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## Preferences & choices experiments with real products consumption: application with plant-based proteins.

LEPLAT Mélody <sup>a, b</sup>, LOHEAC Youenn <sup>c, d \*</sup>, TEILLET Eric <sup>e</sup>

<sup>a</sup> ISEN, 20 rue Cuirassé Bretagne , 29200 Brest, France.

<sup>b</sup> UMR 6308, AMURE, IUEM, University of Brest, Plouzané, France

<sup>c</sup> Rennes School of Business, 2 Rue Robert d'Arbrissel, 35065 Rennes, France.

<sup>d</sup> CREM, UMR 6211, Université de Rennes 1, 7 place Hoche, 35065 Rennes Cedex, France

<sup>e</sup> SensoStat, Dijon, France

\* Corresponding author: Rennes School of Business, 2 Rue Robert d'Arbrissel, 35065 Rennes.  
Email: youenn.loheac@rennes-sb.com

### Résumé :

Dans un contexte de végétalisation des repas se développe une offre de substituts végétaux imitant les propriétés gustatives et nutritionnelles des produits carnés. Par ailleurs, les motivations à réduire la consommation de produits carnés ou à les remplacer par des substituts végétaux repose sur plusieurs arguments tels que la santé, l'environnement ou le bien-être animal. A travers deux études, nous explorons les préférences pour des substituts végétaux à la viande en associant les outils de l'évaluation sensorielles à ceux de l'économie expérimentale. Ainsi les sujets dégustent des produits réels et s'expriment à leur sujet, puis ils sont soumis à des choix relatifs à ces produits (maintien de la consommation ou retour à leur produit habituel). Nos résultats montrent qu'un tiers des participants apprécie les substituts et qu'ils sont prêts à en renouveler la consommation.

**Mots clés :** *substituts à la viande, évaluation sensorielle, expériences de choix, produits réels*

### Abstract:

In a context of vegetablization of meals, a range of plant-based substitutes is developing that imitate the taste and nutritional properties of meat products. Moreover, the motivations to reduce the consumption of meat products or to replace them by plant-based substitutes are based on several arguments such as health, environment or animal welfare. Through two studies, we explore the preferences for plant-based meat substitutes by combining the tools of sensory evaluation with those of experimental economics. Thus, subjects taste real products and express themselves about them, then they are exposed to choices related to these products (maintaining consumption or returning to their usual product). Our results show that a third of the participants appreciate the substitutes and are ready to renew their consumption.

**Keywords:** *meat substitutes, sensory evaluation, choices experiment, real products*

# **Preferences & choices experiments with real products consumption: application with plant-based proteins.**

## **EXTENDED ABSTRACT**

People say that they are interested by meat reduction or meat substitution for many arguments: health, environmental and animal welfare. On this basis, firms explore new models and new supply (better meat or meat substitutes) in order to take, to keep or to increase market shares. But what consumers really do when they face to the real product? In a study with German, French and English meat consumers, Michel et al. (2021) compare expectations about taste, healthiness and environmental friendship of beef burger and two vegetable substitutes (pea and algae). These consumers expected that vegetable burgers are healthier and environmentally friendly but less tasty than beef burger.

A growing literature propose to study consumers preferences for meat substitutes that are close to meat attributes, as burgers, through choice experiments. Slade (2018) conduct a discrete choice experiment (DCE) with five burgers (natural beef, plant-based proteins, cultured meat, each organic or not organic). 65% of their participants prefer the natural beef. The alternatives are preferred by vegetarians, younger, educated people. They underline that women prefer the plant-based proteins (PBP). Van Loo et al. (2020) conduct a DCE with 4 burgers: natural beef, pea alternative, yeast alternative and cultured meat. They consider four treatments depending on informational context: no information, information on brand, information on environmental impact of meat and alternatives, and information on technologies used for alternatives and cultured meat. 72% of participants prefer natural beef. Information has a side effect: consumers quite the market (no choice). Alternatives are preferred by vegetarians, males, younger, educated peoples. Carlsson et al. (2021) conduct a choice experiment with 4 burgers: natural beef, plant-based proteins, meat-like, cultured meat. They first endow people with a natural beef hamburger and propose them to change for an alternatives, and ask what they do if the price will change. The price matter: participants switch from natural beef to alternatives at 2/3 of price. 50% of participants do not want cultured burger even if free. Environmental and health consciousness support substitution. Apostolidis and McLeay (2019) conduct a DCE on 500g of products with various attributes: fat content, carbon footprint, method of production, type of mince, brand, region of origin, price. They consider 3 groups of consumers: meat eaters, meat reducers, vegetarians. They observe that meat reducers have higher health than environmental motivations. They underline the importance to know more on empowerment and motivation of consumers for better targeted policies (price, information, campaigns, education, labels, etc.). The results of these works are based on hypothetical choices and hypothetical products. If in panels some products really exist, it is not the case for others.

