .048                | ns   |
| IRED | <--- | EC_EGO | -.008         | ns   | .083               | ns   | -.030               | ns   |
| IRED | <--- | EC_ALT | .007          | ns   | -.170              | ns   | -.007               | ns   |
| IRED | <--- | AWC    | -.020         | ns   | -.080              | ns   | .050                | ns   |
| IRED | <--- | HC     | .024          | ns   | .020               | ns   | .041                | ns   |

Table 4: structural analyses about IRED, intention of meat consumption reduction

## Discussion

These results are not only interesting for what they show but also for what disappeared from the initial model.

First, risk perception is central for explaining past, present and intended meat consumption behavior, even out of a scare period. Verbeke (27) seems to be right about persistent effects of crisis, even if Zingg *et al.* (2) noticed a very low effect of risk perception on behavior among the Swiss-German they studied at the end of 2009 during a quiet period.

Among the dimensions of environmental concern, the only explanatory one is environmental concern about possible damages on biosphere (plants, animals, birds and marine life). This result shows an internal consistent link between meat consumption and biosphere, even without any explicit mention of livestock farming in the part of the questionnaire about environmental concern.

That animal welfare concern doesn't impact risk perception but impact directly meat consumption frequency is consistent with others scholars' works (28, 29, 10); thus meat consumption frequency has now an ethical driver independent from the perception of potential health risks coming from intensive livestock farming (30).

Looking at the variables that disappeared from the theoretical model, the most noteworthy result is the absence of health consciousness as an explanatory variable. Given that we measured it in a general way and not connected with possible health problems coming from meat consumption, it can make sense: a general health consciousness does not automatically lead to a meat health concern.

Finally, the perceived importance of traceability—acting as a moderating variable—gives some indications about what is really important to trace. For the group who considers traceability as important, meat consumption frequency and past and intended reduction of it depend indirectly on the “biosphere” dimension of environmental concern via risk perception. However, they are not impacted by any health or sanitary concerns. Also, the consumption frequency directly depends on animal welfare concern. People clearly expect better guarantees about the meat they eat. The answers to the open question about what traceability

is, and the question about what was important to be traced (question answered after having read the real definition of traceability) confirmed these results. Spontaneously a lot of people, when giving their perception of traceability, evoked the whole history of their meat (origin, type of farming, type of feeding given to animals, type of medicines...). Furthermore, when expressing the importance of various elements of traceability, their answers indicate that the present definition of traceability is not sufficient, nor is labeling (see table 5).

|   | Not important at all<br>(1) | (2)  | (3)   | (4)   | Very<br>important (5) |
|---|-----------------------------|------|-------|-------|-----------------------|
| Animals' origin                                     | 0%                          | 1.7% | 9.6%  | 22.2% | 66.5%                 |
| Path from producer to<br>consumer                   | 0%                          | 2.2% | 16.5% | 30.4% | 50.9%                 |
| Type of farming<br>(intensive or free<br>range)     | 0%                          | 2.6% | 7.8%  | 27%   | 62.6%                 |
| Type of transformation<br>(artisanal or industrial) | .4%                         | 3%   | 14.3% | 33%   | 49.1%                 |
| Animals' diet                                       | .4%                         | 2.2% | 9.1%  | 30%   | 58.3%                 |
| Treatments (antibiotic<br>or not)                   | .4%                         | 3%   | 11.7% | 24.3% | 60.4%                 |
| Label   | 1.7%                        | 7.8% | 22.2% | 30.9% | 37.4%                 |

Table 5: Consumers' expectations about elements to be traced about meat.

Animal's origin and diet, and type of farming are clearly more important in the consumers' minds. If professionals really want to meet consumers' expectations, they must accept to be as transparent as possible about these issues.

Our research shows some limitations. Answers were declaratory, and the gap between consumers' answers and behaviors is already well-documented. The cross-sectional nature of our study is also a limitation: although we have a dynamic analysis of the issue at hand, it could have been interesting to conduct a longitudinal study. Finally, the weighing of declared consumption frequencies to turn them into scores was quite subjective and may be discussed.

But a great merit of this study is that it gives a "realistic" view, as it is based on 500 respondents, representative of the French population of 15 years of age and more.

