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Membre de l'université Paris Lumières

École doctorale 396 : Économie, organisation, société
Laboratoire : EconomiX (UMR CNRS 7235)

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Conséquences des décisions alimentaires au sein de la famille : politiques publiques et normes sociales

Thèse présentée et soutenue publiquement le 14/11/2024
en vue de l'obtention du doctorat de Sciences économiques de l'Université Paris Nanterre
sous la direction de Mme Johanna Etner (Université Paris Nanterre)
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À ma famille.

Remerciements

Au terme de ce long voyage intellectuel, jalonné d'efforts, de doutes, de découvertes et d'émerveillements, je ressens le besoin impérieux d'écrire quelques mots insuffisants pour traduire la reconnaissance qui emplit mon cœur. Ce chemin, parsemé d'épreuves et d'éblouissements, n'aurait jamais été le même sans le concours bienveillant de celles et ceux qui, de près ou de loin, m'ont apporté leur soutien indéfectible et ont participé à l'aboutissement de ce travail. C'est à eux que je dédie ces quelques lignes, portées par la gratitude, l'affection, qui cherchent à traduire l'incommensurable.

Je tiens tout d'abord à exprimer ma profonde gratitude à mes directrices de thèse, Johanna Etner et Noémi Berlin, pour leur encadrement exceptionnel tout au long de ces cinq années. De la rédaction de mon mémoire de Master 2 à la finalisation de ma thèse, vous avez toujours été présentes pour m'orienter dans mes recherches. Vous avez été pour moi bien plus que des encadrantes académiques. Par votre disponibilité, vos conseils avisés, votre écoute patiente, votre suivi attentif, et surtout, votre soutien moral sans faille, vous avez su transformer mes doutes en certitudes et mes hésitations en résolutions. Je vous suis infiniment reconnaissant pour la confiance que vous m'avez accordée, pour vos mots d'encouragements et vos orientations qui m'ont permis de surmonter les moments de doute et d'incertitude où je me sentais perdu dans mes travaux de recherche. Votre encadrement bienveillant a été une lumière dans les moments les plus sombres, et pour cela, je vous exprime ma plus profonde gratitude.

Je remercie également tous les membres du jury qui m'ont fait l'honneur d'accepter

d'évaluer mon travail. Je remercie Paolo Crosetto et David Crainich d'avoir accepté la tâche de rapporter ma thèse. Un grand merci également à Sabrina Teyssier d'avoir accepté d'être examinatrice dans mon jury après m'avoir prodigué des conseils sur mes travaux pendant les comités de suivi de thèse. Enfin, j'exprime ma reconnaissance à Phu Nguyen Van pour avoir accepté de présider le jury de ma thèse. Merci pour l'honneur que vous me faites d'avoir consacré votre temps et votre énergie à cet exercice.

Mes remerciements s'étendent aussi à l'autre membre de mon comité de suivi de thèse Lisette Ibanez. Vos conseils et vos suggestions ont été d'une aide précieuse et m'ont permis de prendre le recul nécessaire pour mieux cerner les contours de mes recherches. Votre accompagnement a été précieux, et je vous en suis profondément reconnaissant.

J'exprime toute ma reconnaissance à mes co-auteurs, Noémi et Tarek Jaber-Lopez, avec qui j'ai eu la chance de collaborer. Nos échanges ont été sources d'enrichissement et m'ont permis d'explorer de nouvelles perspectives. Je vous remercie pour votre disponibilité et tout ce temps que vous m'avez accordé lors de nos réunions. Un mot particulier pour Tarek, merci d'avoir eu l'idée d'évoquer la Cité des sciences et de l'industrie pour notre expérience au moment où j'étais sur le point de l'abandonner.

Je voudrais également adresser un remerciement tout particulier à Paolo Melindi-Ghidi et Olivier Kayser pour votre implication dans la discussion de mon premier chapitre en séminaire doctorant. Un grand merci également à Olivier Renault et Ludovic Julien pour tout le temps que vous avez consacré pour discuter de mes travaux. Vos suggestions et votre bienveillance ont permis d'affiner mon travail, de le rendre plus solide et plus abouti.

Mes mots de remerciements vont également aux différents membres d'EconomiX. Un grand merci aux dirigeants du laboratoire Nadine Levratto et Saïd Souam pour l'environnement propice à la réflexion et à l'épanouissement que vous avez su créer.

Je souhaite aussi adresser un grand merci à l'ensemble de l'équipe enseignante ainsi que toute l'équipe administrative pour leur investissement. Je remercie en particulier Abdou, pour mes problèmes informatiques, et Frédéric, pour son accueil chaleureux et son aide dans les tâches administratives.

Je me tourne maintenant vers les doctorants et docteurs du laboratoire d'Economix, avec qui j'ai eu à interagir dans un cadre de vie agréable, et qui ont rendu ces années de doctorat plus plaisantes. Je souhaite tout d'abord commencer par remercier ces généreux collègues qui ont sacrifié leurs weekends pour m'aider à mener mon expérience à la cité des sciences et de l'industrie. Je veux nommer mes anciens collègues doctorants et maintenant docteurs : Harouna, Capucine, Fanny, Maria, Mathilde, Morel, ainsi que mes collègues doctorants et très prochainement docteurs : Emmanuelle, Claire, Guibril, Pascal, Olivier et Daniela. Sans vous, la réalisation de cette expérience cruciale pour ma thèse n'aurait pas été possible, je veux vous dire ici, combien je vous suis très reconnaissant. Cette expérience, bien plus qu'un simple chapitre de cette thèse, restera pour moi un souvenir vibrant de camaraderie et de solidarité. J'en profite pour remercier Arnaud Fougeres qui a été le premier à m'accompagner sur le terrain pour la réalisation de cette expérience. Merci beaucoup Arnaud d'avoir accepté de vivre avec moi cette journée de galère à la Défense.

Je remercie chaleureusement mes collègues du bureau 602, et même si je me répète en mentionnant certains prénoms, c'est tout simplement parce que vous avez joué un rôle crucial dans l'aboutissement de ma thèse. Merci à la capitaine Mathilde (la plus drôle) pour ton accueil chaleureux à mon arrivée au bureau et la relecture. Merci à Claire pour ta bonne humeur et ta blague avec la clef du PULV et à tes complices, Mathilde, Maria, Fanny (qui jusque-là était la plus sage), Emma et le président fondateur Morel qui, après avoir tout vu, a opté pour un silence d'innocent. À Claire et Maria, j'ai toujours le souvenir de ces beaux moments passés ensemble lors de nos conférences. À la forte Emmanuelle Faure, merci pour l'affinité spéciale qui s'est développée entre nous à la fin de nos thèses. À toi Morel, merci de m'avoir

aidé plusieurs fois à mieux comprendre mes lignes de codes Stata et pour la mise en forme de la thèse. Un grand merci également à Djeneba, celle qui bosse sans cesse, pour tes conseilles, ton aide précieuse avant les vacances d'été et la relecture. Merci à toi également Daniela pour ces bons moments passés ensemble, ta joie et tes blagues de tous les jeudis. J'exprime également ma gratitude à Olivier, Thomas, Albin et monsieur l'élu, Aswin, pour toute la joie et la bonne humeur que vous m'avez procurée. Vous avez été pour moi bien plus que des compagnons de travail. Vous avez été des amis, des confidents, des sources d'inspiration et de réconfort. Nos échanges, nos rires et nos discussions m'ont apporté une richesse humaine inestimable. Un petit mot pour les nouveaux Corin, Clara et Eliot, je vous souhaite la bienvenue et surtout beaucoup de courage. Mes remerciements vont ensuite vers nos collègues, voisins, du bureau 601 : Lorenzo, Jocelyne, Pablo, Tanguy, Michael, Nabil, Pauline, Souleymane et Benjamin. Et pour finir avec ces bureaux des doctorants du sixième étage, je remercie les anciens que j'ai trouvé sur le point du départ : Dalia, Axel, Florian et mes deux professeurs de TD Chouaib et Joseph. Je tiens aussi à remercier les autres doctorants pour ces moments passés ensemble et avec qui j'ai créé des beaux souvenirs : Pascal, Kadiatou, Maxime et Baptiste. Une mention spéciale à mon collègue, mon ami et mon frère Guibril Zerbo. Je ne sais pas ce que j'aurais fait sans toi. Notre rencontre n'a point été un hasard. De ton partage de note de cours au Master 1, qui m'a permis de rattraper mon arrivée tardive, aux travaux de groupe du Master 2, tu as toujours été généreux et bienveillant. Avec toi, j'ai su transformer les jours de labeur en moments de partage, les doutes en défis collectifs, et les réussites en victoires partagées. Ton soutien, nos rires, et les discussions passionnées que nous avons eues autour des repas au Crous ou lors de nos pauses bien méritées ont fait de ce parcours une aventure humaine des plus enrichissantes. Merci pour ton amitié, pour ta générosité, et pour la chaleur de ta présence. Je tiens à exprimer ma gratitude envers tous les autres doctorants du troisième et du deuxième étage que je n'ai pas pu mentionner ici. J'en profite pour remercier mes camarades de Master : Djéné,

Mouctar, Laura, Ndeye, Sylvie, Yacine et Orlane.

Je tiens également à exprimer ma gratitude la plus sincère à Amdy Moustapha Fall et Sadibou Sarr qui ont eu la gentillesse de m'accueillir en France pour la poursuite de mes études. Sans votre soutien et votre hospitalité, cet accomplissement n'aurait jamais été possible. Votre générosité et votre aide m'ont permis de surmonter les défis et de me concentrer pleinement sur mes études. Merci du fond du cœur d'avoir rendu ce rêve réalisable.

Un grand merci aux doyens Birama Barry, Mansour Diouf et Mamadou Sow qui m'ont accueilli à l'Université Paris Nanterre, avec qui j'ai partagé tant de bons moments. Votre amitié a été une source de joie et de soutien tout au long de ce parcours. Je remercie aussi Mamadou Ndour, pour la relecture, ainsi que tous les anciens et actuels membres de l'Amicale des Etudiants Sénégalais de Nanterre. Votre solidarité, votre camaraderie, et notre esprit d'entraide ont été inestimables, faisant de cette aventure bien plus qu'une simple expérience académique. Merci à vous tous pour ces précieux souvenirs et pour l'énergie positive que vous avez apportée à chaque étape.

En évoquant la chaleur de la présence, il m'est impossible de ne pas tourner mes pensées vers l'autre côté de la Méditerranée, où tout a commencé. Je souhaite exprimer mes remerciements les plus chaleureux et profonds à toute la population de LOUL SESSENE, qui m'a vu grandir et évoluer. C'est là, dans ce village aux valeurs de solidarité, de respect et de travail, que j'ai puisé mes premières inspirations et forgé les bases de mon parcours académique. Vos encouragements m'ont donné la force de persévérer et de surmonter les défis que j'ai rencontrés au cours de mes études. Un merci tout particulier à celles et ceux de mon quartier, SASS ESCALE, où chaque visage, chaque sourire et chaque geste de soutien ont contribué, d'une manière ou d'une autre, à la personne que je suis devenue aujourd'hui. Vous avez été une véritable famille pour moi, et je n'oublierai jamais vos conseils bienveillants qui ont été pour moi une source de motivation inestimable dans les moments de doute. À mes

amis d'enfance, amis et camarades de l'école élémentaire, du collège et du lycée, trop nombreux pour être tous cités ici, vous avez été une source constante de soutien et de joie. Merci pour ces années partagées, pour ces souvenirs que je chéris, et pour ces liens qui, je l'espère, dureront encore longtemps. J'adresse un grand merci aux élèves de la TS2 de 2014 du côté du lycée mixte Blaise Sène de LOUL SESSENE, pour cette belle année d'aventure. Vos présences ont façonné mon parcours et enrichi mon expérience de manière inestimable. Une mention spéciale aux deux autres membres du trio inséparable qui a traversé les années et les étapes de la vie Ousmane Made Diouf, l'homme du président, et Abdou Diouf, le président. À vous deux, qui avez été bien plus que des amis, merci pour votre amitié indéfectible et pour ces innombrables moments partagés, où complicité et soutien étaient nos maîtres mots.

Mon parcours académique m'a offert la chance d'avoir des professeurs qui, par leur passion et leur dévouement, m'ont transmis bien plus que des savoirs académiques. Je pense tout d'abord à mes deux enseignants de l'école primaire, Mme Mariama Faye et M. Dominique Manga, qui ont été les premiers à m'initier aux joies de l'apprentissage. Ensuite, je souhaite également remercier chaleureusement tous les professeurs qui m'ont formé, au collège et au lycée, devenus lycée mixte Blaise Sène de LOUL SESSENE. Une forte pensée pour mon professeur de mathématique, de la quatrième à la première, M. Alioune Ndiaye pour cet esprit d'investissement personnel dans les études que vous m'avez inculqué. J'ai toujours le souvenir de vos termes préférés : rapidité, efficacité et courage, et de cette interdiction d'avoir une note inférieure à 15/20 aux évaluations. Vous m'avez préparé à affronter les défis de la vie académique avec confiance et rigueur, et je vous en suis profondément reconnaissant. Enfin, je tiens à exprimer ma reconnaissance aux professeurs de l'Université Cheikh Anta Diop de Dakar (UCAD) et ceux de l'Université Paris Nanterre. À celles et ceux de Dakar, vous avez nourri mon esprit critique et élargi mes horizons intellectuels. À celles et ceux de Paris Nanterre, vous avez guidé mes derniers pas sur ce chemin académique, m'accompagnant jusqu'à l'aboutissement de ce parcours. Votre soutien

et vos enseignements ont été essentiels à ma formation et à ma réussite. J'en profite pour remercier les amis et copains de l'UCAD avec qui j'ai été très proche : Mamadou Sène, Birame Senghor, Abdoulaye Diagne, Mamadou Thiaw, Ibrahima Sarr, Saliou Thiaw, Ngor Diop, Mbaye Thiaw, Aliou Dieng, Dome Ndour, Waly Dieng, Moussa Ngom, Mouhamed Ndiaye, Mouhamadou Lamine Faye (Lemzo), Baye Faye, Mamadou Padane (Messi), Amath Kébé, Papis Badiane, Omar Diop (Cristiano), Sorry Diallo, Thierno Cissé, Amadou Diallo (Douma), Michel Ndour, Birame Diouf, Thierno Diallo et tous les autres que je n'ai pas pu citer. Mention spéciale aux copains de la FASEG : Cheikh Ndofène, Birama (Bira), Aliou et Mame Mbathiou pour ces beaux moments passés ensemble.

Pour finir, je tiens à exprimer ma profonde gratitude et mon amour infini à ma famille, qui a été ma source de force et de réconfort tout au long de ce parcours. À mes sœurs : Madeleine Daba, Marie Salane, Anne Marie Codou, Daba Ndofane, Amy, Diambal, Jeannette (Bineta), Awa Loul, Marie Odile Ndébane, Fatou Thiaré, Sokhna, Ndéo Awa, Ndeye Mayé et Mariama ; à mes frères : Gilbert Mignane, Louis Waly, Alphonse Birame, Abdoulaye Ngor, Ousmane Ndane et Aliou Mbissane, et à mes cousins et cousines avec qui j'ai grandi : Omar Mbouya, Gorgui Mack, Seynabou, Assane Khoury et Aliou Khabane. Aux épouses de mes frères et cousins : Germaine (Seynabou), Yandé Dione, Daba Ndiaye, Jacqueline Dione, Hélène Awa et Yandé Ndour. Sans oublier ces petits que j'ai vu grandir dans cette fameuse maison, « mbine Diaga » : Jean Noël, Sékène, Nephtalie Fatou Ndour, Jacques Moundor, Louis Korate, Abdoulaye (Abou), Yandé, Soda, Madeleine (Mado), Marie Ngouda, Coumba, Daba, Ismaila, Salane, Amy, Sara, Ndiambal, Birame, Robert Diaga, Makane et Ndébane. Mention spéciale à mon homonyme, Moustapha Sarr junior, grandis en âge et en sagesse, mon petit. On est une belle et grande famille et je suis très fier de vous. Votre soutien, vos encouragements, et la joie que vous avez apportée dans ma vie ont été des sources de motivation. Vous avez toujours été là pour moi, et je suis honoré de pouvoir partager cette réussite avec vous. Je veux aussi dire un grand merci à

ma tante Thérèse Diouf, « ya mack ». Tu as toujours été là, une présence douce et rassurante avec un sourire illuminant et bienveillant.

Je tiens à rendre un grand hommage particulièrement émouvant à mon père, dont l'absence est une présence qui me suit à chaque pas. Diaga Sarr de son vrai nom, *babe* (papa) pour nous, et pour d'autres, *babe Mack*, *Tokor*, Diaga Sarr, *Fap Koumakh*, *Pa Diaga*, *Diaga Yaly*, *Diaga Ndéfaye* ou *Diaga Khawa*, ta générosité a fait que chaque génération a trouvé sa propre façon de t'appeler. Ta mémoire est vivante en moi, chaque jour et à chaque instant. J'aurais tant aimé que tu sois là pour partager ce moment avec moi, pour voir ce que ton amour et tes enseignements ont permis d'accomplir. Ta sagesse, ta bonté et les valeurs que tu m'as inculquées sont les pierres angulaires de cette réussite. C'est en ton honneur, et avec une profonde émotion, que je te dédie ce travail, toi qui m'as toujours guidé. Je prie pour le repos de ton âme.

Enfin, je souhaite exprimer ma gratitude la plus profonde et mon amour éternel à ma maman, Aissatou Sylla, « ya Ayou », pour tous les sacrifices que tu as faits pour moi. Tu as toujours été mon pilier, mon refuge et mon premier soutien à travers tes encouragements et tes mots doux et réconfortants. Tu as su, par ton amour inconditionnel, me donner la force d'avancer, même dans les moments les plus difficiles. Tes sacrifices, tes prières et ton regard bienveillant m'ont accompagné à chaque instant. C'est avec une infinie gratitude que je te dédie ce travail.

Cette thèse, je la dédie à la mémoire de mon père, qui restera à jamais dans mon cœur, à ma mère, ma tante, et mes neveux, Alphonse Ndour, Ibrahima Sène, Alphonse Sagne, Paul Virgile Ndour, Ousmane Cissé, Ibrahima Ngom et Grégoire Thiaré, et mes nièces, Marianne Ndour, Monique Sène, Marie Berthe Sagne, Christine Ndour, Aissatou Ngom et Marème Ngom, ainsi qu'à toute ma précieuse et bien aimée famille.

RÉSUMÉ

Cette thèse étudie l'efficacité de différents instruments de politiques publiques visant à promouvoir une alimentation « saine » dans l'environnement familial. Le premier chapitre évalue théoriquement l'efficacité d'une taxe sur la consommation de bien « malsain » et d'une politique mixte, employant un nudge en soutien à la taxe, sur les choix alimentaires des parents. Nous trouvons qu'une politique de taxation ciblée permet d'atteindre l'optimum de premier rang. Ce chapitre révèle également que la politique mixte permet d'atteindre l'optimum de premier rang tout en fixant un seul niveau de taxe. Le deuxième chapitre s'intéresse à l'impact d'une norme descriptive et d'une information d'opinion sur les croyances des parents ainsi que sur leurs choix alimentaires pour eux et les enfants. En utilisant une expérience de type "*lab-in-the-field*", nous trouvons que seule la norme descriptive réduit significativement la tendance des parents à surestimer la qualité nutritionnelle des aliments. De plus, nous trouvons que la norme descriptive et l'information d'opinion améliorent significativement la qualité nutritionnelle des paniers des parents mais que seule l'information d'opinion améliore significativement la qualité nutritionnelle des paniers pour les enfants. Le troisième chapitre étudie théoriquement l'impact du décideur public sur la dynamique des préférences alimentaires en supposant qu'il existe des préférences « saines » et « malsaines ». Nous trouvons que le mécanisme de transmission des préférences conduit à une population hétérogène où les préférences « malsaines » persistent. Nous montrons que des interventions publiques comme la fourniture d'un bien public et la mise en place d'un programme d'éducation nutritionnelle, font converger la distribution des préférences vers une population homogène avec des préférences « saines ».

Mots clés : *choix alimentaires, préférences alimentaires, environnement familial, perceptions, croyances, normes sociales, transmission intergénérationnelle, politiques publiques.*

ABSTRACT

This thesis studies the effectiveness of different public policy instruments designed to promote healthy eating in the family environment. The first chapter theoretically assesses the effectiveness of a tax on the consumption of an unhealthy good and of a mixed policy, using a nudge to support the tax, on parents' food choices. We find that a targeted tax policy can achieve the first-best optimum. This chapter also reveals that the mixed policy can achieve the first-best optimum while setting only one tax level. The second chapter focuses on the impact of a descriptive norm and opinion information on parents' beliefs and their food choices for themselves and children. Using a lab-in-the-field experiment, we find that only the descriptive norm significantly reduces parents' tendency to overestimate the nutritional quality of food items. Moreover, we find that both the descriptive norm and opinion information significantly improve the nutritional quality of parents' baskets, but only the opinion information significantly improves the nutritional quality of children's baskets. The third chapter theoretically examines the impact of the public decision-maker on the dynamics of food preferences, assuming that there are healthy and unhealthy preferences. We find that the preference transmission mechanism leads to an heterogeneous population where unhealthy food preferences persist. We show that public interventions, such as providing a public good and implementing a nutritional education program, allow the distribution of preferences to converge towards an homogeneous population with healthy food preferences.

Keywords: *food choices, food preferences, family environment, perceptions, beliefs, social norms, intergenerational transmission, public policies.*

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Introduction générale

0.1 Contexte et enjeux de la thèse

0.1.1 Contexte

La prévalence de l'obésité et du surpoids [1] a augmenté de façon conséquente au cours de ces dernières années dans les pays développés et en développement (Figure 0.1). En 1986, l'obésité et le surpoids constituaient un problème essentiellement dans les pays industrialisés (Figure 0.2). Aujourd'hui, cela concerne la planète toute entière (Figure 0.3). Selon l'Organisation mondiale de la santé [2] (OMS), en 2022, 43 % des adultes de 18 ans et plus étaient en surpoids et environ 16 % des adultes de 18 ans et plus étaient obèses. Entre 1990 et 2022 [3], le pourcentage d'enfants et d'adolescents (5 – 18 ans) obèses a été multiplié par quatre, passant de 2 % à 8 % à l'échelle mondiale et celui des adultes (18 ans et plus) obèses a plus que doublé, passant de 7 % à 16 %. Selon l'OCDE (2019), dans 34 sur 36 pays de l'Organisation de Coopération et de Développement Économiques (OCDE), plus de la moitié de la population est en surpoids et près d'une personne sur quatre est obèse. Le taux moyen d'obésité chez les adultes dans les pays de l'OCDE est passé de 21 % en 2010 à 24 % en 2016 (OCDE, 2019). La France, bien qu'étant parmi les pays d'Europe avec un taux de surcharge pondérale (obésité et surpoids) en dessous de 50 % de la population, n'est pas épargnée par cette tendance. Les données provenant de l'enquête Obépi-Roche de la Ligue contre l'obésité montrent que la prévalence du surpoids et de l'obésité a nettement augmenté entre 1997 et 2020 (Fontbonne et al., 2023). Plus précisément, le taux de surcharge pondérale est passé de 38,3 % en 1997 à 47,3 % en 2020 chez les adultes. En 2020, chez les enfants de 2 à 7 ans, 34 % étaient en surpoids ou obèses et 21 % des enfants de 8 à 17 ans étaient en surpoids ou obèses. Cette tendance à la hausse du taux de prévalence de l'obésité et du surpoids dans le monde et surtout

1. « Le surpoids et l'obésité se définissent comme une accumulation anormale ou excessive de graisse corporelle » (OMS). L'outil d'évaluation standard est l'IMC, Indice de Masse Corporelle qui est égal au poids divisé par la taille au carré (poids en kg/ (taille en m)^2).
2. https ://www.who.int/fr/news-room/fact-sheets/detail/obesity-and-overweight.
3. https ://www.who.int/fr/health-topics/obesity.

chez les enfants est préoccupante pour plusieurs raisons. D'abord, les enfants obèses ont plus de chances de le rester à l'âge adulte (Simmonds et al., 2016) et risquent davantage de souffrir de maladies non transmissibles (MNT) à l'âge adulte. L'obésité est associée à de graves problèmes de santé tels que le diabète de type 2, l'hypertension artérielle, les maladies cardiovasculaires et les maladies articulaires (Mathieu-Bolh, 2024; Grover et al., 2015). Elle entraine également une réduction de l'espérance de vie. Grover et al. (2015) estiment le nombre d'années de vie perdues à 8 ans pour les individus avec une obésité sévère ou morbide.