Another growing literature includes real tasting with sensory evaluation and some valuation of products and information (purchase preference -PP-, willingness to buy -WTB-, willingness to pay -WTP-). Grasso et al. (2022) evaluate sensory dimensions of three burgers (100% beef, 100% plant-based, hybrid with 60% beef and 40% vegetables) and include WTB and WTP question (even if hypothetical). In a blind tasting condition, the hybrid product is largely preferred to the two others, and the score of linking increase a little with information about product. The plant-based burger is significantly less preferred in sensory evaluations, and in WTB and WTP evaluations. Martin et al. (2021) compare au pork-based sausage with a plant-based sausage in blind tasting and in tasting with packaging information. They introduce some health and environmental information too. They measure preferences, PP and WTP. The meat

is preferred to the vegetable substitute, but information from the packaging and information of health or environmental issues decrease the gap between the two products. The WTP with all the information are very close. Bazoche et al. (2021) study the substitution between a meat meal and a vegetarian alternative (with comparable products as couscous, chili or pasta) when introducing information about health and environment. At the first stage, before any information, between 15% and 21% of participants choose the vegetarian meal. In the third stage, after two waves of information, the shares of vegetarian choice are from 24% to 35%. Those who react the more are in the group receiving environmental information (a little less for the group with health information). The study identifies a share of population who are information sensitive but does not find a strong average effect of information on vegetarian choices. These results are strong arguments to include real products or real choices in studies in order to better understand the preferences for alternatives to meat consumption.

The studies we present include real products that consumers really eat. Our question is if consumers are ready to substitute their usual meat product by a plant-based proteins (PBP) product. The first study is based on a sensory evaluation and a choice experiment with the same products. The second study introduce the PBP product in a real context of consumption and a real choice between new product and usual product.

The two are conducted at home with real consumers for two reasons. First, we wish to get closer to the real context of consumption. Second, we adapt the design to the Covid-19 restrictions. All participants answer in an online questionnaire which guide them in the design. The participants are consumers of sliced products, take part of food purchases in their home. They could be omnivore or flexitarian (restricted-omnivore), but not vegetarians. The products tested are sliced products from meat or PBP. The two studies use methods from sensory evaluation and economic choices.

Study 1 is divided in two part. The first part is a sensory evaluation of various PBP products (experimental processed food) declined in two aromas and three forms (slices, dices, sticks). 6 samples are given to participants with a drive process. The tests of products are made at home following close laboratory instructions (blind tasting). Participants answered to three questions: (1) General liking of the product, (2) Appearance / color liking of the product, and (3) Open question on improvement on appearance / color. The second part is a discrete choice experiment. The decisions are hypothetical but based on the products subjects just ate. Three products presented: 2 slices of ham (pork), 2 slices of chicken, and 2 slices of plant-based proteins. Products could have five prices: 0.95€ / 1.07€ / 1.19 € / 1.31€ / 1.43€. The full design contains 243 choices. We use a reduction of 8 questions of choice between three options without opt-out option (participants are product consumers and they just test the plant-based product). 101 subjects from the Dijon area participated to this study in June 2020. They are 49% women and the average age is 42. They are selected for their meat reduction behavior. They could conduct this with various and multiple ways (multiple answers): 73.3% do not eat meat at each meal, 24.7% reduce the size of portions, and 20.8% do a day without meat.

Study 2 included the same product but only in slices of two aromas (experimental processed food). The first week of experiment, participants received a number of slices of the PBP based on their week habit consumption (multiples of two) through a drive. Participants are invited to consume the product as they do for their usual product. They follow the online instructions for questions: Description of the meal (photo), number of people, general liking (+ appearance, smell, meal), and have a choice about the product for the second week. The day of consumption, we ask them the following non hypothetical question: "For the week 2, do you prefer to receive

(at the drive) the same product (PBP) or do you prefer to receive your usual product?” (we have the information of the usual product, but for logistical reason we give them a gift card in supermarket). We add hypothetical question on what could change their choice. The second week, they receive the PBP product or their usual product (gift card). 166 subjects from Dijon area participated to this second study in December 2020. They are 55% women and the average age is 42 years. They are selected on their meat consumption (omnivore or restricted omnivore / flexitarian): 74.7% declare to have omnivore diet and 25.3% declare to have flexitarian diet.

We present the preliminary results of two studies on choices with plant-based meat-substitut which could be tasted by consumers (non-vegetarians). In study 1, after blind tasting of PBP, there is no significant reject of this kind of product when consumers have the choice. We observe a negative price effect, and a potential substitution between pork ham and PBP. In study 2, we observe the consumption of the PBP in a natural environment and choice between keep or quite. 38% keep the PBP product. Some additional characteristics (origin, organic or not, nutritional facts, environmental impact) could be of interest for consumers. We do not observe significant effects of traditional socio-demographics. In conclusion, even when the produce is consumed, a market exists, with flexitarians and with omnivores too.

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