In terms of theoretical contributions, our results offer some improvement of the scales we used and a French translation. Thus, the tri-dimensionality of Schultz's (25) environmental concern scale is confirmed on a French sample. However, our doubts about the "my children" as an altruistic indicator are supported and, at least in French, we suggest to introduce "future generations" instead of it. We also recommend to suppress the "people of my country" item. With these slight modifications we obtain an 11-items scale with a .946 Cronbach's  $\alpha$  (see appendix 1).

The best result in terms of measurement is the new scale for animal welfare concern. Based on the 7 dimensions discovered by Vanhonacker *et al* (26) after measuring and factorizing 73 items, we created and validated a unidimensional measure of animal welfare concern with 8

items (transports and slaughter being separated) which is parsimonious and efficient in French (.969 Cronbach's  $\alpha$ ). We suggest testing this scale in an English-speaking context to confirm its efficiency.

Our findings provide some implications for professionals of the meat sector. We show that the reduction of meat consumption is multifactorial. Surprisingly given the exposure that nutrition has in mass media, health consciousness's explanatory power is not as important as could have been expected. The first reason to reduce meat consumption is financial. For most consumers, the crisis is more economic than sanitary. We show that traceability is perceived as important for a large part of the population. But our results show that the guarantees currently offered by traceability are not sufficient in the consumers' mind. Therefore, we suggest two routes for the meat sector: first, to continue their productivity and food safety efforts to deliver meat to consumers concerned about their budget but nevertheless willing to keep eating meat; second, to promote new ways of labeling in order to restore trust in the production stage regarding animal welfare and environmental issues for the consumers of meat who wish to consume less but better.

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## Appendix 1: Scales translation and elaboration

### Health consciousness (Michaelidou, N., & Hassan, L. M., 2008)

translated from English to French

|   |   |
|---|---|
| I reflect about my health a lot                             | Je réfléchis beaucoup à ma santé                                  |
| I'm very self conscious about my health                     | Je me sens très concerné par ma santé                             |
| I'm alert to changes in my health                           | Je suis attentif aux changements de mon état de santé             |
| I'm usually aware of my health                              | Habituellement, je suis conscient de mon état de santé            |
| <i>I take responsibility for the state of my health</i>     | <i>Je me considère comme responsable de mon état de santé*</i>    |
| I'm aware of the state of my health as I go through the day | Je suis conscient de mon état de santé tout au long de la journée |

\*This item was eliminated after an exploratory factor analysis

### Environmental concern (Schultz, P. W., 2001)

translated from English to French

| EC's 3 dimensions | I am concerned about environmental problems because of the consequences for : | Je suis préoccupé(e) par les problèmes environnementaux à cause de leurs conséquences sur... |
|-------------------|---|--|
| Bio               | Plants  | les plantes  |
|                   | Marine life   | la vie marine  |
|                   | Birds   | les oiseaux  |
|                   | Animals   | les animaux  |
| Ego               | Me  | moi  |
|                   | My lifestyle  | mon mode de vie  |
|                   | My health   | ma santé   |
|                   | My future   | mon avenir   |
| Alt               | People in my country  | les Français*  |
|                   | All people  | l'humanité entière   |
|                   | Children  | tous les enfants du monde  |
|                   | My children   | mes enfants*   |
|                   |   | les générations futures  |

\*These items were eliminated after an exploratory factor analysis

## Animal welfare concern adapted from Vanhonacker et al. (2012)

Adapted from English to French

| <b>7 dimensions of animal welfare (Vanhonacker <i>et al.</i>)</b> | <b>8 items adapted from Vanhonacker <i>et al.</i></b>                                 |
|---|---|
| Animal health   | un bon état de santé  |
| Animal suffering & stress   | une vie sans souffrance ni stress   |
| Ability to engage in natural behavior                             | la possibilité de vivre dans des conditions correspondant naturellement à leur espèce |
| Housing & barn climate  | la qualité et le confort de leur habitat  |
| Feed & water  | la qualité de leur alimentation   |
| Transport & slaughter   | la qualité de leurs conditions de transport   |
|   | des conditions d'abattage sans stress, ni douleur                                     |
| Human-animal relationship   | la qualité des relations entre l'éleveur et ses animaux                               |