FIGURE 0.1 – Évolution du pourcentage d'adultes en surpoids ou obèses entre 1986 et 2016

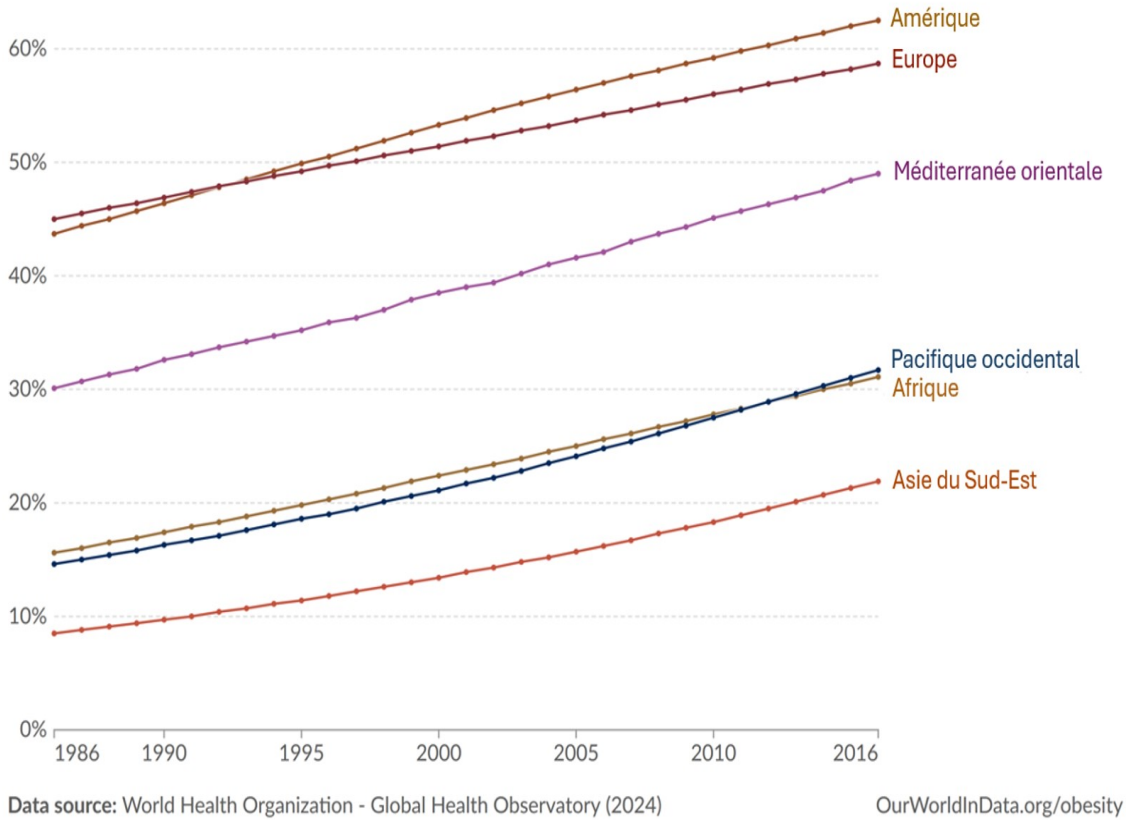


FIGURE 0.2 – Proportion d'adultes en surpoids ou obèses dans le monde en 1986

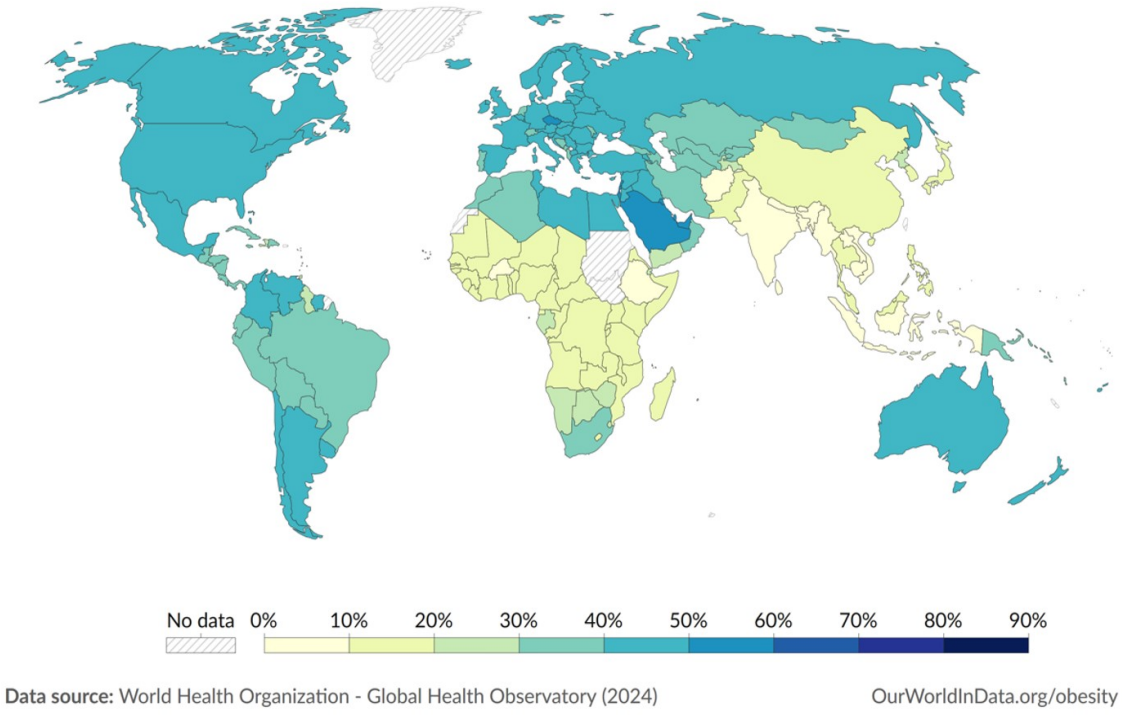
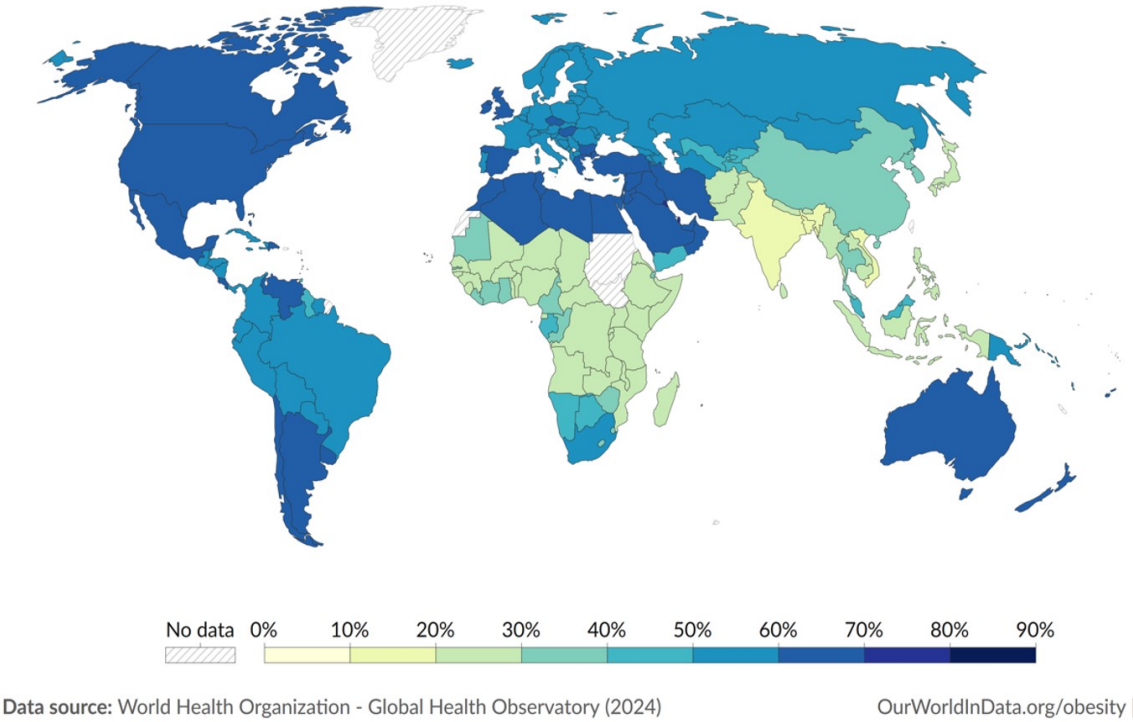


FIGURE 0.3 – Proportion d'adultes en surpoids ou obèses dans le monde en 2016



En plus d'être un problème de santé publique, l'obésité constitue un fardeau pour l'économie des pays. En effet, l'obésité a des effets négatifs importants sur l'économie des pays en raison des coûts élevés de traitement des patients atteints de maladies chroniques qu'elle engendre, ainsi que des coûts indirects liés à la perte de productivité et au départ à la retraite anticipée. L'OCDE (2019) souligne que les pays de l'OCDE consacreront environ 8,4 % de leur budget total de santé au traitement des maladies liées à l'obésité entre 2020 et 2050. Cela équivaut, en tenant compte de la parité de pouvoir d'achat (PPA), à environ 311 milliards de dollars par an. En France [4], en 2023, la prise en charge de l'obésité et de ses complications représentait un coût de 10,6 milliards d'euros par an pour l'assurance maladie, les organismes complémentaires et les entreprises. L'obésité engendre également des coûts économiques liés à la réduction de la productivité de la main-d'œuvre et du capital humain. L'OCDE (2019) estime, les pertes de productivité dues à l'obésité en raison de ses effets sur l'absentéisme, le présentéisme, les retraites anticipées et l'emploi à 863 dollars PPA en moyenne par travailleur obèse et par an dans les pays de l'OCDE. En France, Caby (2016) estime le coût de l'obésité lié aux pertes de productivité (absentéisme et exclusion du marché de travail) à 6,2 milliards d'euros. De plus, le traitement de l'obésité entraine des coûts sociaux assimilables à des externalités négatives. Le fardeau de la prise en charge des personnes obèses affecte les individus non obèses sous la forme d'une augmentation de leurs impôts qui financent le système sanitaire. Caby (2016) évalue le coût social de l'obésité et du surpoids à 20,4 milliards d'euros en majorant son effet sur les dépenses publiques d'un coefficient qui correspond au coût d'opportunité pour l'économie de lever des prélèvements obligatoires qui se traduit par une perte sèche en termes de bien-être collectif.

Au-delà de ces coûts économiques directs, l'obésité a également des répercussions sur les résultats scolaires et la qualité de vie. Selon l'OCDE (2019), les enfants ayant un poids normal ont 13 % de chances de plus de réussir à l'école et d'achever des

4. Asterès – L'obésité en France : un coût de 10,6 Mds€ par an pour la collectivité – mars 2023.

études supérieures. De leur côté, les enfants souffrant d'obésité sont moins satisfaits de leur vie et sont jusqu'à 3,8 fois plus susceptibles d'être victimes de brimades, ce qui peut contribuer à réduire leurs résultats scolaires. Les moins bons résultats scolaires des enfants obèses ont une incidence négative sur leur niveau d'étude et donc leur type d'emploi et leur revenu à l'âge adulte, voire sur le capital humain des pays. L'obésité et ses conséquences affectent la productivité des individus ainsi que leur participation à la vie active et au marché du travail. Les études empiriques montrent que l'obésité a un effet négatif sur les salaires et entraine des discriminations sur le marché de l'emploi (Kesaite and Greve, 2024; Pekkurnaz, 2023; Viinikainen et al., 2022; Campos-Vazquez and Gonzalez, 2020; Johar and Katayama, 2012). À cela, s'ajoute les symptômes de dépression ou d'anxiété, la stigmatisation et le harcèlement dont les personnes obèses peuvent subir, faisant donc de l'obésité un véritable défi pour les décideurs publics.

La lutte contre l'obésité nécessite tout d'abord l'identification de ses causes. Les causes de l'obésité sont multifactorielles. L'obésité est due à des facteurs génétiques, physiologiques, environnementaux, psychologiques, sociaux et économiques (Wright and Aronne, 2012). Entre autres, l'obésité est due à un déséquilibre entre l'apport énergétique et la dépense d'énergie (Hill et al., 2012). C'est pourquoi il est important de considérer l'amélioration des régimes alimentaires dans la lutte contre l'obésité puisque l'apport énergétique provient de l'alimentation (Abdel-Hamid, 2002). Selon le rapport de la Global Burden of Disease, une mauvaise alimentation est associée à un décès sur cinq dans le monde, soit au moins 11 millions de morts et 255 millions années de vie corrigées de l'incapacité (AVCI [5] ou « DALY » en anglais) par an (Afshin et al., 2019). La mauvaise alimentation constitue l'un des principaux facteurs de risque d'un éventail de maladies chroniques, notamment les maladies cardio-vasculaires, le cancer, le diabète et d'autres affections liées à l'obésité. L'alimentation « malsaine »

5. Un AVCI représente la perte de l'équivalent d'un an de santé. Les AVCI pour une maladie ou un état de santé sont la somme des années de vie perdues dues à la mortalité prématurée et aux années de handicap en raison des cas prévalents de maladie ou d'état de santé dans une population (OMS)

est considérée comme l'une des principales causes de l'augmentation de l'obésité et du surpoids. Les études empiriques suggèrent que l'alimentation « malsaine » favorise la prise de poids et augmente le risque d'obésité et de surpoids à la fois chez les enfants, les adolescents et les adultes (Costa et al., 2018; de Deus Mendonca et al., 2016; da Costa Louzada et al., 2015; Malik et al., 2013; Cho et al., 2011). De plus, une amélioration de la qualité de l'alimentation permet de réduire la prise de poids (Fung et al., 2015).

0.1.2 Problématique

Les questions de l'alimentation des enfants constituent une préoccupation majeure des pouvoirs publics, en raison d'un lien fort entre les régimes alimentaires « malsains » et la montée de l'obésité et du surpoids chez les enfants et de la persistance de l'obésité de l'enfance à l'âge adulte. Ainsi, des programmes visant à sensibiliser les enfants et à les aider à acquérir de bonnes habitudes alimentaires sont mis en place commele programme *éducation à l'alimentation et au goût*[6]. Une habitude alimentaire peut être définie comme le choix récurrent que fait une personne, ou un ensemble de personnes, quant aux aliments qu'elle consomme, à la fréquence de leur consommation et à la quantité absorbée à chaque consommation. Il existe de nombreux instruments de politique publique ciblant les régimes alimentaires, telles que les taxes nutritionnelles, les campagnes d'information et les labels alimentaires. Toutefois, il est difficile d'obtenir un changement durable des habitudes alimentaires (Belot et al., 2016). Or, la littérature montre que les habitudes alimentaires s'établissent de façon précoce (Nicklaus, 2016; Birch, 1999) et que celles acquises dès le plus jeune âge et à l'adolescence perdurent jusqu'à l'âge adulte (Nicklaus, 2016; Lien et al., 2001). Belot and James (2022) mettent en évidence que les interventions ciblant les enfants sont les plus susceptibles d'avoir des effets à long terme. Belot et al. (2024), en évaluant la malléabilité des habitudes alimentaires dès le plus jeune âge,

6. https ://www.education.gouv.fr/education-l-alimentation-et-au-gout-7616.

constatent des changements dans l'alimentation des enfants (notamment une diminution de la consommation de sucre ajouté), mais peu de changement chez les parents. Les auteurs soulignent que les parents ajustent leurs achats pour limiter l'accès des enfants aux aliments « malsains », sans pour autant changer leurs propres habitudes alimentaires.

Ces études suggèrent que pour changer les comportements alimentaires, il est plus efficace de cibler les enfants plutôt que les adultes. C'est l'une des raisons pour lesquelles de nombreuses interventions ciblent les enfants, via notamment l'environnement scolaire. Toutefois, il est important de noter que la formation des habitudes alimentaires des enfants est à la fois influencée par l'environnement scolaire et l'environnement familial (Litchford et al., 2020; Micha et al., 2018; Scaglioni et al., 2018). Les interventions visant à améliorer les habitudes alimentaires des enfants en milieu scolaire se font via les cantines scolaires ou par la régulation du type de nourriture accessible à l'école. Cependant, la mise en place de politiques publiques visant à changer les comportements alimentaires au sein de l'environnement familial et dans la société est plus complexe. Pour améliorer les régimes alimentaires des enfants, un défi pour les décideurs publics consiste à déterminer le type de politique qui serait efficace pour favoriser la formation d'habitudes alimentaires « saines » dans l'environnement familial.

Cette thèse s'inscrit dans l'optique des politiques de prévention des problèmes de santé liés à l'alimentation comme l'obésité ou le surpoids chez les enfants. L'objectif principal est d'étudier l'efficacité de différents instruments de politiques publiques visant à promouvoir l'alimentation « saine » au sein de l'environnement familial. Dans le premier chapitre, nous présentons un modèle théorique qui traite de la question de l'efficacité des politiques de taxation des aliments « malsains » et d'usage des nudges dans l'amélioration des régimes alimentaires au sein de la famille. Dans le deuxième chapitre nous étudions, à travers une expérience de type « lab-in-the-field », l'influence des normes sociales sur les croyances et les choix alimentaires des parents,

pour eux-mêmes et pour les enfants. Enfin, dans le troisième chapitre nous faisons une analyse théorique de la transmission intergénérationnelle des préférences alimentaires. Nous considérons dans cette thèse des facteurs susceptibles d'influencer les choix alimentaires des parents, tels que leurs perceptions des effets de l'alimentation sur la santé, leurs croyances sur la qualité nutritionnelle des aliments, l'existence de normes sociales et la parenté qui existe entre celui qui fait les choix alimentaires et l'enfant. Nous nous intéressons également aux pratiques alimentaires parentales qui peuvent engendrer la persistance des habitudes alimentaires « malsaines ». De plus, cette thèse repose sur une pluralité méthodologique, utilisant à la fois des modélisations de la théorie de la décision et une approche expérimentale pour étudier les choix et pratiques alimentaires des parents. En alliant différentes méthodologies, cette thèse contribue à la compréhension des facteurs influençant les choix et pratiques alimentaires des parents et met en exergue des instruments de politiques publiques pouvant permettre d'orienter leurs choix et d'améliorer les régimes alimentaires au sein de l'environnement familial.

Les choix alimentaires des parents résultent d'un processus décisionnel. En effet, les parents décident du type d'aliment et de la quantité de celui-ci à se procurer. Dans un foyer, ces décisions sont généralement prises pour tous les membres de la famille. Toutefois, les choix alimentaires des parents ne restent pas sans conséquences. Dans cette thèse, nous évoquons les conséquences économiques de ces choix, induites par une détérioration de la santé, du point de vue de l'enfant. D'une part, à partir de modèles théoriques, nous proposons des outils pouvant permettre de rationaliser ces choix. La théorie de la décision [7] nous permet de pouvoir formaliser le processus décisionnel des parents. Nous formalisons les décisions des parents comme un problème d'optimisation sous contrainte. Plus précisément, les parents cherchent à maximiser leur bien-être ou celui de la famille tout en tenant compte de certaines

7. « *La théorie de la décision se fonde sur un ensemble de descriptions des problèmes de décision à partir desquelles des analyses cohérentes peuvent être menées ; elle propose des principes sur lesquels des critères de sélection sont construits et des solutions seront proposées* » (Kast, 1993).

contraintes, telles que les ressources financières disponibles et la distribution des préférences alimentaires dans la population. Ces modélisations nous permettent d'analyser l'optimalité des choix résultant de ces prises de décision à la fois du point de vue individuel et collectif. Ces modélisations théoriques nous permettent également d'introduire des instruments de politiques publiques dans l'économie considérée afin d'identifier leurs impacts sur les décisions des parents et d'évaluer leur efficacité dans l'objectif d'obtenir des choix alimentaires optimaux. D'autre part, nous utilisons une démarche expérimentale pour étudier ces mêmes décisions alimentaires dans un contexte moins simplifié de la réalité que la modélisation théorique. Cette démarche s'appuie sur les avancées scientifiques du domaine de l'économie comportementale. Cette expérimentation nous permet d'étudier l'influence des normes sociales sur les décisions alimentaires des parents afin de tester des hypothèses plus « réalistes » et de faire des prédictions plus précises des comportements individuels et de l'efficacité des politiques publiques.

0.2 Problèmes de santé liés à l'obésité

La tendance à la hausse de la prévalence de l'obésité dans le monde et surtout chez les enfants est préoccupante puisqu'elle est persistante de l'enfance à l'âge adulte et engendre de nombreuses complications sanitaires.

En effet, les enfants obèses le restent généralement à l'âge adulte (Woo et al., 2020). La probabilité qu'un enfant obèse avant la puberté le reste à l'âge adulte varie entre 20 et 50 %, cette probabilité atteint 50 à 70 % s'il est obèse après la puberté [8]. Dans leur revue systématique et leur méta-analyse, Simmonds et al. (2016) observent que les enfants et les adolescents obèses sont environ cinq fois plus susceptibles d'être obèses à l'âge adulte que ceux qui ne l'étaient pas. Ils trouvent également qu'environ 55 % des enfants obèses restent obèses à l'adolescence, 80 % des adolescents obèses

8. HAS (2011), Surpoids et obésité de l'enfant et de l'adolescent.

le restent à l'âge adulte et 70 % le seront au-delà de 30 ans.

L'obésité est également à l'origine de nombreuses maladies et de multiples problèmes de santé. Elle est associée à un risque de développer des maladies non transmissibles (MNT) telles que le diabète de type 2, l'hypertension artérielle, les maladies du foie, les cancers, les maladies respiratoires, les maladies articulaires et les maladies cardiovasculaires (Mathieu-Bolh, 2024; Hakimi-Prévot, 2022). De plus, les perturbations induites par l'obésité altèrent les défenses immunitaires (Andersen et al., 2016), ce qui prédispose les individus obèses à un risque accru de développer une forme grave de maladies infectieuses. La pandémie du Covid-19 en est la parfaite illustration. La gravité de l'infection par le Covid-19 augmente avec l'indice de masse corporelle (Simonnet et al., 2020). Des études conduites à Lille et à Lyon ont confirmé que plus de 47 % des patients infectés par le Covid entrant en réanimation étaient en situation d'obésité, et une forme sévère d'obésité augmentait significativement le risque d'être placé sous respiration mécanique invasive, indépendamment de l'âge, de l'hypertension artérielle ou d'un diabète (Caussy et al., 2020). De plus, l'obésité est associée à une réduction de l'espérance de vie. Selon l'OCDE (2019), l'obésité et ses pathologies associées réduisent l'espérance de vie de 0,9 à 4,2 ans.

L'excès de poids a aussi des incidences sur la qualité de vie. L'obésité augmente le risque des troubles dépressifs, des souffrances psychiques, des troubles anxieux et des troubles du comportement. Jagielski et al. (2014) explorent l'association entre l'adiposité, le bien-être mental et la qualité de vie chez les personnes souffrant d'obésité extrême. Ils trouvent une forte prévalence de comorbidité psychologique, y compris une fréquence élevée de symptômes d'anxiété et de troubles dépressifs et une réduction de la qualité de vie chez les personnes souffrant d'obésité extrême.

0.3 Conséquences économiques de l'obésité

Le traitement de l'obésité et ses pathologies associées engendre d'importants coûts économiques. Ces coûts sont composés de coûts directs liés aux dépenses de santé et de coûts indirects, parfois difficiles à estimer. En effet, les personnes obèses supportent des coûts individuels qui peuvent être importants. Ces coûts incluent les frais médicaux directs, tels que les consultations, les médicaments et les interventions chirurgicales. Caby (2016) constate qu'en France, le coût sanitaire supplémentaire payé par les personnes obèses comparativement aux personnes ayant un indice de masse corporelle normal est de 785 euros. Finkelstein et al. (2009) montrent que les dépenses médicales annuelles d'une personne obèse sont environ 42 % plus élevées que celles d'une personne de poids normal. Le traitement de l'obésité engendre également des coûts affectant les personnes non obèses. En effet, les systèmes de santé publique doivent faire face à des coûts accrus pour traiter les maladies liées à l'obésité. Dans des systèmes d'assurance maladie comme celui de la France, le financement des dépenses de santé provient généralement de prélèvements obligatoires (cotisations sociales) et de transferts publics (impôts et taxes), affectant ainsi financièrement l'ensemble de la population, y compris les personnes non obèses. Les personnes non obèses peuvent également être affectées par une augmentation des primes d'assurance maladie. Si les coûts économiques les plus évidents sont ceux liés aux dépenses de santé, l'obésité engendre également d'autres coûts indirects liés à la perte de productivité, à l'absentéisme et à l'exclusion du marché du travail. Les taux d'absentéisme des personnes obèses réduisent la main d'œuvre et le temps destiné aux activités économiques. Dans les 28 pays de l'Union Européenne (UE), l'OCDE (2019) estime à 6 millions le nombre de travailleurs à temps plein perdu en raison de la surcharge pondérale. En France, en 2012, Caby (2016) estime un coût total (coûts directs et indirects) de l'obésité et du surpoids de 20,4 milliards d'euros. Okunogbe et al. (2022) estiment que les coûts directs et indirects de l'obésité et du surpoids devraient atteindre 3,29 % du PIB mondial d'ici 2060. L'OCDE (2019) estime une perte de PIB liée à l'obésité

et au surpoids de 3,3 % par an en moyenne dans les pays de l'OCDE. En outre, les personnes obèses sont moins susceptibles d'être embauchées et obtiennent des rémunérations plus faibles que les personnes avec un poids normal (Shinall, 2015; Rooth, 2009; Cawley, 2004). Campos-Vazquez and Gonzalez (2020) testent l'effet de l'obésité sur la discrimination à l'embauche au Mexique et constatent qu'une femme obèse doit envoyer 37 % de candidatures supplémentaires pour obtenir autant de retours qu'une femme non-obèse. Pinkston (2017) étudie l'impact de la masse corporelle sur les salaires des jeunes travailleurs aux États-Unis et constate qu'un antécédent d'obésité sévère réduit le salaire des hommes d'environ 17 %, tandis qu'un antécédent de surpoids diminue d'environ 8 % le salaire des femmes. Les personnes obèses sont également plus susceptibles de perdre leur emploi, ce qui peut exacerber les inégalités économiques et sociales. De plus, la perte de revenu peut limiter l'accès aux soins de santé et aux opportunités de développement personnel et professionnel, créant ainsi un cercle vicieux de désavantages pour les personnes obèses.

0.4 Déséquilibre de la balance énergétique et obésité

Il est admis dans la littérature que le poids corporel résulte de l'apport énergétique net (Abdel-Hamid, 2002; Schutz, 1995; Doucet and Tremblay, 1997). L'apport énergétique net est la différence entre l'apport énergétique provenant de la consommation d'aliments et de la dépense énergétique résultant des besoins métaboliques et de l'activité physique. L'obésité se développe lorsqu'il existe un excès d'apport énergétique à long terme par rapport à la dépense énergétique (Abdel-Hamid, 2002; Schutz, 1995). Au fil des années, la balance énergétique s'est déséquilibrée, en raison d'un apport excessif de calories et d'une dépense insuffisante d'énergie.

D'une part, les individus consomment des produits plus denses énergétiquement et contenant moins de fibres et de nutriments favorables. Selon la troisième

étude individuelle nationale des consommations alimentaires (INCA 3) [9], les Français consomment en moyenne chaque jour 2 200 kilocalories, soit un tiers de plus qu'en 1970. Les individus consomment beaucoup d'aliments trop gras et trop sucrés et peu de fruits et légumes. Selon l'OCDE (2023), en 2019, seulement 15 % des adultes déclaraient consommer au moins cinq portions de fruits et légumes par jour, en moyenne, dans 30 pays de l'OCDE. En France, ce taux était de 20 %. Les modifications de l'offre alimentaire induites par le développement de l'industrie agroalimentaire ont fortement participé à cet accroissement de la consommation des aliments « malsains ». Les produits industriels sont généralement ultra-transformés, vendus à des prix moins élevés, ont une moindre bonne qualité nutritionnelle et bénéficient d'un fort marketing. Ils ont une attractivité gustative et sont à l'origine d'une part importante des calories consommées. En France [10], la part des calories ingérées provenant d'aliments ultra-transformés est estimée à 36 % pour les adultes et 46 % pour les enfants. À l'abondance de l'offre alimentaire de l'industrie agroalimentaire s'ajoute le développement de la restauration rapide qui offre également des plats prêts à être consommés de moins bonne qualité nutritionnelle et à de faibles prix. En outre, l'implication de chacun dans l'activité économique a induit des changements de comportements alimentaires et notamment une réduction du temps destiné à la préparation de repas à domicile. En effet, il y a un remplacement progessif du « fait maison » par les « prêts à consommer » tels que les pizzas et les burgers. L'Institut national de la statistique et des études économiques (INSEE) [11] estime que le temps destiné à la préparation des repas à domicile a diminué de 25 % entre 1986 et 2010. Selon l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, (ANSES (2017)), plus de la moitié des aliments consommés, en dehors des établissements de restauration, par les adultes de 18 à 79 ans, est issue d'une fabrication industrielle

9. Étude INCA 3, Évolution des habitudes et modes de consommation, de nouveaux enjeux en matière de sécurité sanitaire et de nutrition, 2017. https ://www.anses.fr/fr/system/files/PRES2017DPA04.pdf.
10. Surpoids et obésité, l'autre pandémie : Rapport d'information n° 744 (2021-2022).
11. INSEE, Cinquante ans de consommation alimentaire : une croissance modérée, mais de profonds changements.

alors qu'un peu plus d'un tiers est fait maison. Pour les enfants de 0 à 17 ans, la fabrication industrielle représente plus de deux tiers alors que et le « fait maison » représente près d'un quart des aliments consommés en dehors des établissements de restauration. En outre, le grignotage défini comme la consommation d'aliments ou de boissons caloriques entre les repas principaux (Hess et al., 2016), participe également à l'augmentation des apports caloriques (Dunford and Popkin, 2018). À tout cela s'ajoute les déserts alimentaires [12] ou « food deserts » qui réduisent la possibilité de se procurer des aliments « sains » à des prix abordables. Les individus résidant dans les déserts alimentaires ont des régimes alimentaires de moins bonne qualité (Gray et al., 2018).

D'autre part, la dépense énergétique a baissé. La dépense d'énergie des individus se fait par le biais du métabolisme de base (ou métabolisme de repos), qui est la quantité d'énergie nécessaire permettant à l'organisme de survivre, de l'effet thermique des aliments, qui est la quantité d'énergie que l'organisme dépense pour digérer les aliments et de l'énergie dépensée lors de l'activité physique. Cette dernière reste la composante la plus variable de la dépense énergétique. Cependant, la pratique de l'activité physique n'est pas favorisée par les modes de vie actuels en raison notamment de la sédentarisation au travail, l'usage de la voiture ou le temps passé devant les écrans. L'ANSES (2022) estime que 95 % des adultes français ont une activité physique en deçà des seuils recommandés en durée et fréquence de pratique. D'après l'OCDE (2021), « *la proportion de jeunes français déclarant avoir au moins une activité physique modérée tous les jours était la deuxième plus faible des pays de l'UE en 2018, après l'Italie. Cette tendance est particulièrement marquée chez les filles : 4 % seulement des adolescentes de 15 ans déclaraient exercer une activité physique au moins modérée, contre 11 % des garçons du même âge* ». De plus, selon l'ANSES (2017), entre 2007 et 2014, le temps passé quotidiennement devant les écrans (hors

12. Les déserts alimentaires sont des régions où les gens ont un accès limité à des aliments sains et à des prix abordables. Cela peut être dû à un faible revenu ou à la nécessité de parcourir de longues distances pour trouver des aliments sains.

temps de travail) a augmenté en moyenne de 20 minutes chez les enfants de 3 à 17 ans et d'une heure 20 minutes chez les adultes. L'augmentation des apports en énergie et l'insuffisance de la dépense calorique favorisent la prise de poids et participent à l'accroissement de l'obésité dans le monde. Toutefois, il est important de noter que nous nous concentrons sur l'apport énergétique et non sur la dépense d'énergie dans le cadre de cette thèse.

0.5 Environnement familial et habitudes alimentaires des enfants

0.5.1 La famille : un levier pour l'amélioration des régimes alimentaires des enfants

Les parents sont les principaux responsables des choix alimentaires dans l'environnement familial et peuvent jouer un rôle déterminant dans l'amélioration des régimes alimentaires des enfants. Selon l'ANSES (2017), les enfants de 1 à 17 ans prennent très majoritairement les différentes repas à domicile (93,4 % pour le petit déjeuner ; 59,9 % pour le déjeuner et 87,9 % pour le dîner). Concernant les repas pris en dehors du domicile, 61,6 % des déjeuners sont pris à la cantine et 67,2 % des dîners sont pris chez des amis/familles. Une petite proportion des repas consommés hors domicile est prise dans des restaurants, cafés et fast-food (5,9 % pour les déjeuners et 17,1 % pour les dîners). Toutefois, il est important de noter que le nombre de repas pris à l'extérieur augmente avec le niveau d'étude et la catégorie socioprofessionnelle des parents. L'ANSES (2017) souligne qu'environ un tiers des déjeuners des enfants dont le représentant a un niveau d'étude inférieur ou égal au bac (34 %) sont pris hors domicile contre près de la moitié pour ceux dont le représentant a un niveau d'étude supérieur au bac (47 %). Cela peut s'expliquer par l'activité professionnelle des parents avec des niveaux d'éducation plus élevés qui réduit le temps qu'ils peuvent consacrer à la

préparation des repas.

0.5.2 Déterminants des choix alimentaires des parents

Les choix alimentaires des parents sont influencés par plusieurs facteurs qui font qu'ils choisissent des produits alimentaires de plus ou moins bonne qualité nutritionnelle. Le revenu est un des déterminants majeurs des choix alimentaires. Les individus à faible revenu ont généralement une alimentation déséquilibrée et des apports alimentaires faibles en fruits et légumes. Le prix des aliments joue également un rôle important dans la prise de décision d'achat des produits alimentaires. En France, Etilé (2013) montre que la baisse des prix des pizzas et des boissons rafraichissantes sans alcool (BRSA) entre 1985 et 2010 s'est accompagnée d'une augmentation parallèle de leur consommation au cours de cette période. Le caractère appétissant des aliments qui dépend de leurs propriétés sensorielles (goût, odeur, texture et apparence) constitue également un aspect qui influence les choix alimentaires. Dès le plus jeune âge, le goût influence les comportements alimentaires. L'attirance pour le sucré et l'aversion pour l'amer sont considérées comme des traits innés. Cette préférence pour le sucré des enfants renforce leur acceptabilité des produits sucrés. Un autre facteur susceptible d'influencer les choix alimentaires des parents est le temps de préparation nécessaire. Les occupations professionnelles imposent aux parents des contraintes de temps qui les poussent à acheter des produits ou repas prêts pour la consommation au détriment d'autres aliments nécessitant des préparations supplémentaires avant leur consommation. Les choix alimentaires des parents peuvent dépendre également de leurs perceptions de l'aspect nutritif ou sanitaire des produits. Toutes choses égales par ailleurs, un produit perçu comme ayant une meilleure qualité nutritionnelle ou étant plus bénéfique pour la santé pourrait être choisi au détriment d'un autre considéré comme ayant une mauvaise qualité nutritionnelle. D'autres aspects tels que les habitudes de consommation, la qualité et l'origine du produit peuvent également avoir des impacts sur les choix alimentaires des parents. Selon le rapport de l'ANSES

(2017), au moment de l'achat, le prix est le premier critère de choix cité par les ménages (48 %), suivi par l'habitude de consommation (43 %), le goût (38 %) et l'origine du produit (36 %). De plus, ce rapport souligne que seulement 19 % des ménages déclarent choisir entre deux produits identiques systématiquement celui qui mentionne sur son emballage un intérêt nutritionnel ou de santé.

0.5.3 Environnement social et comportements alimentaires

Les choix des produits alimentaires ainsi que leur consommation se font souvent dans un contexte social. La famille, les amis, ainsi que la société au sens large, orientent les choix alimentaires des parents et façonnent les habitudes et les comportements alimentaires des enfants. L'exposition à une norme sociale en faveur ou en défaveur d'une catégorie d'aliments lors des choix alimentaires peut augmenter ou réduire l'inclusion de cette catégorie dans le panier ou l'assiette. Hogreve et al. (2021) montrent qu'une intervention basée sur une norme sociale conçue pour promouvoir des choix alimentaires « sains » augmente la proportion des parents faisant des choix alimentaires « sains » pour leurs enfants. Hang et al. (2020) observent que les normes sociales, et plus particulièrement une norme descriptive, a un effet positif à la fois sur les intentions de manger sainement et sur les choix de collations plus « saines » des enfants. Les comportements alimentaires des enfants sont aussi soumis à l'influence des pairs. Les parents, les frères et sœurs et les amis sont les principaux modèles de vie des enfants. Par conséquent, les enfants sont susceptibles d'adopter les mêmes comportements alimentaires que les personnes avec qui ils mangent. Ragelienė and Grønhøj (2020) mettent en évidence dans leur revue de la littérature que l'influence des pairs sur le comportement alimentaire des enfants est bien souvent négative en raison de l'augmentation de la consommation d'aliments à forte densité énergétique et à faible valeur nutritive.

0.6 Les politiques publiques visant à améliorer les régimes alimentaires

Les autorités publiques s'inquiètent des conséquences sanitaires, sociales et économiques de l'obésité et de ses tendances futures. Cela justifie la nécessité de mettre en place des interventions publiques. Les pouvoirs publics disposent de plusieurs outils leur permettant d'agir sur les choix alimentaires des consommateurs. D'une part, ils peuvent utiliser des instruments économiques standards permettant de décourager la consommation des biens « malsains » par les prix, telles que les taxes, ou d'inciter la consommation des biens « sains », telles que les subventions. D'autre part, ils peuvent utiliser d'autres leviers pour modifier les comportements alimentaires des individus sans les contraindre comme les programmes d'éducation nutritionnelle et les nudges.

Les taxes nutritionnelles semblent être un moyen efficace pour améliorer les régimes alimentaires. En effet, les taxes nutritionnelles optimales devraient accroître les prix des aliments « malsains ». La plupart de ces taxes cible les aliments riches en sucre ou en graisses saturées. D'après Mathieu-Bolh (2024), en 2020, cinquante taxes sur les boissons rafraichissantes sans alcool (BRSA) étaient en vigueur à travers le monde. Par exemple, en France, en 2012, une taxe sur les boissons contenant du sucre ajouté ou des édulcorants artificiels a été instaurée. Cette taxe qui ne prenait pas en compte l'exacte teneur en sucre a été rendue proportionnelle à la quantité de sucre ajouté en 2018 (Le Bodo et al., 2022). Les études empiriques qui évaluent l'effet des taxes nutritionnelles montrent des effets généralement significatifs mais faibles sur la consommation des produits visés par la taxe (Cawley et al., 2020). En France, la taxe sur les sodas de 2012 a réduit la consommation des boissons sucrées de moins de 5 % en moyenne (Capacci et al., 2019). Les comportements de substitution des produits visés par la taxe par d'autres produits non taxés limitent les effets de la taxe sur les apports nutritionnels (Pell et al., 2021). Les taxes nutritionnelles sont également pointées du doigt pour leurs effets anti-redistributifs. En effet, les taxes

nutritionnelles favorisent les consommateurs ayant les revenus les plus éleves surtout si elles sont combinées avec des subventions sur les aliments « sains » (Muller et al., 2017). Toutefois, les taxes nutritionnelles peuvent engendrer des modifications dans la composition des aliments du côté des producteurs. Dickson et al. (2023) montrent qu'au Royaume-Uni, à la suite de l'imposition des boissons non alcoolisées, la plupart des marques ont réduit la teneur en sucre contenue dans les boissons.

Les subventions des produits « sains » constituent également un moyen pour améliorer la qualité des régimes alimentaires. Elles prennent la forme de chèques alimentaires ou de réduction de prix concernant une catégorie d'aliments. An (2013), dans sa revue concernant l'efficacité des subventions, trouve que les subventions des aliments « sains » augmentent de manière significative l'achat et la consommation des produits subventionnés. En France, Bihan et al. (2009) analysent l'impact des chèques destinés exclusivement à l'achat de fruits et légumes frais, sur la consommation de fruits et légumes d'une population en situation de précarité. Les auteurs trouvent que la distribution de ces chèques augmente la consommation de fruits et légumes (93 % de consommateurs quotidiens avec la réception des chèques vs 71 % avant l'intervention).

Pour améliorer les régimes alimentaires des campagnes d'information sur les bonnes pratiques alimentaires sont également mises en place. Ces campagnes visent à sensibiliser les consommateurs en leur fournissant des informations concernant les recommandations sur l'alimentation et les invitent à modifier leurs habitudes alimentaires. Ces campagnes peuvent prendre la forme de publicités à la télévision, d'annonces sonores ou d'affichages. En France, plusieurs messages véhiculant des informations sur les recommandations du Programme National Nutrition Santé (PNNS) existent déjà comme « *Pour votre santé, mangez 5 fruits et légumes par jour* » ou bien « *Pour votre santé, mangez moins gras, moins sucré, moins salé* » ou encore « *Pour votre santé, évitez de grignoter* ».

Le recours à des programmes d'éducation nutritionnelle est également une piste exploitée dans le but d'améliorer la qualité des régimes alimentaires. L'idée de ces programmes est que l'acquisition de compétences et de connaissances dans le domaine de l'alimentation permet de faire des choix alimentaires plus « sains ». Ces programmes, mis en place généralement dans les écoles, visent en première ligne les enfants. Ces programmes proposent également des thèmes liés à l'alimentation accessibles pour les parents. En France, nous pouvons citer par exemple la mallette des parents [13] qui propose une fiche qui aborde le sujet de l'alimentation et de l'activité physique ou bien les thèmes de l'alimentation accessibles au sein des espaces parents [14].

Un autre instrument non économique devenu très populaire et conçu de plusieurs manières pour orienter les choix alimentaires est le nudge ou « coup de pouce » (Barahona et al., 2022; Bauer and Reisch, 2019). Le terme nudge a été mis en lumière par Thaler and Sunstein (2008) qui le définissent comme « *tout aspect de l'architecture du choix qui modifie de façon prévisible le comportement des gens sans interdire aucune option ou modifier de façon significative les incitations financières* [15] ». Parmi les types de nudges alimentaires, on retrouve l'étiquetage nutritionnel visant les problèmes informationnels. Les informations contenues dans l'étiquetage nutritionnel sont souvent synthétisées par un label alimentaire plus simple à comprendre tel que le Nutri-Score [16]. Crosetto et al. (2020) examinent dans une expérience l'impact de cinq labels alimentaires sur les achats de produits alimentaires dans un catalogue de 290 produits. Les auteurs constatent que tous les labels améliorent la qualité nutritionnelle des paniers des participants.

Les nudges alimentaires prennent également la forme d'interventions expérimentales (Bauer and Reisch, 2019). Ces interventions expérimentales peuvent consister

13. https ://mallettedesparents.education.gouv.fr
14. https ://eduscol.education.fr/cid100930/espaces-parents.html
15. La définition du nudge est tirée de la version traduite en Français par Marie-France Pavillet « Nudge la méthode douce pour inspirer la bonne décision » p.25.
16. Le Nutri-Score est un système d'étiquetage nutritionnel à cinq niveaux, allant de A à E et du vert au rouge, placé sur le devant des emballages alimentaires, établi en fonction de la valeur nutritionnelle d'un produit alimentaire.

à réorganiser la présentation des aliments (Wongprawmas et al., 2023; Koch et al., 2020), à désigner les plats plus « sains » par des termes plus attractifs (Turnwald et al., 2017), à rendre les aliments « sains » plus accessibles (Hanks et al., 2012). Cadario and Chandon (2019) classifient les nudges alimentaires en trois catégories : 1) les nudges cognitifs, tels que l'étiquetage nutritionnel descriptif ou évaluatif ou améliorant la visibilité ; 2) les nudges affectifs tels que les appels à manger plus sainement ou les perfectionnements hédoniques ; 3) les nudges comportementaux, tels que les améliorations de l'accès aux aliments « sains » ou la modification de la taille des portions. Les auteurs évaluent l'efficacité de ces catégories de nudges et trouvent que les nudges comportementaux sont les plus efficaces suivis des nudges affectifs et ensuite des nudges cognitifs.

Les études empiriques comparent l'efficacité des taxes à celle des nudges en termes d'amélioration de bien-être et de modification d'achats de produits alimentaires (Barahona et al., 2023; List et al., 2023; Hartmann-Boyce et al., 2018). Hoenink et al. (2020) examinent l'efficacité des nudges et des stratégies de tarification (augmentation du prix des produits « malsains », réduction du prix des produits « sains », ou augmentation du prix des produits « malsains » et réduction du prix des produits « sains ») pour augmenter les achats d'aliments « sains » en fonction du statut socio-économique d'adultes néerlandais. Les auteurs observent que les nudges et les stratégies de prix non saillants seuls n'augmentent pas significativement les achats d'aliments « sains », tandis qu'une combinaison d'augmentations et de réductions de prix saillants entraîne une augmentation des achats d'aliments « sains ». La combinaison de stratégies de prix saillants et de nudge entraîne une augmentation d'achats d'aliments « sains », les effets les plus importants étant observés dans la combinaison nudge avec augmentation et réduction de prix.

Un argument en faveur des nudges par rapport aux taxes nutritionnelles concerne leur acceptabilité par la population. Hagmann et al. (2018) comparent l'acceptabilité de différents types de politiques publiques visant à réduire la consommation de sucre,

en utilisant les données d'une enquête menée dans les régions germanophones et francophones de la Suisse. Les auteurs montrent que les politiques moins intrusives (comme l'étiquetage et les campagnes de santé publique) sont mieux acceptées que les interventions plus restrictives (comme les taxes, la substitution du sucre par des édulcorants artificiels et la réduction de la taille des portions).

Outre ces politiques publiques visant à améliorer les régimes alimentaires, les gouvernements peuvent également interdire certaines pratiques du côté des offreurs d'aliments « malsains ». Par exemple, nous pouvons citer l'arrêté du 18 janvier 2017 [17] relatif à l'interdiction de la mise à disposition à volonté, gratuite ou pour un prix forfaitaire de boissons avec du sucre ajouté ou d'édulcorants de synthèse.

0.7 Présentation de la thèse

Cette thèse a pour objectif de mieux comprendre les effets des politiques publiques sur les décisions alimentaires des parents et les habitudes alimentaires des enfants. Il s'agit d'étudier l'efficacité de différents instruments de politiques publiques visant à promouvoir l'alimentation « saine » dans l'environnement familial afin de prévenir les problèmes de santé liés à l'alimentation « malsaine » tels que l'obésité ou le surpoids. Deux approches méthodologiques sont proposées : des modélisations théoriques et une expérience de terrain. Les travaux abordés dans le cadre de cette thèse s'articulent autour de trois chapitres.

0.7.1 Chapitre 1 : Promouvoir une alimentation saine au sein de la famille : taxation et nudge

Le chapitre 1, intitulé « Inciting Family Healthy Eating : Taxation and Nudging », s'intéresse à l'effet d'une taxe sur la consommation de bien « malsain » et d'une politique mixte alliant à la fois taxation et nudge sur les choix alimentaires des

17. https ://sante.gouv.fr/IMG/pdf/2017_0118_arrete_interdiction_boissons_a_volonte.pdf.

parents. Nous considérons une économie composée de deux types de familles qui diffèrent par leurs revenus et leurs connaissances nutritionnelles. Chaque famille est composée d'un parent et d'un enfant, et chaque individu vit deux périodes : l'enfance et l'âge adulte. À chaque période, ils peuvent consommer deux types de biens : un bien « malsain » et un bien « sain ». La consommation du bien « malsain » génère une satisfaction immédiate, mais a également des conséquences négatives sur la santé future de l'enfant, qui sont mal perçues par le parent. En revanche, la consommation du bien « sain » génère une satisfaction immédiate et a des effets bénéfiques sur la santé future de l'enfant, qui sont également mal perçus par le parent. Nous supposons que le niveau des connaissances nutritionnelles du parent reflète sa perception des dommages et des bénéfices de l'alimentation sur la santé future de l'enfant et que les dommages et bénéfices perçus sont inférieurs aux effets réels de l'alimentation sur la santé. Les parents prennent les décisions d'acquisition des biens alimentaires pour toute la famille en fonction de leurs perceptions et sous contrainte de leurs revenus et des prix des deux biens.

Nous montrons que les mauvaises perceptions des parents conduisent à une surconsommation du bien « malsain » et une sous-consommation du bien « sain ». Dans ce cadre, nous étudions l'efficacité d'une politique de taxation du bien « malsain » et d'une politique mixte basée sur l'utilisation simultanée d'une taxe sur le bien « malsain » et d'un nudge dans l'objectif d'améliorer la qualité nutritionnelle des régimes alimentaires des familles. Le nudge utilisé dans le modèle agit sur les perceptions que les parents ont des effets de l'alimentation sur la santé. Il est utilisé comme instrument non économique de soutien à la taxe dans l'objectif d'améliorer les perceptions des parents. Nous considérons le cas où le revenu issu de la taxe est reversé au ménage sous forme de transferts. Nous montrons tout d'abord que la solution décentralisée consistant à taxer la consommation du bien « malsain » et à redistribuer le revenu de la taxe sous forme de transferts permet d'atteindre l'optimum de premier rang si et seulement s'il est possible pour le planificateur central de mettre en œuvre une

politique de taxation ciblée. Nous constatons ensuite qu'une politique mixte consistant à soutenir la taxe par un nudge permet d'atteindre l'optimum de premier rang tout en fixant une taxe uniforme pour tous les types de familles. En utilisant un exemple numérique avec une fonction d'utilité plus complexe, nous illustrons le fait que la qualité des régimes alimentaires dépend à la fois du revenu et des niveaux de perceptions des effets de l'alimentation sur la santé. Dans certains cas, la famille ayant plus de connaissances nutritionnelles consomme une plus grande quantité du bien « malsain » que la famille ayant moins de connaissances nutritionnelles.

0.7.2 Chapitre 2 : Normes sociales, croyances et choix alimentaires des parents : une expérience

Le chapitre 2 intitulé « Social Norms, Parents' Food Beliefs and Choices : an Experiment » provient d'un article co-écrit avec Noémi Berlin et Tarek Jaber-Lopez. L'objectif de ce chapitre est d'étudier l'effet des normes sociales sur les croyances des parents concernant la qualité nutritionnelle des aliments ainsi que sur leurs choix alimentaires pour eux-mêmes et pour les enfants. Ce chapitre repose sur une expérience que nous avons menée sur le terrain, à la cité des sciences et de l'industrie à Paris. La collecte des données s'est déroulée sur un total de cinq jours, en octobre et novembre 2022, pendant le weekend de la fête de la science et les weekends suivants. Au total, 300 parents, chacun ayant au moins un enfant âgé de 3 à 10 ans, ont participé à cette expérience.

Dans cette expérience, les tâches principales effectuées par les parents consistent à : 1) attribuer un indice de qualité alimentaire, à savoir le « Nutri-Score », à différents produits alimentaires affichés sur leur écran ; 2) sélectionner un panier de quatre produits pour eux-mêmes et pour un enfant. Ces tâches sont répétées deux fois (étape 1 et étape 2). Nous utilisons une liste de 15 produits alimentaires comprenant 5 snacks salés, 5 snacks sucrés et 5 boissons.

Notre expérience est basée sur un 3x2 « between-subject design » dans lequel nous faisons varier : 1) l'information fournie (*contrôle* vs *norme descriptive* vs *information d'opinion*) ; 2) le destinataire des décisions alimentaires prises par les parents pour les enfants (pour *leur propre enfant* ou pour *un enfant inconnu*). Les participants sont randomisés dans un de ces six groupes (4 groupes de traitement et 2 groupes de contrôle).

La première dimension des traitements est basée sur le type d'information fournie : les groupes de *contrôle* ne reçoivent aucune information, les groupes des traitements *norme descriptive* reçoivent une norme descriptive et les groupes des traitements *information d'opinion* reçoivent une information sur les opinions d'autres parents. Plus précisément, les traitements *norme descriptive* fournissent aux participants des informations sur le pourcentage des parents qui ont choisi un produit alimentaire spécifique pour eux-mêmes ou pour les enfants (calculé sur la base des groupes de contrôle). Dans les traitements *information d'opinion*, les participants sont informés du pourcentage de parents qui pensent que les parents devraient choisir un produit alimentaire spécifique pour eux-mêmes ou pour les enfants (calculé sur la base de questionnaires réalisés avant l'expérience).

La deuxième dimension du design repose sur le destinataire du choix alimentaire : les parents prennent une série de décisions alimentaires pour eux-mêmes et une deuxième série, soit pour leur enfant, soit pour un enfant inconnu. Dans tous les groupes, les parents prennent ces décisions deux fois. En intégrant la dimension du choix pour un enfant inconnu, nous considérons les choix alimentaires des parents pour leurs enfants comme une fonction de la distance parentale. La distance parentale indique si le parent choisit pour son propre enfant ou pour un enfant inconnu. Cette approche nous permet de déterminer si les choix d'aliments de moindre qualité nutritionnelle que font les parents pour leurs enfants sont dus au désir des parents de faire plaisir à leur propre enfant ou si les parents font les choix alimentaires de la même manière, quel que soit l'enfant.

La divulgation des informations des traitements n'a lieu qu'au cours de la deuxième phase (étape 2) de l'expérience (pour les groupes de traitement), ce qui nous permet d'effectuer une régression de différence-en-différence afin d'estimer l'effet causal de la divulgation d'informations. Les croyances sur la qualité nutritionnelle des aliments sont évaluées en demandant aux parents d'attribuer, à deux reprises, un « Nutri-Score » avant de recevoir toute information, et après avoir reçu une information. Il est à noter que dans les groupes de contrôle, les participants sont simplement invités à attribuer un « Nutri-Score » à deux reprises, sans recevoir d'informations supplémentaires.

Nos variables d'intérêt sont la qualité nutritionnelle des paniers constitués par les parents (mesurée par le score FSA [18]) et la croyance des parents sur la qualité nutritionnelle des items alimentaires (mesurée par quatre variables : l'écart absolu de croyance, le taux de surestimation, le taux de sous-estimation et le taux d'exactitude).

Nos résultats montrent que la *norme descriptive* réduit significativement la tendance des parents à surestimer la qualité nutritionnelle des aliments, tandis que l'*information d'opinion* n'a pas d'effet significatif sur les croyances des parents. De plus, nous trouvons que la *norme descriptive* et l'*information d'opinion* améliorent de manière significative la qualité nutritionnelle des paniers alimentaires des parents, l'effet de la *norme descriptive* étant plus important. Nous trouvons également que l'*information d'opinion* a un impact significatif et positif sur la qualité nutritionnelle des paniers alimentaires des enfants. En revanche, nous ne trouvons pas d'effet significatif de la *norme descriptive* sur la qualité nutritionnelle des paniers alimentaires des enfants. En outre, notre analyse révèle que les parents ont tendance à constituer des paniers alimentaires de moins bonne qualité nutritionnelle pour les enfants que pour eux-mêmes. Cependant, il n'y a pas de différence significative de la qualité nutritionnelle entre les paniers destinés à leurs propres enfants et ceux destinés à des enfants

18. Le socre FSA est une mesure de la qualité nutritionnelle des produits élaboré par l'Agence britannique Food and Standard Agency.

inconnus. Concernant les croyances, nous constatons que les parents sous-estiment généralement la qualité nutritionnelle des aliments, c'est-à-dire qu'ils pensent que les produits alimentaires ont une qualité nutritionnelle inférieure à leur qualité réelle.

0.7.3 Chapitre 3 : Orienter la transmission intergénérationnelle des préférences alimentaires : l'influence des décideurs publics

Le chapitre 3 intitulé « Targeting the Inter-generational Transmission of Food Preferences : the Effect of Public Decision-Makers » repose sur une modélisation théorique. Il s'intéresse à la transmission intergénérationnelle des préférences alimentaires. Nous développons un modèle de transmission intergénérationnelle des préférences alimentaires inspiré du modèle de Bisin and Verdier (2000, 2001) dans lequel les parents transmettent leurs propres préférences alimentaires à leurs enfants par le biais de leurs pratiques alimentaires. Nous considérons deux types de parents : les parents ayant des préférences alimentaires « saines » et les parents ayant des préférences alimentaires « malsaines ». Les parents ayant des préférences alimentaires « saines » ont des pratiques alimentaires « saines », tandis que les parents avec des préférences alimentaires « malsaines » ont des pratiques alimentaires « malsaines ». Les pratiques alimentaires des parents consistent à contrôler la disponibilité et l'accessibilité des aliments. Les parents se soucient des préférences alimentaires de leurs enfants et se préoccupent également de la santé publique qui est influencée par leurs pratiques alimentaires. La transmission des préférences alimentaires suit un mécanisme à la Bisin and Verdier (2000, 2001) qui fait intervenir la transmission verticale (au sein de la famille) et la transmission oblique (en dehors de la famille, dans la société en général).

Nous constatons que, même si les parents se soucient pleinement de la santé publique, le mécanisme de transmission des préférences alimentaires conduit à une po-

pulation hétérogène où les préférences alimentaires « malsaines » persistent. Dans ce contexte, nous étudions comment le décideur public peut influencer la dynamique des préférences alimentaires de la population en favorisant l'émergence des préférences alimentaires « saines ». Nous modélisons l'intervention du décideur public, dans un premier temps, par la fourniture d'un bien public (un chèque fruits et légumes par exemple) destiné à promouvoir l'alimentation « saine » et, dans un second temps, par la mise en place d'un programme d'éducation nutritionnelle destiné à sensibiliser les enfants des dommages et bénéfices de l'alimentation sur la santé. Nous montrons que les interventions publiques (fourniture de biens publics et programme d'éducation nutritionnelle) permettent de faire converger la distribution des préférences alimentaires vers une population homogène avec des préférences alimentaires « saines ».

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Chapter 1

Inciting Family Healthy Eating: Taxation and Nudging

1.1 Introduction

Unhealthy eating patterns can negatively affect people's health. Diseases related to an unhealthy diet, such as diabetes, have reached epidemic proportions worldwide (Lovic et al., 2020). Empirical evidence suggests that unhealthy food consumption is associated with an increased risk of childhood obesity (Ludwig et al., 2001; Malik et al., 2006), which in turn is associated with increased risks of non-communicable diseases such as type 2 diabetes, hypertension, coronary heart disease, cardiovascular disease, and certain types of cancers. Obesity in childhood and adolescence has consequences for morbidity and mortality in adulthood (Reilly and Kelly, 2011) and significantly reduces life expectancy, particularly in young adults (Fontaine et al., 2003). Therefore, due to the strong link between diet and the rise of obesity and overweight in children, improving children's diets has become an important challenge for public decision-makers.

Food products consumed by children most often come from the family environment. Implementing nutritional policies to improve children's diets within the family environment seems more delicate due to the lack of control that public decision-makers have over this environment. Nevertheless, there are public interventions, such as unhealthy goods taxation or nutritional labels that aim to improve diets within the home environment. These interventions mostly target parents, who are primarily responsible for food choices in the family.

The purpose of this chapter is to theoretically analyze the effectiveness of public policies aiming at promoting healthy eating within the family environment. Specifically, we study how the implementation of a tax policy on the consumption of an unhealthy good and a mixed policy based on the simultaneous use of tax on the consumption of an unhealthy good and nudge can improve the nutritional quality of families' diets in a framework where parents differ in their income and their degree of misperception of the effects of diet on their children's future health.

There are many reasons why consumers might not act in their own best interest when making food choices. Allcott et al. (2019) identify two reasons in the sweetened beverage tax debate: imperfect information and the lack of self-control. Levels of parental nutritional knowledge may also influence family consumption patterns. A mother's low level of nutritional knowledge is associated with lower dietary adequacy of children's food intake (Al-Shookri et al., 2011; Vereecken and Maes, 2010). Consumption of unhealthy foods can also be explained by addiction effects (Davis et al., 2011). All these biases support the need for public policy interventions to reduce diet-related diseases.

In this chapter, we focus on the case where the intervention of the public decision-maker is justified by an insufficient level of individuals' nutritional knowledge. Indeed, we assume that individuals cannot establish an accurate link between food consumption patterns and the future effects of food on health. This assumption is consistent with empirical evidence that has shown the need to raise public awareness about the effects of food on health (Khawaja et al., 2019).

To improve people's diets, taxation of unhealthy goods is the most common public policy remedy. For example, the 2016 World Health Organization (WHO) report points out that appropriately designed taxes on unhealthy foods would result in a proportional reduction in their consumption. [1] In response to guidance from the WHO, many governments have implemented taxes on unhealthy goods (Cawley et al., 2019; Griffith et al., 2019). According to Mathieu-Bolh (2024), fifty taxes on non-alcoholic beverages were in effect worldwide in 2020. For example, the French government introduced a tax on all drinks with added sugar or artificial sweeteners in 2012. The design of this tax has been modified to be indexed to the quantity of added sugars in the drink in 2018 (Le Bodo et al., 2022). Economic theory predicts that if the price of an item increases the consumption of that item will typically fall which justifies the use of taxes on unhealthy goods. However, the effectiveness of taxation policies in

1. WHO : Fiscal policies for diet and the prevention of noncommunicable diseases.

reducing household consumption of unhealthy food has been questioned. Assessing the effects of a fat tax on the nutrients purchased by French households across different income groups, Allais et al. (2010) find that a fat tax has small and ambiguous effects on nutrients purchased by French households. Furthermore, the French soda tax evaluation conducted by Capacci et al. (2019) reveal that the soda tax showed evidence of very little reduction in purchases. They attribute this small reduction in purchases to the fact that the tax rate was very small. Tax increases the prices of unhealthy goods and in the case of intergenerational choices, in addition to reducing the unhealthy good consumption of children, it also reduces the parent's unhealthy good consumption, which is not associated with an externality. Therefore, these effects of the tax on parent's unhealthy good consumption make it no longer the first-best. Kalamov and Runkel (2020) show that a tax on unhealthy food may underinternalize or overinternalize the marginal damage of intergenerational externalities.

Moreover, nudge is a non-economic tool used to improve the quality of individual's diets. Nudging is a technique to encourage individuals or a whole human group to change certain behaviors or to make certain choices without putting them under constraint or obligation and which does not involve any sanction (Thaler and Sunstein, 2008). The problem that may justify the use of nudge is that people sometimes do not make the best decisions for themselves (e.g., an individual may decide to consume a portion of food that has harmful effects on his future health), so they can be helped to make better choices. According to Thaler and Sunstein (2008), a specific reason why people make bad choices is that they do not have complete self-control. Self-control issues are most likely to arise when decisions and their consequences are separated in time, which is the case for dietary choices. The use of a nudge (such as nutrition labeling systems) to improve the nutritional quality of family diets has become quite common in several countries. Crosetto et al. (2020) study in a laboratory framed field experiment, in Grenoble (France) the impact of five Front of Pack labels (Multiple

Traffic Lights, Reference Intakes, Health Star Rating, Nutri-Score and SENS [2]) on the nutritional quality of shopping carts. They find that labels significantly improve the shopping carts' nutritional quality.

In this chapter, we consider an economy composed of two types of families that differ in their income and their nutritional knowledge. Each family consists of a parent and a child, and each individual lives two periods: childhood and adulthood. At each period, they can consume two types of goods: an *unhealthy* good and a *healthy* good. Consumption of the unhealthy good generates immediate satisfaction but has also adverse consequences on the child's future health, which are misperceived by the parent. In turn, the consumption of the healthy good generates immediate satisfaction and has beneficial effects on the child's future health, which are misperceived by the parent as well.

We first show that the decentralized solution of taxation on the consumption of the unhealthy good and redistributing the tax proceeds in the form of transfers achieves the first-best optimum if and only if it is possible for the central planner to implement a targeted tax policy. We then find that a mixed policy of supporting the tax with a nudge achieves the first-best optimum while setting a uniform tax for all family types. Using a numerical example with a more complex utility function, we illustrate that there may be cases where the family with more nutritional knowledge consumes more or less of both types of goods than the family with less nutritional knowledge.

Our chapter is related to the growing literature on sin taxes. Kalamov and Runkel (2020) examine whether taxes on unhealthy food are suitable for internalizing intergenerational externalities inflicted on children by parents when they decide on their children's diet. They find that the optimal steady-state tax rate on unhealthy food is indeed strictly positive but is only second-best because, in addition to reducing the food consumption of the child, it distorts the parent's food consumption. Cremer

2. SENS, Simplified Nutritional Labelling System is a French nutrient profiling system that means in French "Système d'Etiquetage Nutritionnel Simplifié".

et al. (2016) analyze the political support of a tax on the unhealthy good, combined with a subsidy for the healthy good, and examine how the government can affect this political support by earmarking the tax revenue. They consider an economy wherein individuals differ in their incomes and their degree of misperception concerning the health effects of fat and a healthy good. Individuals vote over a fat tax according to their misperceived utility. A fraction of the tax proceeds is earmarked to reduce health insurance premiums and the remainder finances a subsidy for the healthy good. As a prelude to their main question, they show that the equilibrium level of the fat tax is typically not optimal, neither from a utilitarian nor from a Rawlsian perspective. We model our utility function closely to theirs but our approach differs in two main directions. First, we separate the satisfaction (utility) derived from the consumption of the healthy good from the health benefit associated with its consumption and assume that only the health benefit associated with the consumption of the healthy good is misperceived by parents. Second, we are not interested in a voting equilibrium tax and the tax revenue is redistributed as a transfer in our model. We contribute to this literature by showing that the first-best optimum can be achieved in a utilitarian perspective if the central planner has the possibility to set a targeted tax policy according to the degree of misperception.

Our study is also related to the literature on the use of tax and nudge to modify agents' behavior. Farhi and Gabaix (2020) develop a theory of optimal taxation with behavioral agents. They use a general framework that encompasses a wide range of biases such as misperceptions and internalities and study how to incorporate nudge into the optimal taxation framework. Comparing the effectiveness of tax and nudge in correcting internalities, they find that nudge can be better or worse than tax depending on the tax's revenue redistribution and the internality-corrective objectives of the government. We contribute to this literature by showing that it is better to combine nudge and tax in a mixed policy to correct agents' misperceptions.

Finally, our chapter is related to the literature on food labels. Moran and Roberto

(2018) use an online survey to study whether warning labels influence parents' beliefs on sweetened beverages' healthiness and their purchase intentions of sweetened beverages. They find that warning labels significantly reduce the odds of selecting sweetened beverages and may correct parents' misperceptions about sweetened beverages' healthiness. Dubois et al. (2021) examine whether four pre-selected front-of-pack nutrition labels ("Nutri-Score", "Nutri-Repère", "Nutri-Couleurs" and SENS) improve food purchases in real-life grocery shopping settings. They find that the effect sizes of front-of-pack nutrition labels were smaller on average than those find in comparable laboratory studies. They find also that the most effective nutrition label, Nutri-Score, increased the purchases of foods in the top third of their category nutrition-wise but had no impact on the purchases of foods with medium, low, or unlabeled nutrition quality. Hence, the contribution of our chapter is to theoretically show that the use of labels to improve the nutritional quality of individuals' food choices can be more effective if it is combined with an adjustment of the prices of food items.

The remainder of the chapter is organized as follows. Section 3.3 describes the model and provides the results of the individual choice. The social optimum is specified in Section 1.3. Section 1.4 provides a numerical example with a more complex utility function. We discuss the results of the model and conclude in section 1.5.

1.2 The Model

We consider an economy composed of two types of families that differ in their nutritional knowledge: the family of type 1 has better nutritional knowledge than the family of type 2. Families differ also in their income denoted by w^i, $i = 1, 2$. Each family consists of a parent and a child, and each individual lives two periods, childhood and adulthood. At each period, they can consume two types of good: an unhealthy good, that is, a high-fat or sugary food, denoted by c^u (e.g., potato chips

or sodas), and a healthy good denoted by c^h (e.g., vegetables). We assume that the effects of food intake in childhood on health appear later in adulthood. Indeed, the consumption of unhealthy goods during childhood could have negative health effects (causing obesity or overweight) in adulthood. It is also quite possible that the effects of diet on health appear in childhood. For example, a child may become overweight or obese. Empirical studies have shown that most obese children and adolescents remain obese in adulthood (Simmonds et al., 2016; Hughes et al., 2011; Srinivasan et al., 1996; Must and Strauss, 1999). These studies suggest that the likelihood of persistence of obesity into adulthood is high for overweight and obese children and adolescents.

We suppose that consumption during childhood is the family consumption chosen by the parent, so that c^{hi} denotes the healthy consumption of family i and c^{ui} denotes its unhealthy consumption when parents and children live together. [3]

1.2.1 Health risks

We assume that the effects of childhood consumption on health appear later in adulthood and may affect an individual's health. Specifically, the family consumption of the healthy good generates a future health benefit for the child that is misperceived by parents. On the other hand, family consumption of the unhealthy good generates future health damage for the child (may cause overweight or obesity in the long-run, which usually comes with health problems) that is also misperceived by parents. These effects of the family consumption on child's future health are captured by the child's health function $v(c^{hi}, c^{ui})$ with v an increasing and concave function with respect to healthy good and a decreasing and concave function with respect to unhealthy good (i.e., $v'_h > 0$, $v''_{hh} < 0$, $v'_u < 0$, and $v''_{uu} < 0$). [4]

3. We do not incorporate discounting because consumption decisions are made at a single date by parents for the whole family.

4. We denote by: $v'_h = \frac{\partial v(c^{hi},c^{ui})}{\partial c^{hi}}$, $v''_{hh} = \frac{\partial^2 v(c^{hi},c^{ui}))}{\partial {c^{hi}}^2}$, $v'_u = \frac{\partial v(c^{hi},c^{ui})}{\partial c^{ui}}$ and $v''_{uu} = \frac{\partial^2 v(c^{hi},c^{ui})}{\partial {c^{ui}}^2}$.

In the short-run, parents may misperceive parts of these health effects of family consumption on their child's future health. Their perceived child's health function is given by $\alpha^i v(c^{hi}, c^{ui})$ with α^i the health effect of family consumption on the child's health perceived by the parent i (i.e., $1-\alpha^i$ is the health effect of family consumption misperceived by the parent i). The impact of diet on children's future health perceived by the parent could be smaller than the real effects of diet on children's future health. For example, studying the impact of food risk perception on fish consumption behavior in five European countries, Pieniak et al. (2008) find that consumers perceive a rather low risk of food poisoning from eating fish across the countries. We make the following assumption:

Assumption A1: $0 \leq \alpha^i \leq 1, \quad \forall \ \ i = 1, 2$.

Indeed, the public health problem related to diet would be that individuals exhibit a high consumption level of unhealthy food and a low consumption level of healthy food. This seems to be more likely to occur if individuals perceive lower health benefits and costs related to diet than the effective health benefits and costs of diet. It is well documented in the nutrition literature that consumers have a stronger belief in the presence of beneficial than of harmful components in their diet (Verbeke et al., 2005). In assessing potential misperceptions among parents regarding the healthfulness of sugary drinks for their children, Munsell et al. (2016) find that almost all parents (96%) provide sweetened beverages to their children and believe that some sweetened beverages are healthy options for children, particularly flavoured waters, fruit juices, and sports drinks. This supports the hypothesis that individuals perceive low risks associated with diet. We also suppose that $\alpha^1 > \alpha^2$, i.e., parents of type 2, with lower nutritional knowledge, have a higher misperception about the effects of diet on their children's future health than parents of type 1. This hypothesis is in line with empirical studies suggesting that nutritional knowledge could affect individuals' perceived healthiness of food (Ares et al., 2008) and their evaluation of

food healthiness (Crites and Aikman, 2005).

1.2.2 Preferences

The utility of a parent i depends on the family consumption of healthy good c^{hi}, unhealthy good c^{ui}, and the child's health function. Parent i's utility is written:

$$\hat{U}_i(c^{hi}, c^{ui}) = u(c^{hi}, c^{ui}) + \alpha^i v(c^{hi}, c^{ui}). \tag{1.1}$$

Moreover, we suppose that the marginal satisfaction of the unhealthy good is greater than its marginal health cost (i.e., $u'_u(c^{hi}, c^{ui}) > |v'_u(c^{hi}, c^{ui})|$). This assumption makes sense because if the consumption of the unhealthy good costs more than it brings in, then no family would be interested in consuming it. In other words, if this hypothesis is not verified for a family, then it will only consume the healthy good.

1.2.3 Individual choices

Parent i chooses the family consumption of healthy and unhealthy goods by maximizing utility (1.1) subject to their budget constraint:

$$\begin{aligned} \max_{\{c^{hi}, c^{ui}\}_{i=1,2}} \quad & \hat{U}_i(c^{hi}, c^{ui}) = u(c^{hi}, c^{ui}) + \alpha^i v(c^{hi}, c^{ui}), \\ s.t. \quad & w^i = p^u c^{ui} + p^h c^{hi}. \end{aligned} \tag{1.2}$$

with p^u and p^h, the prices of the unhealthy good and the healthy good respectively, and w^i is the parent i's income.

The first order conditions are the following:

$$u'_h(c^{hi}, c^{ui}) + \alpha^i v'_h(c^{hi}, c^{ui}) = \frac{p^h}{p^u}\left[u'_u(c^{hi}, c^{ui}) + \alpha^i v'_u(c^{hi}, c^{ui})\right], \tag{1.3}$$

$$w^i - p^h c^{hi} - p^u c^{ui} = 0. \tag{1.4}$$

Equations (1.3) and (1.4) give the demand functions of the healthy good and the unhealthy good as functions of the perception parameter (α^i), prices (p^h and p^u), and income (w^i).

Each parent i chooses family consumption levels of healthy and unhealthy goods such that the sum of the marginal satisfaction and his/her perceived marginal health benefit of healthy consumption is equal to the difference between the marginal satisfaction and his/her perceived marginal health cost of unhealthy consumption weighted by the price ratio.

Results of the comparative statics concerning the perception parameter (α^i) and income (w^i) are summarized in table 1.1. [5]

Table 1.1 – Comparative statics

Parameters	Effects on c^{hi}	Effects on c^{ui}
α^i	+	-
w^i	$\pm$	$\pm$

The consumption levels of healthy and unhealthy goods are influenced by a perception effect and an income effect. Perception has a positive impact on the consumption of healthy good and a negative impact on the consumption of unhealthy good.

5. See Appendix 1.A for proof of the comparative statics.

Perceptions play a crucial role in the dietary choices made by parents especially, when they have a clear understanding of the health benefits of consuming the healthy good and the health risks of consuming the unhealthy good. When parents have a high perception of the positive health benefits associated with the consumption of healthy good, they are more likely to increase the family's consumption of this good. On the other hand, a strong awareness of the negative health impacts of the unhealthy good leads to a decrease in the family's consumption of this good. Therefore, an accurate perception of the health benefits of healthy eating and the health harms of unhealthy eating can lead parents to make healthier food choices. The effect of income on the consumption of healthy and unhealthy goods cannot be signed without additional assumptions on the form of the utility function. We will determine this effect using a numerical example. In the case that both family types have the same income level, only the perception effect influences the consumption of the healthy and unhealthy goods. The nutritional quality of families' diet will be better for the family with the best nutritional knowledge.

1.3 Social optimum

We assume a utilitarian social central planner whose welfare function is expressed by the sum of individual utilities. But she has no misperceptions about the effects of diet on health and therefore makes decisions as if $\alpha^1 = \alpha^2 = 1$.

1.3.1 First-best solution

The program of the utilitarian social central planner writes:

$$\begin{aligned} \max_{\{c^{hi},c^{ui}\}_{i=1,2}} \quad & \sum_{i=1,2} \left[u(c^{hi},c^{ui}) + v(c^{hi},c^{ui})\right], \\ s.t. \quad & W = p^u \sum_{i=1,2} c^{ui} + p^h \sum_{i=1,2} c^{hi}. \end{aligned} \tag{1.5}$$

with $W = w^1 + w^2$.

The optimal conditions are given by, $\forall\ i = 1, 2$:[6]

$$u'_h(c^{hi},c^{ui}) + v'_h(c^{hi},c^{ui}) = \mu p^h, \tag{1.6}$$

$$u'_u(c^{hi},c^{ui}) + v'_u(c^{hi},c^{ui}) = \mu p^u, \tag{1.7}$$

$$W - p^u \sum_{i=1,2} c^{ui} - p^h \sum_{i=1,2} c^{hi} = 0. \tag{1.8}$$

At the optimum, all families consume the same amount of healthy and unhealthy goods, i.e., $c^{h1} = c^{h2} = c^{h\star}$ and $c^{u1} = c^{u2} = c^{u\star}$.

Combining equations (1.6) and (1.7) , we deduce that:

$$u'_h(c^{h\star},c^{u\star}) + v'_h(c^{h\star},c^{u\star}) = \frac{p^h}{p^u}\left[u'_u(c^{h\star},c^{u\star}) + v'_u(c^{h\star},c^{u\star})\right], \tag{1.9}$$

and the budget constraint

$$c^{u\star} = \frac{W}{2p^u} - \frac{p^h}{p^u} c^{h\star}. \tag{1.10}$$

6. μ denotes the Lagrange multiplier.

Comparing equations (1.3) and (1.9), we see that for any $\alpha^i < 1$, families' consumption levels of healthy and unhealthy goods are non-optimal.

The non-optimality of the individual choice solution justifies the need for public intervention to reduce health inequalities and against diet-related non-communicable diseases.

1.3.2 Taxation policy

Public intervention is required to restore the social optimum. In this section, we study the case of a differentiated tax on the consumption of the unhealthy good.

We suppose that the public authority decides to tax the consumption of unhealthy good. An argument that often raises against the taxation of unhealthy goods (fat taxes or soda taxes) is the regressive nature of this policy (Allais et al., 2010; Leicester and Windmeijer, 2004). On average, people with low socioeconomic status consume more unhealthy food (Ogden et al., 2011; Best and Papies, 2019; Wang et al., 2010) and therefore bear the burden of a tax on unhealthy goods.[7] Nevertheless, this regressive nature of the tax can be minimized if the revenues of the taxes on unhealthy food are used for the benefit of the poor (Brownell et al., 2009; Jacobson and Brownell, 2000).

Moreover, there is empirical evidence that suggests that taxation of unhealthy food items is an effective means for reducing consumption of these goods (Epstein et al., 2012; Block et al., 2010), and therefore reducing the prevalence of obesity (Lin et al., 2011; Hall et al., 2011). Allcott et al. (2019) suggest that taxation of unhealthy good (soda) is probably a good idea.

Let us consider the decentralized problem with a differentiated tax τ^i on the consumption of the unhealthy good of the type i family. We assume that the tax

7. In the model, we do not make any assumptions about which family has more income. Hence, the regressive nature of the tax is no longer a problem as we allow each type of family to be more or less wealthy than the other.

revenue is redistributed to families as a transfer s^i. The government budget constraint writes:

$$p^u \sum_{i=1}^{2} \tau^i c^{ui} = \sum_{i=1}^{2} s^i. \tag{1.11}$$

Parents choose the family consumption levels of healthy and unhealthy goods by maximizing their perceived utility (1.1) subject to their modified budget constraint.

For a type i family, the individual choice program then becomes:

$$\begin{aligned} \max_{\{c^{hi},c^{ui}\}_{i=1,2}} \quad & \hat{U}_i(c^{hi}, c^{ui}) = u(c^{hi}, c^{ui}) + \alpha^i v(c^{hi}, c^{ui}), \\ s.t. \quad & w^i + s^i = p^u(1+\tau^i)c^{ui} + p^h c^{hi}. \end{aligned} \tag{1.12}$$

The first order conditions are written:

$$u'_h(c^{hi}, c^{ui}) + \alpha^i v'_h(c^{hi}, c^{ui}) - \tfrac{p^h}{p^u(1+\tau^i)}\left[u'_u(c^{hi}, c^{ui}) + \alpha^i v'_u(c^{hi}, c^{ui})\right] = 0, \tag{1.13}$$

$$w^i + s^i - p^h c^{hi} - p^u(1+\tau^i)c^{ui} = 0. \tag{1.14}$$

Equations (1.13) and (1.14) give the demand functions of healthy good (c^{hi}) and unhealthy good (c^{ui}) as a function of the tax τ^i and transfers s^i, $\quad c^{hi}(\tau^i, s^i)$ and $c^{ui}(\tau^i, s^i)$.

We show that the social optimum can be decentralized by discriminating taxes and transfers.

Proposition 1.1 *The social optimum can be decentralized by individual taxes, τ^i, and transfers, s^i, such as:*

$$\tau^i = \frac{p^h}{p^u}\frac{u'_u(c^{h\star}, c^{u\star}) + \alpha^i v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + \alpha^i v'_h(c^{h\star}, c^{u\star})} - 1, \tag{1.15}$$

and

$$s^i = (1+\tau^i)\frac{W}{2} - w^i - \tau^i p^h c^{h\star}. \tag{1.16}$$

Proof. See Appendix 1.B

The tax that each type of family will pay depends on its marginal rate of substitution of the unhealthy good for the healthy good.

$$\frac{\partial \tau^i}{\partial \alpha^i} = \frac{p^h}{p^u}\frac{v'_u(c^{h\star}, c^{u\star})\left[u'_h(c^{h\star}, c^{u\star}) + \alpha^i v'_h(c^{h\star}, c^{u\star})\right] - v'_h(c^{h\star}, c^{u\star})\left[u'_u(c^{h\star}, c^{u\star}) + \alpha^i v'_u(c^{h\star}, c^{u\star})\right]}{\left[u'_h(c^{h\star}, c^{u\star}) + \alpha^i v'_h(c^{h\star}, c^{u\star}))\right]^2} < 0. \tag{1.17}$$

The central planner will tax families proportionally to their levels of misperception of the health effects of food. Individuals with higher levels of misperception will pay a higher tax rate. The tax paid by the family of type 2 will be greater than the tax paid by the family of type 1, regardless of income level.

The difference between the transfer received by the family of type 1 (s^1) and that received by the family of type 2 (s^2) is given by: [8]

$$s^1 - s^2 = (\tau^1 - \tau^2)(\frac{W}{2} - p^h c^{h\star}) - (w^1 - w^2). \tag{1.18}$$

The first term of equation (1.18) is always negative, but the second term can be positive or negative depending on whether the family of type 1 is assumed to have a

8. $(\frac{W}{2} - p^h c^{h\star}) = p^u c^{u\star} > 0$. This is deduced from equation (1.10)

higher or lower income than the family of type 2. If we assume that the income of the family of type 1 is higher than the income of the family of type 2 ($w^1 > w^2$) or if we assume that both types of families have the same income ($w^1 = w^2$), then the transfer received by the family of type 2 will be higher than the transfer received by the family of type 1. On the other hand, if we assume that the family of type 2 has the highest income, the sign of equation (1.18) becomes ambiguous.

If possible, the implementation of a targeted tax policy could therefore solve the problem of non-optimality of family food consumption. However, it is very difficult in practice for a central planner to put a discriminating tax on food products. The viable solution to restore the social optimum with taxation is to set a uniform tax for both family types.

1.3.3 Mixed policy: taxation and nudge

Let us now consider the most realistic tax policy, in which the central planner sets a uniform tax for both family types and supports the tax with a non-economic instrument called a nudge in a mixed policy. The reason for using a nudge is that it is a tool that can help families to improve the nutritional quality of their diets with negligible implementation costs. The nudge we consider corresponds to information provided by the public authority concerning the healthiness of food items. The use of nudge therefore aims to reduce the degree of individuals' misperception of the effects of diet on health. The nudge used in our model can be interpreted as a nutrition labeling system (like the "Nutri-Score" [9]) or the promotion of a social norm on food, for example. Its goal is to make the choice of healthy food easier. We assume that the implementation of the nudge, η, does not generate additional costs for the public authority.

Following Farhi and Gabaix (2020), we assume that the nudge influences con-

9. The Nutri-score is a five-level nutrition labeling system, ranging from A to E and from green to red, placed on the front of food packaging, based on the nutritional value of a food product.

sumption but has no effect on a parent's budget constraint. As in Farhi and Gabaix (2020), we also assume that the reaction of an individual to the implementation of the nudge depends on his nudgeability ρ^i. Nugeabitlity here refers to a parent's sensitivity to the change in their food choice environment after the implementation of the nudge. More precisely, a parent's nudgeability refers to the improvement in the parent's perception of the effects of food on health due to the implementation of the nudge. We can therefore assume that parents who suffer from greater misperception are more sensitive to the implementation of nudge (i.e., $\rho^2 > \rho^1$). Intuitively, a parent who has a good perception of the health effects of food will have a good classification of goods based on their healthiness. Therefore, the introduction of the nudge will not significantly modify his or her consideration of the healthiness of goods. On the other hand, a parent who has erroneous perceptions of the health effects of food will have a bad classification of goods according to their healthiness. For this parent, the implementation of the nudge may alter his or her consideration of the healthiness of goods. If we think about the nutrition labeling system for example, Koenigstorfer et al. (2014) find that traffic light color-coded label leads to more healthful food choices, particularly for consumers who struggle to resist unhealthful food.

In general, a nudge may also affect the agents' perceived utility. In our model, the nudge increases the health effects of food perceived by parents. Under the implementation of the nudge, parent i's utility is now given by:

$$\hat{U}_i(c^{hi}, c^{ui}) = u(c^{hi}, c^{ui}) + (\alpha^i + \rho^i \eta) v(c^{hi}, c^{ui}). \tag{1.19}$$

where $\rho^i \geq 0$ captures the nudgeability of the agent i; $\rho^i = 0$ corresponds to a non-nudgeable agent.

Under the implementation of the mixed policy, parents choose family consumption of healthy and unhealthy goods by maximizing perceived utility (1.19) subject to their budget constraint.

For family i:

$$\begin{aligned} \max_{\{c^{hi},c^{ui}\}_{i=1,2}} \quad & \hat{U}_i(c^{hi},c^{ui}) = u(c^{hi},c^{ui}) + (\alpha^i + \rho^i\eta)v(c^{hi},c^{ui}), \\ s.t. \quad & w^i + s^i = p^u(1+\tau)c^{ui} + p^h c^{hi}. \end{aligned} \tag{1.20}$$

The first order conditions are written:

$$u'_h(c^{hi},c^{ui}) + (\alpha^i + \rho^i\eta)v'_h(c^{hi},c^{ui}) = \frac{p^h}{p^u(1+\tau^i)}\left[u'_u(c^{hi},c^{ui}) + (\alpha^i + \rho^i\eta)v'_u(c^{hi},c^{ui})\right], \tag{1.21}$$

$$w^i + s^i - p^h c^{hi} - p^u(1+\tau)c^{ui} = 0. \tag{1.22}$$

With the mixed policy, we obtain the following result:

Proposition 1.2 *The social optimum can be decentralized by:*

(i) a nudge such that,

$$\eta^\star = \frac{\alpha^1 - \alpha^2}{\rho^2 - \rho^1}, \tag{1.23}$$

(ii) a uniform tax,

$$\tau^\star = \frac{u'_h(c^{h\star},c^{u\star}) + v'_h(c^{h\star},c^{u\star})}{u'_u(c^{h\star},c^{u\star}) + v'_u(c^{h\star},c^{u\star})} \times \frac{u'_u(c^{h\star},c^{u\star}) + (\alpha^i + \rho^i\eta^\star)v'_u(c^{h\star},c^{u\star})}{u'_h(c^{h\star},c^{u\star}) + (\alpha^i + \rho^i\eta^\star)v'_h(c^{h\star},c^{u\star})} - 1, \tag{1.24}$$

(iii) and individual transfers,

$$s^i = p^h c^{h\star} + p^u(1+\tau^\star)c^{u\star} - w^i, \quad \forall i = 1,2. \tag{1.25}$$

Proof. See Appendix 1.C

The nudge allows the central planner to address the differences in perceptions of the effects of food on health between the two family types and to set a uniform tax on the consumption of the unhealthy good. The optimal nudge from equation (1.23) can be understood as the optimality of the nudge design. The design of the nudge must consider both the perception gaps among families and their nudgeability. The optimal design of the nudge needs to be refined when there are significant perception gaps between the two types of families, or when the nudgeability of the family with the most misperceptions is similar to that of the other family. This may involve tailoring the nudge to improve the perceptions of each type of family, ensuring that the family with the most erroneous perceptions is more sensitive to the implementation of the nudge. Under the implementation of the mixed policy, a portion of the income of the family with the highest income is redistributed to the family with the lowest income as a transfer. Thus, the mixed policy also allows the central planner to reduce the income gap between the two family types.

1.4 Numerical example

We run numerical simulations to illustrate the results of our theoretical model. [10] We make graphical representations highlighting how family consumption of healthy and unhealthy goods varies with income.

Let's take as a numerical example based on:

$$u(c^{hi}, c^{ui})) = (c^{hi} \times c^{ui})^{\theta}, \qquad v(c^{hi}, c^{ui})) = \left[c^{hi} \times (\overline{C} - c^{ui})\right]^{\theta},$$

with $\overline{C}$ the maximum value that the consumption of unhealthy good can reach and $0 < \theta < 1$.

We compare the family's consumption levels of healthy and unhealthy goods of the

10. The numerical results are obtained with Mathematica 13.

individual choice outcome to the first-best optimum when the income of the type 1 family varies *ceteris paribus*. Table 1.2 gives the predefined values of all parameters.

Table 1.2 – Predefined values of parameters

Parameters	Predefined values
α^1	0.5
α^2	0.25
p^h	2
p^u	1
$\overline{C}$	250
θ	1/2
w^1	$\in [50; 250]$
w^2	100

We represent the variation of consumption levels for both family types and the first-best solution of the healthy good (Figure 1.1) and the unhealthy good (Figure 1.2) as a function of type 1 family's income. The vertical purple line in both figures represents the income value of type 2 family. We can see that family consumption of healthy and unhealthy good increases with income. When the incomes of both family types are equal (i.e., $w^1 = w^2 = 100$), type 1 family consumes more of the healthy goods and less of the unhealthy goods than type 2 family. However, both family types under-consume the healthy good and over-consume the unhealthy good compared to the first-best. If the incomes of both family types are different, the disparity between their consumption levels of healthy and unhealthy goods depends both on the gap between their incomes and their perceptions.

From this numerical example, we deduce the following results:

Result 1.1 *If both family types have the same income level ($w^1 = w^2$), then the family with more nutritional knowledge (type 1) will consume more healthy good and less unhealthy good than the family with less nutritional knowledge (type 2).*

Result 1.2 *If type 1 family has a higher income than type 2 family ($w^1 > w^2$), then the type 1 family will consume more healthy good than the type 2 family but may*

consume more or less unhealthy good than the type 2 family.

Result 1.3 *If the type 1 family has a lower income than the type 2 family ($w^1 < w^2$), then the type 1 family will consume less unhealthy good than the type 2 family but may consume more or less healthy good than type 2 family.*

These two graphs confirm that if parents suffer from misperceptions about the future health effects of diet, families' consumption levels of healthy and unhealthy goods are non-optimal. These two graphs also highlight that the differences in perception and income between family types play an important role in the nutritional quality of their diets. Especially, if the income gap between families is very large, one could have the family with better nutritional knowledge consuming more or less healthy good or unhealthy good than the family with little nutritional knowledge.

Figure 1.1 – Families' healthy good consumption levels and the first-best's healthy good consumption as a function of type 1 family's income

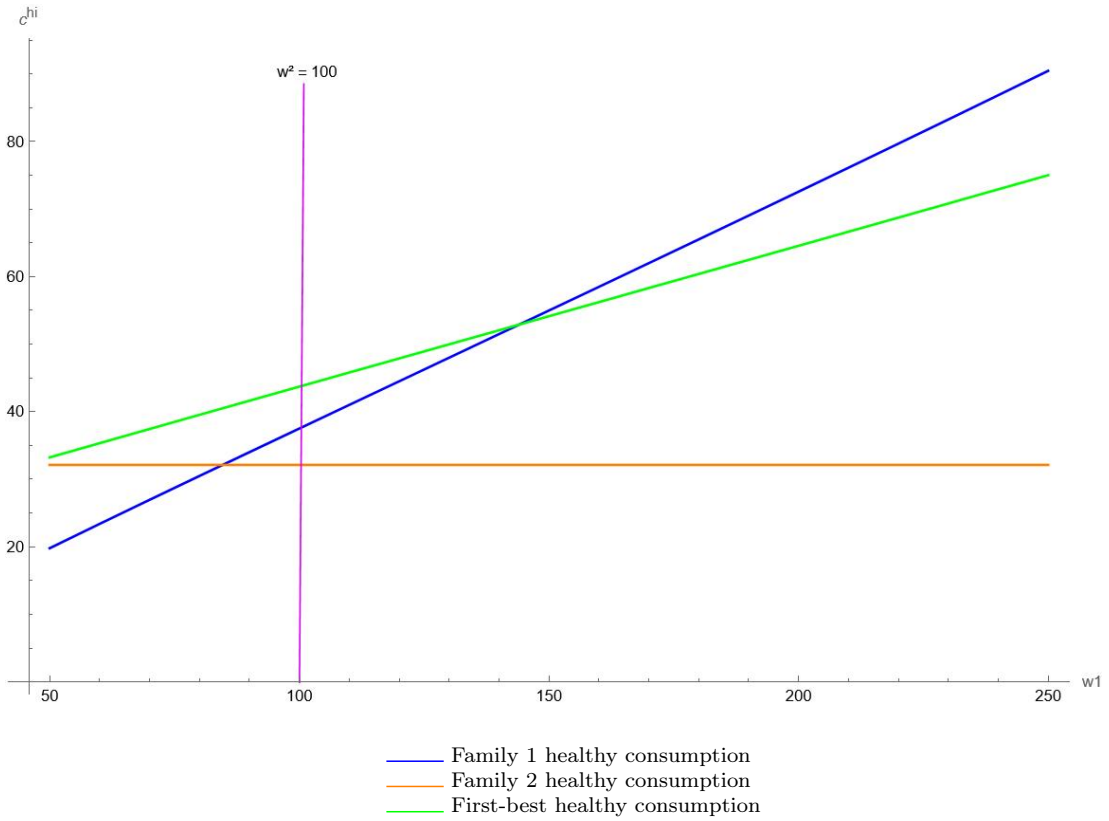
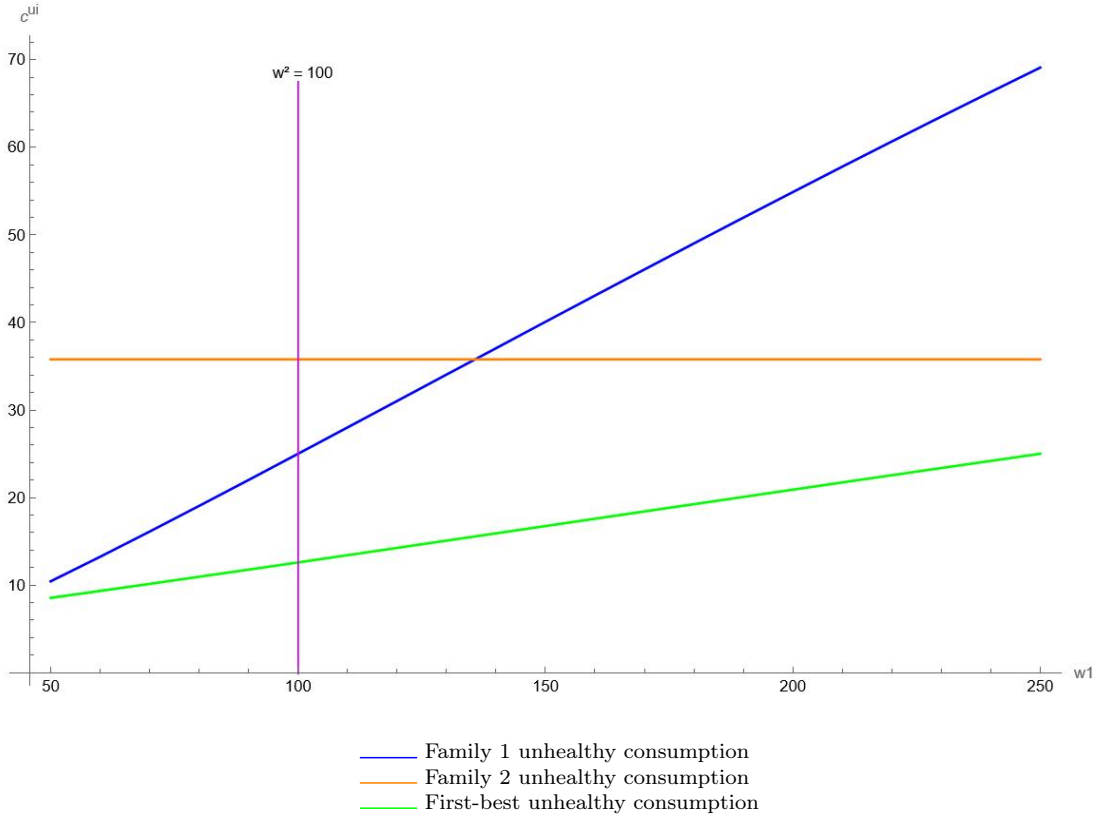


Figure 1.2 – Families' unhealthy good consumption levels and the first-best's unhealthy good consumption as a function of type 1 family's income



1.5 Discussion and concluding remarks

This chapter studies the effectiveness of two public policies (tax and nudge) in an economy composed of two types of family that differ in their income and their degree of misperception of the effects of diet on their children's future health.

Our model clearly highlights the need for public interventions to improve the nutritional quality of families' diets. We show that a simple tax policy on the consumption of the unhealthy good achieves the first-best optimum if and only if it is possible to implement a targeted tax policy. Then, we find that the use of nudge as a support to the tax on the consumption of the unhealthy good allows to reach the first-best optimum with a uniform tax for both types of families.

In our model, we consider family consumption and therefore we implicitly assume that the parent and the child consume the same types of goods. One might think

that the model does not show the existence of children's consumption, and therefore think that we can consider it as the choice of a given individual living two periods. However, this configuration does not fit the model for two reasons. First, it would be necessary in this case to take into account the consumption of this individual in the second period. We will then need the existence of a source of income or a possible saving that would allow him/her to finance his/her consumption during the second period. In our model, the family consumption of the period includes the consumption of both the parent and the child which are financed by the parent. Thus there is no need to save for the second period because the family consumption of the second period will be financed by the income of the child of the first period who will become the parent in the second period. Second, if we consider that it is the choice of an individual living two periods, the result of the individual choice can be the result of a rational choice. The individual will make his/her decisions by making a trade-off between his/her instantaneous satisfaction derived from the consumption of the two types of goods and his/her future health which depends on his/her consumption levels. In our model, there are intergenerational externalities due to the parents' lack of nutritional knowledge. If we assume that parents care about their children's future health, then they will need better knowledge about the link between children's food consumption and their future health. This may justify public intervention to clarify the link between health and diet, which would not necessarily be required if the model was considered to apply to the choice of an individual living two periods. For future work, one way to avoid this confusion about the existence of children in the model would be to distinguish between parental and child consumption. Note that we do not include the effect of diet on parents' future health in the model. Indeed, the chapter is in line with policies aiming to tackle childhood's obesity and overweight, so only the effect of family consumption on children's future health is considered here. The health status of parents (obese or not) is assumed to be already known and to depend on their family consumption when they were children.

Another point of the model that should be discussed for an empirical application is the measurability of the perception and nudgeability parameters α^i, and ρ^i. The optimal nudge in our model is based on the assumption that the values of these parameters are known in advance. The values of the perception parameter (α^i) can be obtained from experimental studies that measure individuals' perceptions of the effects of eating certain food items on their future health or their perceptions of the safety of certain food items. In contrast, the determination of the values of the nudgeability parameter (ρ^i) seems more delicate because it requires first implementing the nudge and then measuring how individuals react to the implementation of the nudge. A way to find out if the implementation of a nudge will have the desired effect on the purchase decisions of food items would be to first conduct an experiment on the implementation of the nudge. This will allow the decision-maker to measure individuals' sensitivities to the nudge and to evaluate the capacity of the nudge to alter their food choices. The nudge can be considered as optimal if it allows the decision-maker to get as close as possible to the target objective. If we take the example of food labels, a label can be considered as optimal if it effectively reduces the consumption of unhealthy goods and increases the consumption of healthy goods. To be optimal, a nudge must be understandable by consumers and have real effects on their food purchase decisions. We should also discuss the implications of the assumption which states that parents who suffer from greater misperception are more sensitive to the implementation of nudge (i.e., $\rho^2 > \rho^1$). If this assumption does not hold, then the nudge may not work or achieve adverse effects. Misunderstanding the nudge may lead to a false estimation of the healthiness of food items, and in particular, it may possibly contribute to a decrease in the consumption of healthy goods and an increase in the consumption of unhealthy goods. If the information provided by the nudge is misunderstood, then it may not influence the food purchases of families.

Finally, the results of our model suggest a potential complementarity between the use of taxation of unhealthy goods and a nudge. To confirm this potential

complementarity between tax and nudge found in our model, experimental studies could be considered to find out if tax and nudge are complementary public policy instruments. These extensions are left for future research.

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Appendices

Appendix 1.A *Proof of the comparative statics in Table 1.1.*

The first order conditions of the Lagrangian of the maximization program of a parent i are given by:

$$\frac{\partial \mathcal{L}}{\partial c^{hi}} = 0 \Rightarrow \quad u'_h(c^{hi}, c^{ui}) + \alpha^i v'_h(c^{hi}, c^{ui}) - \lambda p^h = 0 \equiv \mathcal{L}_h \tag{1.A1}$$

$$\frac{\partial \mathcal{L}}{\partial c^{ui}} = 0 \Rightarrow \quad u'_u(c^{hi}, c^{ui}) + \alpha^i v'_u(c^{hi}, c^{ui}) - \lambda p^u = 0 \equiv \mathcal{L}_u \tag{1.A2}$$

$$w^i - p^h c^{hi} - p^u c^{ui} = 0 \equiv F(c^{hi}, c^{ui}) \tag{1.A3}$$

Differentiating the first order conditions with respect to α^i we obtain:

$$\mathcal{L}_{hh}\frac{dc^{hi}}{d\alpha^i} + \mathcal{L}_{hu}\frac{dc^{ui}}{d\alpha^i} + F_h\frac{d\lambda}{d\alpha^i} + \mathcal{L}_{h\alpha^i} = 0 \tag{1.A4}$$

$$\mathcal{L}_{uh}\frac{dc^{hi}}{d\alpha^i} + \mathcal{L}_{uu}\frac{dc^{ui}}{d\alpha^i} + F_u\frac{d\lambda}{d\alpha^i} + \mathcal{L}_{u\alpha^i} = 0 \tag{1.A5}$$

$$F_h \frac{dc^{hi}}{d\alpha^i} + F_u \frac{dc^{ui}}{d\alpha^i} + F_{\alpha^i} = 0 \tag{1.A6}$$

With:

$\mathcal{L}_{hh} = \frac{\partial \mathcal{L}_h}{\partial c^{hi}} = u''_{hh}(c^{hi}, c^{ui}) + \alpha^i v''_{hh}(c^{hi}, c^{ui}) < 0$;

$\mathcal{L}_{uu} = \frac{\partial \mathcal{L}_u}{\partial c^{ui}} = u''_{uu}(c^{hi}, c^{ui}) + \alpha^i v''_{uu}(c^{hi}, c^{ui}) < 0$;

$\mathcal{L}_{hu} = \mathcal{L}_{uh} = \frac{\partial \mathcal{L}_h}{\partial c^{ui}} = u''_{hu}(c^{hi}, c^{ui}) + \alpha^i v''_{hu}(c^{hi}, c^{ui}) \lessgtr 0$;

$\mathcal{L}_{h\alpha^i} = \frac{\partial \mathcal{L}_h}{\partial \alpha^i} = v'_h(c^{hi}, c^{ui}) > 0$; $\mathcal{L}_{u\alpha^i} = \frac{\partial \mathcal{L}_u}{\partial \alpha^i} = v'_u(c^{hi}, c^{ui}) < 0$

$F_h = \frac{\partial F(c^{hi}, c^{ui})}{\partial c^{hi}} = -p^h$; $F_u = \frac{\partial F(c^{hi}, c^{ui})}{\partial c^{ui}} = -p^u$; $F_{\alpha^i} = \frac{\partial F(c^{hi}, c^{ui})}{\partial \alpha^i} = 0$

We deduce that:

$$\frac{dc^{hi}}{d\alpha^i} = \frac{-p^h p^u v'_u(c^{hi}, c^{ui}) + {p^u}^2 v'_h(c^{hi}, c^{ui})}{\Delta} > 0 \tag{1.A7}$$

and

$$\frac{dc^{ui}}{d\alpha^i} = \frac{-p^h p^u v'_h(c^{hi}, c^{ui}) + {p^h}^2 v'_u(c^{hi}, c^{ui})}{\Delta} < 0 \tag{1.A8}$$

with $\Delta = 2p^h p^u \mathcal{L}_{hu} - ({p^h}^2 \mathcal{L}_{uu} + {p^u}^2 \mathcal{L}_{hh}) > 0$

Analogically, differentiating the first order conditions with respect to income w^i *we obtain:*

$$\mathcal{L}_{hh}\frac{dc^{hi}}{dw^i} + \mathcal{L}_{hu}\frac{dc^{ui}}{dw^i} + F_h\frac{d\lambda}{dw^i} + \mathcal{L}_{hw^i} = 0 \tag{1.A9}$$

$$\mathcal{L}_{uh}\frac{dc^{hi}}{dw^i} + \mathcal{L}_{uu}\frac{dc^{ui}}{dw^i} + F_u\frac{d\lambda}{dw^i} + \mathcal{L}_{uw^i} = 0 \tag{1.A10}$$

$$F_h\frac{dc^{hi}}{dw^i} + F_u\frac{dc^{ui}}{dw^i} + F_{w^i} = 0 \tag{1.A11}$$

With:

$\mathcal{L}_{hw^i} = \frac{\partial \mathcal{L}_h}{\partial w^i} = 0$; $\mathcal{L}_{uw^i} = \frac{\partial \mathcal{L}_u}{\partial w^i} = 0$; $F_{w^i} = \frac{\partial F(c^{hi}, c^{ui})}{\partial w^i} = 1$

We deduce that:

$$\frac{dc^{hi}}{dw^i} = \frac{p^u\mathcal{L}_{hu} - p^h\mathcal{L}_{uu}}{\Delta} \lessgtr 0 \tag{1.A12}$$

And

$$\frac{dc^{ui}}{dw^i} = \frac{p^h\mathcal{L}_{hu} - p^u\mathcal{L}_{hh}}{\Delta} \lessgtr 0 \tag{1.A13}$$

Appendix 1.B *Proof of proposition 1.1.*

The central planner sets the tax rate so that equation (1.13) is equal to zero for $c^{hi} = c^{h\star}$ *and* $c^{ui} = c^{u\star}$, $\forall i = 1, 2$.

$$u'_h(c^{h\star}, c^{u\star}) + \alpha^i v'_h(c^{h\star}, c^{u\star}) - \frac{p^h}{p^u(1+\tau^i)}\left[u'_u(c^{h\star}, c^{u\star}) + \alpha^i v'_u(c^{h\star}, c^{u\star})\right] = 0 \quad \text{(1.B1)}$$

We deduce that:

$$\tau^i = \frac{p^h}{p^u}\frac{u'_u(c^{h\star}, c^{u\star}) + \alpha^i v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + \alpha^i v'_h(c^{h\star}, c^{u\star})} - 1 \quad \text{(1.B2)}$$

From the parent i's budget constraint and equations (1.10) and (1.14), we deduce that:

$$s^i = (1+\tau^i)\frac{W}{2} - w^i - \tau^i p^h c^{h\star} \quad \text{(1.B3)}$$

Appendix 1.C *Proof of proposition 1.2.*

The central planner's objective is to implement a nudge and a uniform tax that achieve the levels of healthy and unhealthy goods consumption of the first-best with the mixed policy. Thus, we can rewrite equation (1.21) as follows:

$$u'_h(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_h(c^{h\star}, c^{u\star}) = \frac{p^h}{p^u(1+\tau^i)}\big[u'_u(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_u(c^{h\star}, c^{u\star})\big] \quad \text{(1.C1)}$$

$$\Rightarrow \frac{p^u}{p^h} = \frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_u(c^{h\star}, c^{u\star})}{(1+\tau)\big[u'_h(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_h(c^{h\star}, c^{u\star})\big]} \quad \text{(1.C2)}$$

From equation (1.9) we also have:

$$\frac{p^u}{p^h} = \frac{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})} \quad \text{(1.C3)}$$

From equations (1.C2) and (1.C3), we deduce that:

$$\frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_u(c^{h\star}, c^{u\star})}{(1+\tau)\big[u'_h(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_h(c^{h\star}, c^{u\star})\big]} = \frac{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})}$$

$$\Rightarrow (1+\tau) = \frac{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})}{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})} \times \frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta)v'_h(c^{h\star}, c^{u\star})} \quad \text{(1.C4)}$$

If we rewrite equation (1.C4) for each family type we get:

For the type 1 family ($i = 1$):

$$(1+\tau) = \frac{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})}{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})} \times \frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^1 + \rho^1\eta)v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + (\alpha^1 + \rho^1\eta)v'_h(c^{h\star}, c^{u\star})} \quad \text{(1.C5)}$$

For the type 2 family ($i = 2$):

$$(1+\tau) = \frac{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})}{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})} \times \frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^2 + \rho^2\eta)v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + (\alpha^2 + \rho^2\eta)v'_h(c^{h\star}, c^{u\star})} \tag{1.C6}$$

From equations (1.C5) and (1.C6), we obtain:

$$\begin{aligned}&\big[u'_h(c^{h\star}, c^{u\star}) + (\alpha^1 + \rho^1\eta)v'_h(c^{h\star}, c^{u\star})\big]\big[u'_u(c^{h\star}, c^{u\star}) + (\alpha^2 + \rho^2\eta)v'_u(c^{h\star}, c^{u\star})\big] = \\ &\big[u'_h(c^{h\star}, c^{u\star}) + (\alpha^2 + \rho^2\eta)v'_h(c^{h\star}, c^{u\star})\big]\big[u'_u(c^{h\star}, c^{u\star}) + (\alpha^1 + \rho^1\eta)v'_u(c^{h\star}, c^{u\star})\big]\end{aligned}$$

Then, we deduce that:

$$\eta^\star = \frac{\alpha^1 - \alpha^2}{\rho^2 - \rho^1} \tag{1.C7}$$

$$\tau^\star = \frac{u'_h(c^{h\star}, c^{u\star}) + v'_h(c^{h\star}, c^{u\star})}{u'_u(c^{h\star}, c^{u\star}) + v'_u(c^{h\star}, c^{u\star})} \times \frac{u'_u(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta^\star)v'_u(c^{h\star}, c^{u\star})}{u'_h(c^{h\star}, c^{u\star}) + (\alpha^i + \rho^i\eta^\star)v'_h(c^{h\star}, c^{u\star})} - 1 \tag{1.C8}$$

and from equation (1.22),

$$s^i = p^h c^{h\star} + p^u(1+\tau^\star)c^{u\star} - w^i \tag{1.C9}$$

Chapter 2

Social Norms, Parents' Food Beliefs and Choices: an Experiment

2.1 Introduction

Dietary intake has a significant impact on individuals' future health. Unhealthy diets are considered as the main cause of the recent increase in obesity and overweight. Unhealthy consumption is associated with an increased risk of childhood obesity (Ludwig et al., 2001; Malik et al., 2006). Evidence on the links between diet and health indicates that dietary patterns play a key role in reducing the risk of many chronic diseases (Schulze and Hu, 2002; Shi et al., 2019). It has been shown that improvements in diet quality are associated with lower weight gain over several years (Fung et al., 2015). In addition to their negative effects on health and quality of life, obesity has a substantial economic burden in both developed and developing countries (Tremmel et al., 2017). Okunogbe et al. (2022) estimate, on average, the direct and indirect costs of overweight and obesity, in 2019, at 2.19% of global Gross Domestic Product of 161 countries. d'Errico et al. (2022) find that the total costs attributable to obesity in Italy amounted to €13.34 billion in 2020. Both the health and economic consequences of obesity make it a public health challenge worldwide. With the escalating predominance of childhood obesity, policymakers are implementing initiatives to improve children's diets, especially within the school environment. For example, France's 2004 public health law prohibits the installation of vending machines for drinks or manufactured foods in schools. One more recent example is the promotion from the European Union School Fruit, Vegetables and Milk scheme in the France's national food program 2019-2023 [1]. The objectives of this program are among others to make lasting changes in dietary patterns, promote healthier eating habits from early childhood, and diversifying diets by familiarizing children to rarely consumed products.

Nevertheless, parents can also play a crucial role in combating childhood obesity and overweight. They are the main responsible for food choices within the family and a large part of food products consumed by children stems from the family

1. France's national food program the regions in action 2019-2023.

environment. For instance, Feunekes et al. (1998) identify a notable similarity in habitual fat and food intake between parents and their adolescent children. Hence, understanding the determinants of parents' food choices is essential for promoting healthier eating habits within families. This knowledge is pivotal in addressing childhood obesity and overweight issues. Parents' decisions regarding food are not strictly rational; rather, they are often shaped by prevailing social norms. The social context significantly influences parents' food choices, and their perceptions of others' choices play a crucial role in shaping their own preferences and assessments of the nutritional value of food items. Consequently, interventions aimed at promoting healthier eating habits should consider the influential role of information and social norms in parental decision-making regarding food.

The purpose of this chapter is twofold. First, we aim to explore the impact of two types of information - a *descriptive norm* and an *opinion information* - on parents' beliefs regarding the nutritional quality of food. Second, we examine how these two types of information shape parents' food choices for themselves, their children, and an unknown child. To do so, we conduct a lab-in-the-field experiment at the "Cité des sciences et de l'industrie"[2], a science museum in Paris. Our experiment involves the participation of 300 parents, each having at least one child aged between 3 and 10 years old. Participants have mainly to decide in two tasks twice: 1- assigning a food quality index, namely the "NUTRI-SCORE"[3], to different food items displayed on their screen and 2- selecting a basket of four items for both themselves and a child.

Our experiment consists of a 3x2 between-subject design where we vary two factors when parents decide on the two aforementioned tasks: 1-the provided information (*control* vs. *descriptive norm* vs. *opinion information*) and 2-the receiver of the food decisions made by parents (their *own child* vs. an *unknown child*). The first dimen-

2. https://www.cite-sciences.fr/fr/accueil.

3. The NUTRI-SCORE is a five-level nutrition labeling system, ranging from A to E and from green to red, placed on the front of food packaging, based on the nutritional value of a food product (see figure 2.A1).

sion of the treatments is based on the type of the provided information: The control group involves no information, the first treatment group involves the disclosure of a *descriptive norm* to participants, and the second treatment group involves the disclosure of an *opinion information*. Specifically, the *descriptive norm* treatment provides participants with information about the percentage of parents who have chosen a specific food item for themselves or for children (calculated based on the control groups). In the *opinion information* treatments, participants are informed about the percentage of parents who express the belief that parents should choose a specific food item for themselves or for children. The information provided in the *opinion information* treatments comes from a survey. Note that the provision of the information only takes place during the second stage of the experiment (for treatment groups).

The second dimension of the design relies on the recipient of the food choice: parents have to simultaneously make one set of food decisions for themselves, and a second set, either for their child or for an unknown child, depending on their randomly assigned treatment group. By incorporating the dimension of choosing for an unknown child, we consider parents' food choices for children as a function of parental distance. Parental distance refers to whether the parent makes the choices for his or her own child versus making choices for an unknown child. This approach enables us to discern whether the choices of lower nutritional quality food items that parents make for their children are due to parents' desire to delight their own children or whether parents make food choices consistently, regardless of the child.

Our findings show that a *descriptive norm* significantly reduces parents' tendency to overestimate the nutritional quality of food items, while *opinion information* shows no significant effect on parents' beliefs. Furthermore, we find that both *descriptive norm* and *opinion information* significantly improve the nutritional quality of parents' food baskets with the effect of *descriptive norm* being more pronounced. Interestingly, *opinion information* also have a significant and positive impact on the

nutritional quality of the child's food baskets. In contrast, we do not find significant effects of *descriptive norm* on the nutritional quality of the child's food baskets. Moreover, our analysis reveals that parents tend to select food baskets with lower nutritional quality for children than for themselves. However, there is no significant difference in the nutritional quality between baskets for their own children and baskets for unknown children. Additionally, we find that parents generally underestimate the nutritional quality of food, i.e. they believe that food items have a lower nutritional quality than its actual quality.

This chapter contributes to the literature on the potential different effects that different types of social norms can have on individuals' decisions (Bonan et al., 2020; Mollen et al., 2013; Stok et al., 2014). These previous studies suggest that the descriptive norm has more influence than the injunctive norm on people's own decisions. Our findings highlight that disclosing what others do has a more significant influence on one's own decisions, whereas disclosing the opinions of others has a greater influence on decisions made for others. This chapter contributes also to the literature on of food choices made by parents for children (Marette et al., 2016). In our experiment, we are interested in parents' food choices for children as a function of parental distance. In other words, we investigate whether the nutritional quality of the food items chosen by parents differs depending on whether the choice is made for their own child or for an unknown child. To the best of our knowledge, this is the first experiment that introduces the notion of parental distance into the study of parents' food choices for children.

The chapter is structured as follows: Section 2.2 presents a literature review. The experimental design is described in section 2.3. Section 2.4 presents an overview of the data analysis methods. Section 2.5 provides the results and Section 3.6 concludes.

2.2 Literature review

2.2.1 Information provision and social comparison

Information framed as social norms can have an impact on eating behaviors. According to Paluck et al. (2010), "a social norm is a perception of where a social group is or where the social group ought to be on some dimension of attitude or behavior". The social norms literature distinguishes two types of social norms: injunctive norm and descriptive norm (Cialdini et al., 1991; Paluck et al., 2010; Bonan et al., 2020). The injunctive norm refers to what most members of a group approve or disapprove while the descriptive norm refers to what most members of a group do or do not do. Parents' food choices may be influenced by the choices of other parents with whom they interact. The actions of others around you, as well as their opinions regarding appropriate actions, can influence people's decisions and actions. It is now well documented that there are conformity effects in eating behaviors. Hogreve et al. (2021) show that a social norm designed to set a new healthy norm increases parents' healthy choices. Gonçalves et al. (2021) find that a social norm nudge designed to increase the purchase of fruit and vegetables in a supermarket context positively affects those whose purchasing habits are categorized as less healthy. James (2004) explores the factors shaping food choices, dietary intake, and nutrition-related attitudes among African Americans. The study reveals a prevailing perception that adopting a 'healthy' diet involves relinquishing part of the cultural heritage to align with the dominant culture. Conformity in eating habits may depend on how similar an individual's eating habits are to the reference provided in the information they receive. Individuals are more likely to adopt a diet if it is similar to their current eating habits rather than requiring a radical change. Studies on information feedback with social comparisons in other areas suggest that the influence of social comparison on individuals' behavior depends on how far their own behavior is from the reference point. Callery et al. (2021) examine the degree to which an individual's proximity

to the norm influences their electricity conservation behavior. They find that individuals whose initial behavior is closer to the norm are more likely to converge to the norm than those whose initial behavior is further from the norm. Information provision can also have an impact on people's beliefs. People may use the provided information to update their beliefs. Vlasceanu and Coman (2022) find that providing a social norm has an impact on health-related belief updating.

Variations in the types of information provided can result in different effects on human behavior. The extent to which individuals follow a particular message can depend on how it is presented. Stok et al. (2014) find that a descriptive norm positively affects fruit intake among adolescents but an injunctive norm does not increase fruit intake and causes a decrease in fruit intake intentions. Mollen et al. (2013) find that the descriptive norm leads to more healthy food choices but the injunctive norm does not have a significant effect on healthy food choices. Robinson et al. (2014) compare the effect of a message containing health-related information (information about the benefits of vegetables on health), a descriptive norm (information about what others are eating), and an injunctive norm (information about what others approve of) on fruit and vegetable selection and intake. They find that exposure to the descriptive norm message results in significantly more fruit and vegetables selection and consumption than exposure to the health-related information, although there is no effect of the injunctive norm message. In our case, we differ from these previous studies in that we look at the influence of information provision on individuals' own decisions and on the decisions they make for others.

2.2.2 Choosing for themselves and for others

The growing literature on choices made for other people suggests that people choose differently when they choose for others than for themselves (Zikmund-Fisher et al., 2006; Polman, 2012). Individuals are more attentive to information on choice options when choosing for others than when choosing for themselves (Jonas et al., 2005;

Polman, 2010). For example, Liu et al. (2018) study the relationship between making choices for others and searching for information. They find that people look for more alternatives and more attributes when making decisions for others than when making decisions for themselves.

Parents typically take the lead in making food decisions for the family, including choices on behalf of their children. Hence, the nutritional value of the selected foods for their children is influenced by the quantity and nature of the information they take into account during the decision-making process. Children's low acceptance of healthy food and their preferences for high-sugar and/or high-fat foods may lead parents to choose unhealthy products for their children in order to immediately satisfy their preferences (Cooke and Wardle, 2005). Marette et al. (2016) conduct an experiment in which mothers and their child separately choose, for themselves and the other person of the dyad, between relatively healthy foods (flasks of stewed apples) and relatively unhealthy foods (candy bars) to study the effect of a simple nutritional message on vitamins and sugar contents of foods on their food choices. Their results indicate that before disclosing the nutritional message, mothers choose, on average, a lower number of relatively healthy foods for their child than the one they choose for themselves, thus showing "indulgence". The level of parental "indulgence" may also depend on the parental distance from the child for whom the choice is made. Candelo et al. (2018) and Bechler et al. (2015) show that in ultimatum and dictator games, the share of proposals from the first player decreases as social distance increases.

2.3 The Experiment

The experiment consists of a 3x2 between-subjects experimental design, where participants decide in two main tasks. The first task is the Belief elicitation task, where participants are asked to assign a "NUTRI-SCORE" to a list of 15 food items (incentivized belief elicitation task). The second task is the Basket composition, in which

participants choose a hypothetical basket of 4 items among the same list of 15 food items (see figure 2.A2 in the Appendix). Each treatment has two stages, hence each task (tasks 1 and 2 explained below) is repeated twice (stages 1 and 2, that is the participants decide in both tasks once per stage. We have a total of 6 treatments in which we vary: 1- the information provided in stage 2, and 2- the kid who is the recipient of the basket composed by parents (see below for more details).

2.3.1 Experimental Tasks

Task 1 - Belief elicitation task: assigning a "NUTRI-SCORE"

Parents have to assign a "NUTRI-SCORE" to each food item from the aforementioned list of 15 food items based on their beliefs about its nutritional quality (see Figure 2.A4 in the Appendix) [4]. We intentionally present the products with the "NUTRI-SCORE" label concealed and we randomize the order in which food items are displayed both between and within subjects. The elicitation of beliefs through the attribution of the "NUTRI-SCORE" is incentive-compatible. Participants are explicitly informed that they earn €0.30 for each correct "NUTRI-SCORE" assignment to a product. This means that, by accurately assigning the "NUTRI-SCORE" to all 15 items in both stages, participants can earn up to €9.

Task 2 - Basket composition

Parents make hypothetical baskets composed of four items selected from the fifteen-item list [5]. In total, participants are asked to make those choices twice for themselves and twice for either their child (henceforth "*mykid*") or an unknown child (henceforth, "*otherkid*"), depending on the treatment group to which they have been randomly

4. Prior to assigning a "NUTRI-SCORE" parents are asked if they know about the "NUTRI-SCORE" with the following question: "Do you know the "NUTRI-SCORE" (image below) or have you ever heard about it?

5. We were not able to provide any actual food item to the participants for logistic reasons. At each step of basket composition participants read in the instructions the following sentence: "We ask you to make your choice of items as you would do in a real food shopping situation".

allocated.

2.3.2 Selection of the 15 food items

All participants across treatments, are presented with an identical list of 15 (non perishable) food items which includes 5 savory snacks, 5 sweet snacks and 5 beverages [6]. The selection of items ensures an equal representation of each possible "NUTRI-SCORE" (from category A to E) with 3 food items for each category: Three items that have a "NUTRI-SCORE" A, three items with a "NUTRI-SCORE" B, and so on. For the sake of consistency, the food items share the same unit price at the time of the study [7]. Since the "NUTRI-SCORE" on food packaging is not mandatory, we were limited to selecting products that display it.

Moreover, we selected the food items to ensure that they could both meet adults' and children's preferences and align with the usual snack habits of French adults and children. Pastries, milk, fruit juices, sweets, fruit, ice cream, and non-alcoholic soft drinks are typical snacks for children and teenagers aged from 0 to 17. In addition to these children's and teenagers' categories, adults also enjoy hot drinks for snacks (Anses, 2017 [8]).

2.3.3 Experimental Treatments

Control groups:

- Control group and decision for "*mykid*" (henceforth **C_mykid**): In the current treatment, parents' beliefs are elicited and are asked to make a food basket for

6. Our initial plan for this project was to run a lab experiment and provide the selected food items to the participants. Therefore, the selected food items needed to be non-perishable so they could be stored in the lab. Unfortunately, we were unable to conduct these sessions due to the difficulty in attracting parents to come to the lab. Consequently, we decided to redesign our experiment to move the sessions to the field with the inconvenience of not being able to physically give the products to parents. Nevertheless, we kept the same list of food items since data collection on *opinion information* had been already conducted based on that list.

7. Even though our experiment does not deal with prices, since prices are not shown to participants, the quantities of the food items that are displayed have equivalent prices.

8. https://www.anses.fr/sites/default/files/NUT2014SA0234Ra.pdf.

themselves and another for their own child in stage 1 (henceforth, Basket stage 1) and stage 2 (henceforth, Basket stage 2), hence repeating those two decisions twice. No information is provided between the two stages.

- Control group and decision for "*otherkid*" (henceforth **C_otherkid**): In the current treatment, parents' beliefs are elicited and are asked to make a food basket for themselves and for an unknown child in stage 1 (Basket stage 1) and stage 2 (Basket stage 2), hence repeating those two decisions twice. No information is provided between the two stages.

The two aforementioned control groups have two objectives: first, as a control for subsequent treatment comparisons; second, we use the answers from parents to generate the information provided in the *descriptive norm* treatment groups.

Descriptive Norm treatments:

- Descriptive norm and decision for "*mykid*" (denoted by **D_mykid** treatment): In the current treatment, parents' beliefs are elicited and are asked to make a basket for themselves and another basket for their child (Basket stage 1). In stage 2, parents are provided with the information on a *descriptive norm* and have to repeat the tasks: belief elicitation and making the second choice of basket for themselves and for their child (Basket stage 2).
- Descriptive norm and decision for "*otherkid*" (denoted by **D_otherkid** treatment): this treatment replicates the features of treatment **D_mykid** with the difference that parents make in each stage a 4-item basket for themselves and a 4-item basket for an unknown child, as opposed to their own child.

To compute the *descriptive norm*, we use the data from the control groups' sessions. For each food item, we compute the proportion of parents selecting each of the 15 food items. Consequently, in the second stage, information is displayed next to each food item in the following way: "For a good nutritional quality diet, X% of

adults chose this item for their own consumption" (see Figure 2.A5 in the Appendix for a screenshot). When they are asked to make a 4-item food basket for their child the second time, the following information is displayed next to each food item: "For a good nutritional quality diet, X% of parents chose this item for children" (see Figure 2.A6 in the Appendix for a screenshot).

Opinion information treatments:

- Opinion information and decision for "*mykid*" (denoted by treatment **O_mykid**): In a stage 1, parents make a basket by choosing 4 items for themselves and another 4-item basket for their child (Basket stage 1). In stage 2, participants are provided with an *opinion information* and have to repeat the task by making their second choice of basket for themselves and for their child (Basket stage 2).
- Opinion information and decision for "*otherkid*" (denoted by **O_otherkid** treatment): this treatment replicates the features of treatment **O_mykid** with the difference that parents make in each stage a 4-item basket for themselves and a 4-item basket for an unknown child, as opposed to their own child.

Before running the experimental sessions, we conducted two surveys (an online survey and a field survey) to generate the *opinion information* that would be displayed on the screens during the baskets making. The first survey aimed at eliciting the parents' opinions about a child's diet. More precisely, we sent an online questionnaire to 48 parents who have a child between 3 and 10 years old. For each of the 15 food items that we use in the experiment, parents had to answer yes or no to the following question: "In order to propose a good nutritional quality diet to their child(ren), do you think that parents should choose the product below?". The share of parents who answered yes for each item was used in the *opinion information* treatment when parents are asked to make a second basket for their or another child (basket stage 2). The second survey was aimed at eliciting the adults' opinions about

an adult's diet. We conducted a field survey (in a park and in the financial district close to a supermarket, near the university Paris Nanterre) before the experiment, to which 50 adults responded on tablets. For each of the 15 food items, adults had to answer yes or no to the following question "For a good nutritional quality diet, do you think that adults should choose the item below for themselves?" The share of adults who answered "yes" for each item is used as information displayed in the *opinion information* treatment sessions when parents are asked to make their own basket for the second stage (basket stage 2).

Hence, during the *opinion information* treatment sessions, the following information is displayed next to each food item when parents are asked to make their own basket choices in the second stage "X% of adults think that for a good nutritional quality diet, adults should choose this item for their own consumption" (see Figure 2.A7). When they are asked to make a basket for children in the second stage, they see the following information next to each food item: "X% of parents think that for a good nutritional quality diet, parents should choose this item for children" (figure 2.A8).

Summary:

Table 2.1 summarizes the 6 treatment groups of our experiment and the corresponding sample size. Participants are randomly assigned to one of the 6 groups.

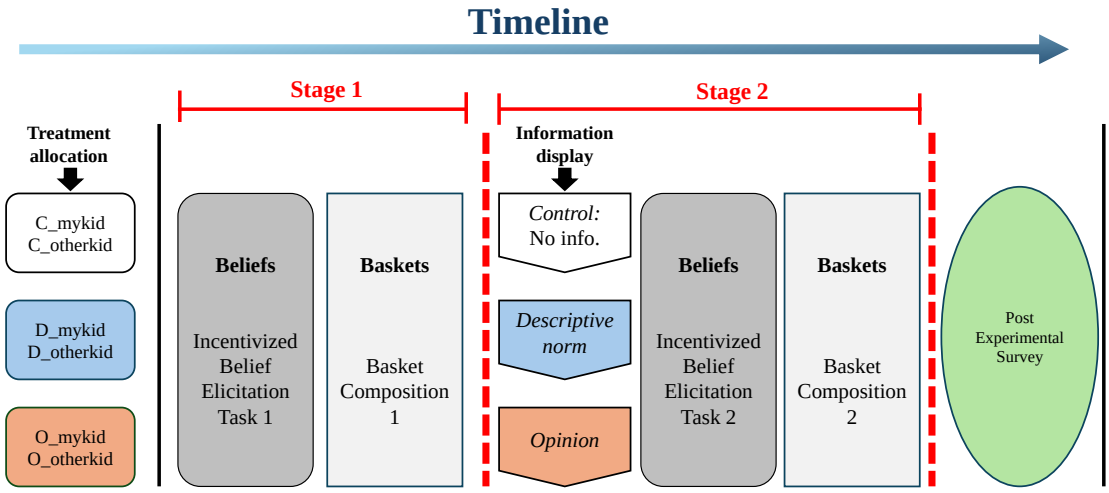
Table 2.1 – Summary of treatments

	Control groups	**Descriptive norm**	**Opinion information**
mykid	C_mykid (N=51)	D_mykid (N=50)	O_mykid (N=50)
otherkid	C_otherkid (N=48)	D_otherkid (N=50)	O_otherkid (N=51)

At the very end of the experiment, after the two main tasks, participants are asked to fill in a survey about their risk and time preferences (10-point Likert scales), socio-demographics, and eating habits (type of diet, snacking habits, grocery shopping

habits etc...) (see Tables 2.A2 and 2.A3 in the Appendix for descriptives statistics on those variables). Figure 2.1 shows the overall timeline of the experiment.

Figure 2.1 – Experiment timeline.



2.3.4 Participants

Our sample consists of parents with child(ren) aged from 3 to 10 years who came to visit the museum. The decision to limit the maximum age of participants' children to 10 years is driven by our focus on investigating food choices within the family environment. By including children aged up to 10, a stage predating adolescence, we aim to capture a period in which parents predominantly influence their children's dietary habits. At this developmental stage, parents typically play a significant role in providing and controlling the food consumed by their children outside the school environment. Kasparian et al. (2017) study parenting practices and decision-making at restaurants versus at home. They find that a majority of mothers report preparing dinner at home three to five times each week and eating together with their children (5 to 8 years old). Additionally, they find that mothers who eat out with their children generally choose their child's food menu. Beyond this age, children enter

adolescence and tend to experience more peer effects in their eating behaviors (Fortin and Yazbeck, 2011). During adolescence, parents lose some control of their children's diet when they eat out. In fact, Fortin and Yazbeck (2011) find that parents are absent 38% of the stages during the consumption of evening meals of their teenagers (7th to 12th grade) and that 83% of adolescents have the freedom to choose their meals.

2.3.5 Hypotheses

The literature on food choices made by parents for themselves and their children highlights the fact that parents choose items of lower nutritional quality for their children than for themselves (Marette et al., 2016). Based on this finding, we formulate our first hypothesis:

Hypothesis 1 *Parents choose food items with lower nutritional quality for their child than for themselves.*

Research on sharing behavior shows that people are more generous with those who are socially closer to them (Candelo et al., 2018; Bechler et al., 2015). Parents might choose items of poor nutritional quality for their children to satisfy their children's preferences. When parents select food items for an unknown child, they lack information about the child's preferences. Therefore, we predict that parents may be less inclined to please children when they do not know their likes and dislikes:

Hypothesis 2 *Parents choose food items with better nutritional quality for other children than their own child.*

Studies on promoting healthy eating through social norms indicate that descriptive norms influence people's eating behaviors more effectively than injunctive norms (Stok et al., 2014; Robinson et al., 2014; Mollen et al., 2013). Here, we do not use an injunctive norm. Instead, provide information about the opinions of others. In other words, we share what others believe to be the right thing to do. Thus, we expect

that the descriptive norm will have a stronger influence on parents' beliefs and food choices than the opinion information.

Hypothesis 3 *The descriptive norm makes parents to be more accurate in their beliefs and has a positive effect on improving healthy choices whereas opinion information does not affect parents' beliefs and food choices.*

2.3.6 Procedures

We run a lab-in-the-field experiment (Harrison and List, 2004) at the Parisian science museum "La Cité des Sciences et de l'Industrie" during the weekend of the science festival [9] and the 2 following weekends, in October 2022 (5 days in total). This museum appeared to be an efficient field to include parents with children aged 3 to 10 year old, compared to a regular experimental laboratory participants' database. We had a meeting with the coordinator of the mediation program of the "Cité des Sciences et de l'Industrie" who agreed to host the project on their premises. Information about the experiment was published on the museum's website before the start of the experiment, and posters at various points inside the museum during the experiment. The experimental team stands at several areas in the museum with the information of the experiment to inform potential participants. Participation was fully voluntary.

During the science festival, entry is free, which is not usually the case. Hence, we chose to run sessions during the science festival because it allows us to have a more heterogeneous sample in terms of socio-economic status. This is more likely to occur if the museum entry is free [10]. Admission fees to the museum are €13 for the full price, €10 for under 25 years and over 65 years old, €3.50 for children aged 2 to 5 (only for the exhibition ticket), and free for under 2 years old.

9. The science festival is an annual French scientific culture event that takes place over ten days in October in Metropolitan France.

10. Table 2.A1 in the Appendix shows a comparative table of descriptive statistics showing that participants who came during the science festival have a significantly lower income than participants who came during the other sessions.

The setting was the following: a mobile lab is set up in one of the museum's rooms with tablets on which the participants answer directly (see Figure 2.A3 in the Appendix). Tables are placed to minimize communication during the experiment between participants from different families. Participants are randomly assigned to the different treatments. Every day, time slots of two hours were scheduled and corresponded to one treatment group. Treatments were randomized by days and within a day (see Table 2.A7 in the Appendix for the exact schedule). To guarantee anonymity, each participant is given a five-digit code as a personal identification number. On average, participants earned €6 that includes a show-up fee of €3. The average time to complete the questionnaire was 16 minutes.

The experiment was developed with Limesurvey GMBH [11]. The experiment was pre-registered on AsPredicted #98336 [12] and got ethical approval N° 2022-06-02 from the research ethics committee of the University of Paris Nanterre. [13]

2.4 Analysis methods

2.4.1 Beliefs measures

We build 4 different measures to investigate how beliefs change between the first and the second stage, based on the different treatments. Note that the "NUTRI-SCORE" is coded such that: $A = 1$; $B = 2$; $C = 3$; $D = 4$ and $E = 5$.

1. *Absolute belief gap* (hereafter *Absolute_ belief_ gap*) measures how close parents are to the actual "NUTRI-SCORE". It sums the absolute gaps between the "NUTRI-SCORE" of the item and the belief of the participant.

11. Limesurvey GmbH. / LimeSurvey: An Open Source survey tool /LimeSurvey GMBH, Hamburg, Germany. http://www.limesurvey.org.
12. https://aspredicted.org/WSC_QDF.
13. Note that we removed one of our hypothesis in the final version of the manuscript since we realized that it no longer applies with our data.

$$Absolute_belief_gap_{it} = \sum_{f=1}^{15} |Nutri_Score_f - Belief_{fit}|$$

The indexes f, i, t denote each food item f for subject i in stage $t = \{1; 2\}$.

2. *Overestimation rate* (hereafter *Overestimation_ rate*) measures how often parents overestimate the nutritional quality of food items. This measure provides the rate of overestimation in the assignment of the "NUTRI-SCORE" among the 15 products. We create a variable "$overestimate_ns_f$" which takes the value 1 if the participant overestimates the nutritional quality of the food item f, i.e. the participant estimates a better "NUTRI-SCORE" in terms of nutritional quality than the actual one, and 0 otherwise.

$$Overestimation_rate_{it} = \frac{\sum_{f=1}^{15} overestimate_ns_{fit}}{15} \times 100$$

3. *Underestimation rate* (hereafter *Underestimation_ rate*) measures how often parents underestimate the nutritional quality of food items. This measure provides the rate of underestimation in the assignment of the "NUTRI-SCORE" among the 15 products. We create a variable "$underestimate_ns_f$" which takes value 1 if the participant underestimates the nutritional quality of the item, i.e. the participant estimates a worse "NUTRI-SCORE" in terms of nutritional quality than the actual one, and 0 otherwise.

$$Underestimation_rate_{it} = \frac{\sum_{f=1}^{15} underestimate_ns_{fit}}{15} \times 100$$

4. *Accuracy rate* (hereafter *Accuracy_ rate*) measures how often parents correctly

estimate the nutritional quality of food items. It provides the rate of accurate estimation in the assignment of the "NUTRI-SCORE" among the 15 products. We create a variable "accurate_ns" which takes value 1 if the participant assigns the correct "NUTRI-SCORE", and 0 otherwise.

$$Accuracy_rate_{it} = \frac{\sum_{f=1}^{15} accurate_ns_{fit}}{15} \times 100$$

2.4.2 Nutritional quality score

As a measure of the nutritional quality of an item, we use the Nutrient Profiling Model developed by the UK Food and Standard Agency (FSA score, see Rayner et al. (2009) for details of the score calculation). The model provides a single score for any given food product, based on calculating the number of points for 'negative' nutrients (energy, saturated fat, sugar, and sodium) and the number of points for 'positive' nutrients (fiber, fruit, and vegetable content and proteins). We calculate the aggregated nutritional quality score of each basket following the aggregation method of Crosetto et al. (2020) which adds the FSA score of each item and normalizes by 100 Kilocalories (Kcal). The lower the basket's FSA score, the better the nutritional quality of the basket.

$$FSA_{it} = \frac{\sum_{f=1}^{4} Kcal_{fit} \cdot FSA_{fit}}{\sum_{f=1}^{4} Kcal_{fit}}$$

for each food item f, participant i at stage $t = \{1; 2\}$.

2.5 Results

2.5.1 Descriptive statistics

Our sample consists of 300 participants.[14] Table 2.2 provides a description of the socioeconomic characteristics of the participants broken by treatment groups. We conduct randomization checks to confirm the proper allocation of participants across different treatments. The last four columns provide comparison tests of difference in means (t-tests for quantitative variables) or distribution functions (Kolmogorov–Smirnov tests for categorical variables) between treatment and control groups. Our analysis reveals no significant differences in sociodemographic characteristics across treatments (t-test), with only a few exceptions: Participant's age (c_mykid vs. O_mykid, p-value = 0.06), Age of the oldest child (c_mykid vs. O_mykid, p-value = 0.02), Number of child (c_otherkid vs. D_otherkid, p-value = 0.06), and Females who are significantly less represented in D_mykid compared to other treatments (chi-squared test, p-value = 0.00). Note that the overweight and obesity rate is lower in our sample (39.67%) than in Metropolitan France (47.3% among adults)[15].

2.5.2 Treatment comparisons

Belief elicitation: assigning a "NUTRI-SCORE"

Figure 2.2 displays the distribution of the "NUTRI-SCORE" assigned by the participants for the 15 food items across treatments. As described in Section 2.3.2, the food list includes three items for each "NUTRI-SCORE", meaning that perfectly accurate beliefs are represented by a rate of 0.2 for each "NUTRI-SCORE" (horizontal red line in Figure 2.2). Nevertheless, each distribution is slightly right-skewed with a peak at

14. 302 participants actually took part in the experiment but 2 participants were excluded from the analysis. One observation refers to a participant who had difficulties reading the instructions and understanding them and needed help from the experimenter. The second refers to a participant who let his teenager answer the questions.

15. Enquête Obépi-Roche, 2020.

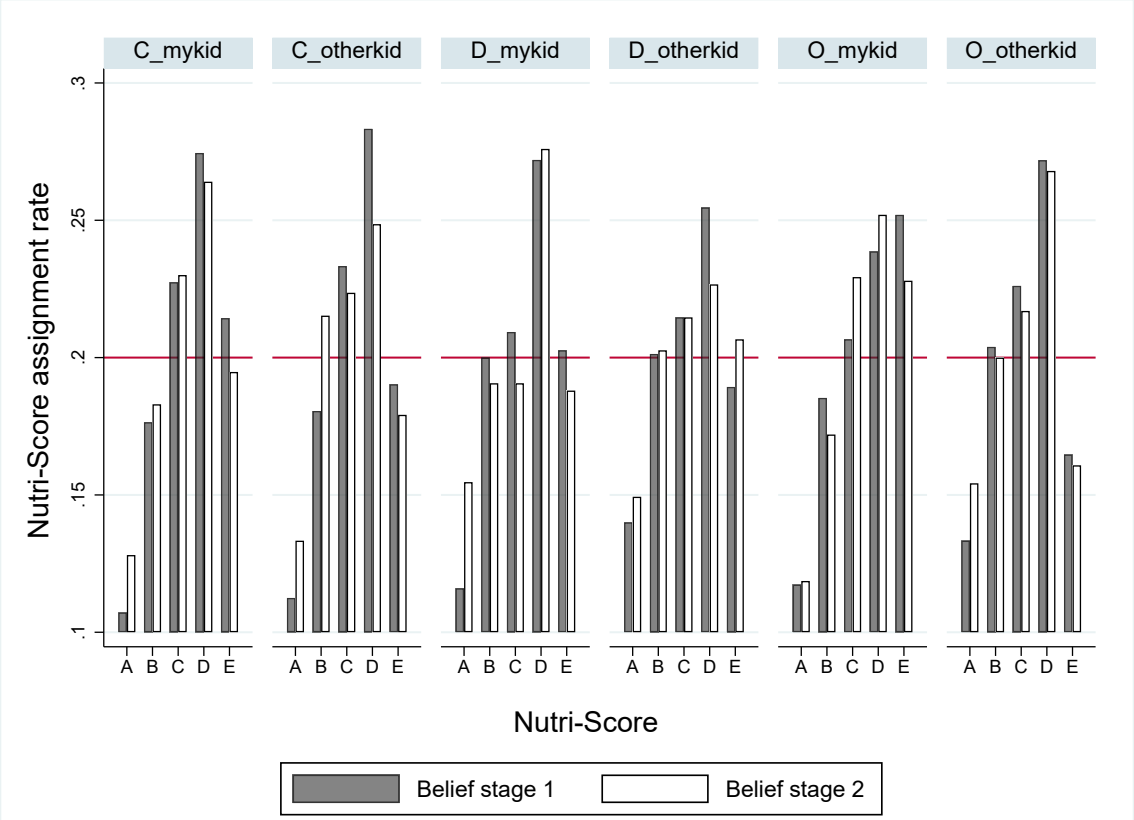
Table 2.2 – descriptive statistics

Variable	All	C_mykid (1)	C_otherkid (2)	D_mykid (3)	D_otherkid (4)	O_mykid (5)	O_otherkid (6)	(1) vs. (3)	(1) vs. (5)	(2) vs. (4)	(2) vs. (6)
Participant's age (mean)	39.44	38.06	39.13	37.94	40.80	40.36	40.37	0.92	0.06	0.18	0.34
Number of child (mean)	1.58	1.59	1.73	1.56	1.46	1.58	1.57	0.83	0.95	0.06	0.28
Age of the oldest child (mean)	7.72	7.00	7.85	7.58	7.50	8.16	8.26	0.23	0.02	0.39	0.30
Number of household member (mean)	3.90	3.78	4.15	3.72	3.80	3.84	1.19	0.74	0.79	0.11	0.84
Nutri-Score reference (%)	62.00	58.82	56.25	60.00	64.00	68.00	64.71	1.00	0.96	0.99	0.99
Education level								0.93	0.94	0.67	0.56
No diploma (%)	2.00	1.96	2.08	2.00	4.00	0.00	1.96				
CAP-BEP (%)	6.67	3.92	6.25	2.00	4.00	8.00	15.69				
High school degree (%)	15.00	17.65	14.58	18.00	6.00	18.00	15.69				
Bachelor's degree (%)	20.00	19.61	20. 83	24.00	16.00	14.00	25.49				
Master's degree (%)	43.67	39.22	43.75	42.00	54.00	52.00	31.37				
PhD (%)	4.67	5.88	2.08	10.00	6.00	0.00	3.92				
Others (%)	8.00	11.76	10.42	2.00	10.00	8.00	5.88				
Income								0.26	0.73	0.91	0.75
Less than 20000 (%)	11.33	11.76	16.67	6.00	8.00	10.00	15.69				
Between 20000 and 25000 (%)	9.67	13.73	4.17	10.00	6.00	10.00	13.73				
Between 25000 and 30000 (%)	9.67	3.92	12.50	4.00	16.00	12.00	9.80				
Between 30000 and 35000 (%)	4.33	5.88	8.33	2.00	8.00	0.00	1.96				
Between 35000 and 42000 (%)	9.33	9.80	6.25	4.00	4.00	12.00	19.61				
Between 42000 and 50000 (%)	10.33	13.73	12.50	16.00	10.00	2.00	7.84				
Between 50000 and 55000 (%)	5.67	1.96	4.17	6.00	6.00	10.00	5.88				
Between 55000 and 65000 (%)	7.00	7.84	8.33	6.00	8.00	6.00	5.88				
Between 65000 and 85000 (%)	11.67	7.84	6.25	22.00	20.00	8.00	5.88				
More than 85000 (%)	11.00	11.76	4.17	18.00	8.00	16.00	7.84				
No answer (%)	10.00	11.76	16.67	6.00	6.00	14.00	5.88				
Gender								0.00	0.47	0.19	0.19
Female (%)	66.33	78.43	64.58	46.00	66.00	74.00	68.63				
Male (%)	32.33	19.61	29.17	54.00	34.00	26.00	31.37				
No answer (%)	1.33	1.96	6.25	0.00	0.00	0.00	0.00				
Body Mass Index								1.00	1.00	0.99	0.96
Underweight (%)	1.67	3.92	0.00	2.00	0.00	4.00	0.00				
Normal weight (%)	55.67	56.86	58.33	60.00	50.00	60.00	49.02				
Overweight and obese (%)	39.67	35.29	35.42	38.00	48.00	34.00	47.06				
No answer (%)	3.00	3.92	6.25	0.00	2.00	2.00	3.92				
N	300	51	48	50	50	50	51	-	-	-	-

Notes: The CAP and BEP are professional diplomas in the French education system, awarded after secondary school. The values reported in the last four columns for quantitative variables (age, number of child, age of the oldest child, number of household member) are the p-values obtained from a t-test. For Nutri-Score reference, education level and income and Body Mass Index, the p-values of the Kolmogorov–Smirnov test are reported in the last four columns. For gender, the p-values of the chi-squared test are reported in the last four columns.

"NUTRI-SCORE" D, suggesting that participants tend to underestimate the nutritional quality of food. In essence, participants believe that food has a lower quality level than its actual level. A more detailed analysis of belief accuracy is provided in sub-section 2.6.1.

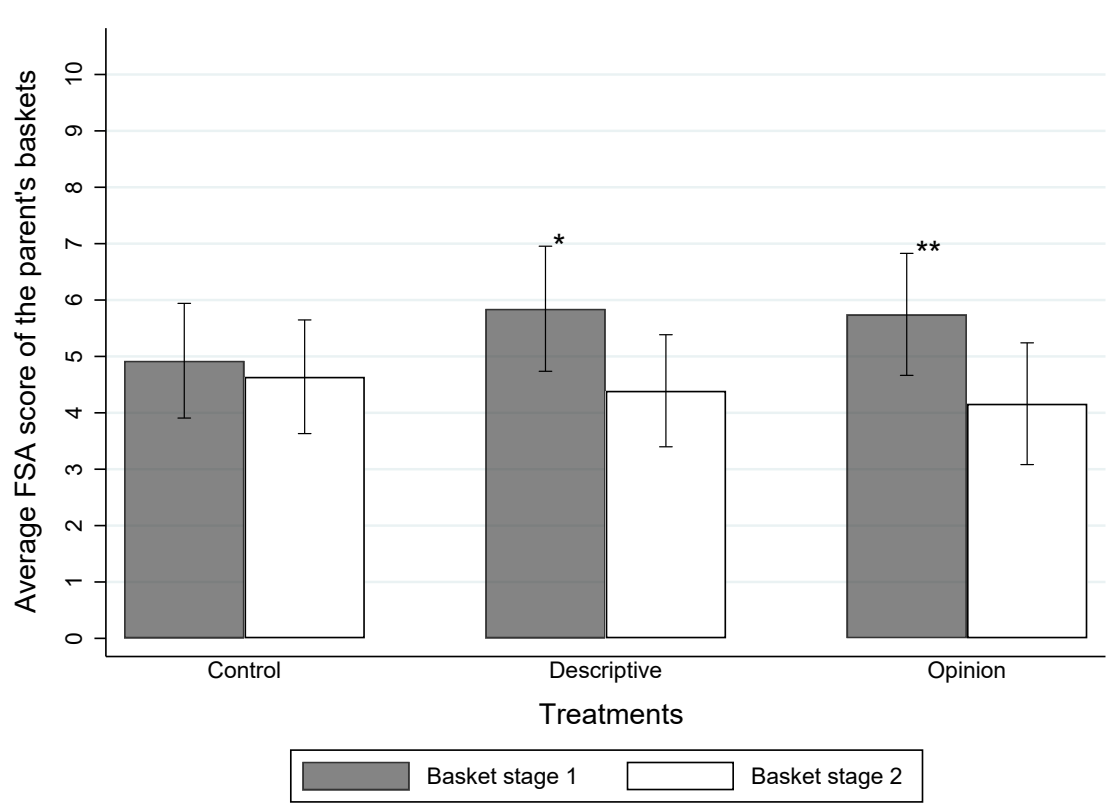
Figure 2.2 – Rate of each "NUTRI-SCORE" assigned to the 15 items.



FSA scores

Figure 2.3 represents the average FSA scores of the first and second parents' baskets. In the Control group, we find no significant differences, with average FSA scores of 4.92 and 4.64 for baskets 1 and 2, respectively (p-value = 0.69). However, we find significant differences in the *descriptive norm* treatments, with FSA scores of 5.85 and 4.39 (p-value = 0.054), and in the *opinion information* treatments, with FSA scores of 5.75 and 4.16 (p-value = 0.04) for baskets 1 and 2, respectively. We thus observe that providing parents with information on *descriptive norm* and *opinion information* significantly improves the nutritional quality of their food baskets.

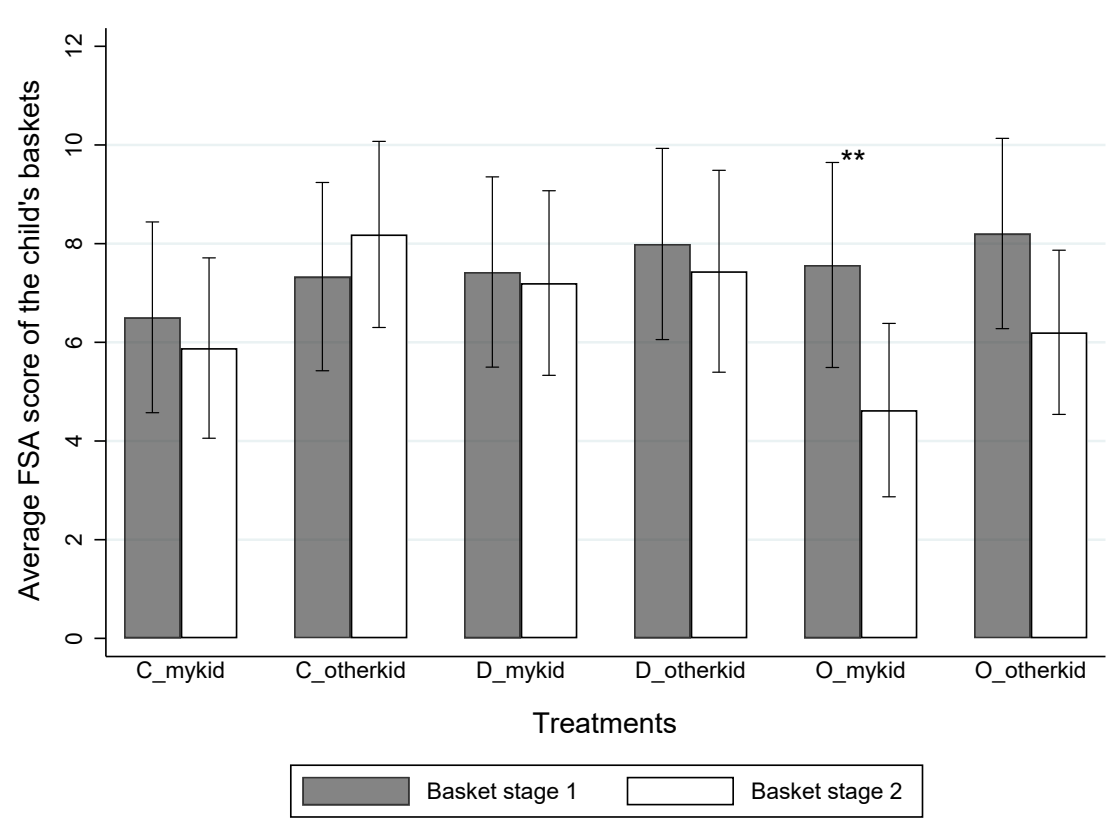
Figure 2.3 – Parents' average FSA score by treatment, basket stage 1 vs. basket stage 2.



Notes:Two sided t-tests of differences in average FSA score between basket 1 and basket 2.:
* p-value < 0.10, ** p-value < 0.05.

Figure 2.4 shows the average FSA scores of the first and second baskets made by parents for children overall, across treatments. We find no significant differences between treatments, except for O_mykid, where we observe a significant reduction in the FSA score (p-value = 0.03). This finding suggests that parents' choices for their own children are influenced when they observe other parents' opinion.

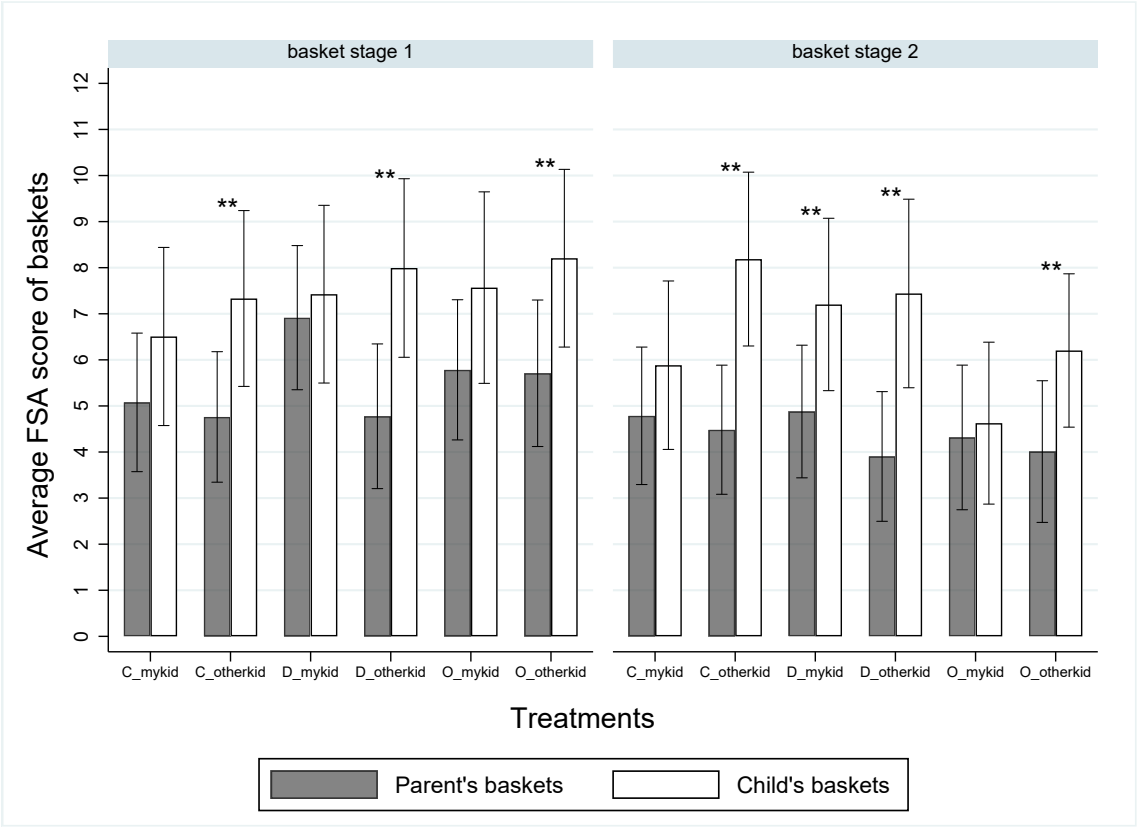
Figure 2.4 – Children's average FSA score by treatment, basket stage 1 Vs. basket stage 2.



Notes: Two-sided t-tests of differences in average FSA score between basket 1 and basket 2.
** p-value < 0.05.

Figure 2.5 illustrates the average FSA score across treatments for basket 1 (on the left) and basket 2 (on the right), comparing parents' and children's baskets. Notably, parents' baskets consistently exhibit a lower FSA score than children's baskets. This difference is statistically significant for basket 1 in C_otherkid (p-value = 0.03), D_otherkid (p-value = 0.01), and O_otherkid (p-value = 0.047). Same significant differences are observed for basket 2, including treatment D_mykid (p-value = 0.05). Overall, parents consistently opt for products with lower nutritional quality for their children compared to themselves, aligning with the findings from Marette et al. (2016).

Figure 2.5 – Average FSA score of parent's and child's basket by treatments and control groups.



Notes: 95% confidence intervals. The tests of differences in average FSA score between parent's baskets and child's baskets are done with a t-test and the stars above the bars of the histograms indicate if this difference is significant:
** p-value < 0.05.

In figure 2.6 we investigate whether parents make food choices differently based on the parental distance (own child vs. unknown child). We display the average FSA score across treatments for basket 1 (on the left handside) and for basket 2 (on the right handside), comparing *mykid*'s basket to the *otherkid*'s basket. Overall, we observe that baskets for *mykid* tend to have a lower FSA score than baskets for *otherkid*, although the differences are significant only in Control (p-value < 0.1) for basket 2.

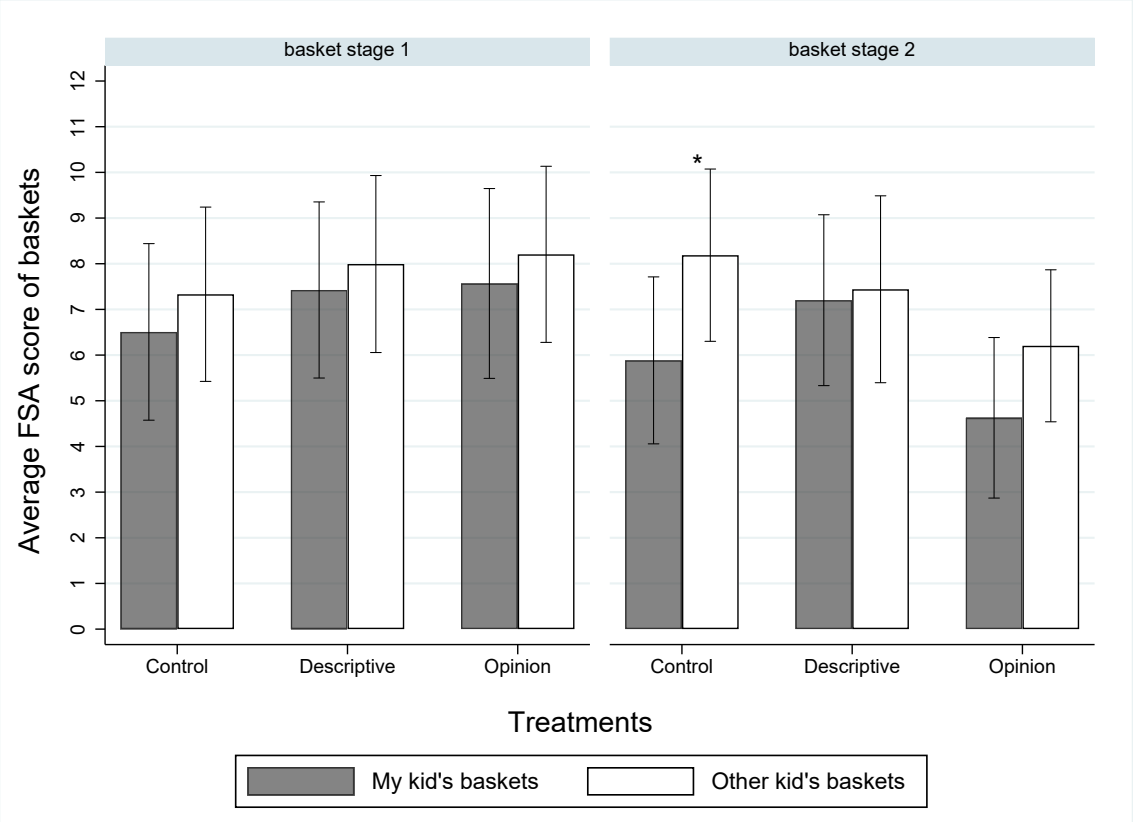
We confirm our hypothesis 1:

Result 2.1 *Parents tend to select food baskets with lower nutritional quality for their children compared to themselves.*

We reject our hypothesis 2:

Result 2.2 *There is no significant difference in the nutritional quality between baskets for their own children and those for other children.*

Figure 2.6 – Average FSA score of child's baskets, my kid vs. other kid



Notes: The tests of differences in average FSA between parent's baskets and child's baskets are done with a t-test and the stars above the bars of the histograms indicate if this difference is significant:
* p-value < 0.10.

2.6 Econometric analysis

Our main measures of interest are the change in beliefs between the two stages of the "NUTRI-SCORE" assignment (with social norm vs. without social norm) and the aggregation per treatment of the individual change in the FSA score between basket 2 (with social norm) and basket 1 (without social norm). We estimate treatment effects, using a difference-in-difference regression analysis, comparing each treatment group to the control group. Our estimation equations are the following (equation 2.1

for beliefs and equation 2.2 for baskets' nutritional quality):

$$Y_{it} = \alpha_0 + \alpha_1 \times stage2 + \alpha_2 \times treatment \times stage2 + \alpha_3 \times controls + \epsilon_{it} \quad (2.1)$$

with the outcome, Y corresponds to one of our four variables of interest on beliefs.

In which the benchmark treatment with no social norm serves as reference category, α_0 identifies the average effect on belief of the first stage, α_1 the impact of the second stage, α_2 is a vector of 4×2 coefficients identifying the difference on belief between the first and second stage of belief elicitation for each of the four treatments (D_mykid, D_otherkid, O_mykid, O_otherkid) compared to the control, and α_3 is a vector of subject-specific characteristics (controls variables).

$$FSA_{it} = \beta_0 + \beta_1 \times stage2 + \beta_2 \times treatment \times stage2 + \beta_3 \times controls + \epsilon_{it} \quad (2.2)$$

In which the benchmark treatment with no social norm serves as a reference category, β_0 identifies the average nutritional value of the first basket, β_1 the impact of the second basket, β_2 is a vector of 4×2 coefficients identifying the difference in nutritional quality between the first and second basket for each of the four treatments (D_mykid, D_otherkid, O_mykid, O_otherkid) compared to the control, and β_3 is a vector of subject-specific characteristics.

Our explanatory variables are defined as follows: *Stage 2* takes value 1 for the second stage, 0 otherwise. We include the interaction terms *Stage 2* $\times$ *Descriptive* for treatments with *descriptive norm* and *Stage 2* $\times$ *Opinion* for treatments with *opinion information*. *Free day* is a dummy variable that takes value 1 if the day of the

corresponding session the admission to the museum is free, and 0 otherwise. [16] *"Nutri-Score" reference* is a dummy variable that takes the value 1 if the parent refers to the "Nutri-Score" (when available) when doing food shopping and 0 otherwise. *Female* is a dummy variable that takes value 1 for female, and 0 otherwise. For *parent meeting PNNS' recommendations* and *child meeting PNNS' recommendations*, participants complete a questionnaire about their eating habits and those of their child. We use these responses to construct a score indicating whether the participants and their children follow the recommendations of the "Programme national nutrition santé" (PNNS) [17] for parents and for children. We then subdivide the sample into quartiles on the basis of the score obtained by each individual (parent and child). Individuals in the first quartile have the least PNNS-compliant eating habits, and those in the fourth quartile have the most PNNS-compliant eating habits. [18] *Food risk lover* measures participants' willingness to take risks when it comes to food risks. We use a 11-point Likert scale from 0 to 10 (0 = "not willing to take any risks" and 10 = "quite willing to take risks"). *Future food effects* captures participants' consideration of the potential future health effects of their food choices (0 = "I do not consider the possible future effects of food on my health" and 10 = "I take fully consider the possible future effects of food on my health"). We have also a list of socio-demographic variables such as *Number of children*, *Age*, *Income*, *Education level*, *Child age* [19], and *Body Mass Index* [20].

16. We include this variable to control for possible selection biases.
17. The "Programme national nutrition santé" (PNNS) has overall the aim to improve the state of health of the entire population by acting on one of its major determinants: nutrition.
18. See Appendix 2.C for the method used to construct the score of following the recommendations of the PNNS.
19. In case the participant has more than one child, this variable is defined as the age of the oldest child. We assume that parents put more effort on the education of the first child (Kim, 2020; Hotz and Pantano, 2015) .
20. We use the Body Mass Index classification of the WHO. Our three categories are underweight (BMI $<$ 18.5), normal weight (18.5 $\leq$ BMI $<$ 25), and overweight and obese (BMI $\geq$ 25). Note that it is not mandatory to respond to questions on weight and height.

2.6.1 Treatment effect on beliefs

Table 2.3 provides the results of the difference-in-difference estimation (OLS model with fixed effects) of the belief elicitation on "Nutri-Score". Our dependent variables are the *Absolute belief gap* in columns (1) and (2), the *Overestimation rate* in columns (3) and (4), the *Underestimation rate* in columns (5) and (6), and the *Accuracy rate* in columns (7) and (8).

The interaction term *Stage 2* × *Descriptive* has a negative and significant effect on the overestimation rate (columns 3 and 4) suggesting that *descriptive norm* significantly reduces the overestimation of the nutritional quality of products compared to control groups, hence resulting into more accurate "Nutri-Score" guesses. This effect is robust even when controlling for socio-demographic variables. In contrast, we do not find any significant effect for *opinion information*. *Female* has a significant and negative coefficient on the overestimation rate suggesting that women underestimate rather than overestimate the nutritional quality of food items compared to men. Parents with healthy eating habits are more likely to underestimate the nutritional quality of food items (*Fourth quartile*). In terms of socio-demographic variables (see appendix Table 2.A4), parents who have more children underestimate the nutritional quality of food. Underweight participants overestimate the nutritional quality of food items and are less likely to be accurate than those with normal weight.

Our hypothesis 3 is partially confirmed:

Result 2.3a *The descriptive norm significantly reduces parents' overestimation rate of the nutritional quality of food items although opinion information has no significant effect on parents' beliefs.*

Table 2.3 – Difference-in-difference on belief accuracy.

	Absolute belief gap (1)	Absolute belief gap (2)	Overestimation rate (3)	Overestimation rate (4)	Underestimation rate (5)	Underestimation rate (6)	Accuracy rate (7)	Accuracy rate (8)
Stage 2	-0.25	-0.31	1.96**	2.12**	-3.09***	-3.18***	1.12	1.06
	(0.27)	(0.29)	(0.80)	(0.86)	(0.94)	(1.00)	(1.13)	(1.21)
Descriptive	0.00	0.49	0.00	1.61	0.00	-1.69	0.00	0.08
	(0.00)	(0.83)	(0.00)	(3.82)	(0.00)	(4.20)	(0.00)	(3.10)
Opinion	0.00	-0.25	0.00	-0.29	0.00	-1.11	0.00	1.40
	(0.00)	(0.57)	(0.00)	(2.37)	(0.00)	(2.52)	(0.00)	(1.90)
Stage 2 × Descriptive	-0.09	-0.05	-2.38*	-2.47*	1.03	1.10	1.35	1.37
	(0.40)	(0.42)	(1.29)	(1.35)	(1.41)	(1.47)	(1.66)	(1.74)
Stage 2 × Opinion	0.30	0.27	-0.76	-0.89	1.74	1.73	-0.98	-0.84
	(0.38)	(0.40)	(1.22)	(1.28)	(1.43)	(1.49)	(1.54)	(1.63)
Free day		0.34		-0.22		-0.88		1.10
		(0.68)		(3.28)		(3.66)		(2.50)
Nutri-Score reference		-0.30		-1.45		2.60		-1.16
		(0.44)		(1.89)		(1.90)		(1.34)
Female		0.11		-4.52***		3.71**		0.81
		(0.42)		(1.75)		(1.64)		(1.41)
Parent meeting PNNS' recommendations								
First quartile		Ref		Ref		Ref		Ref
Second quartile		-0.72		-1.05		-0.65		1.70
		(0.50)		(2.33)		(2.32)		(1.71)
Third quartile		0.22		0.75		1.38		-2.12
		(0.54)		(2.34)		(2.34)		(1.82)
Fourth quartile		0.19		-5.08**		6.50***		-1.42
		(0.51)		(2.43)		(2.52)		(1.79)
Food risk lover		-0.05		-0.26		0.41		-0.15
		(0.10)		(0.39)		(0.42)		(0.30)
Future food effects		-0.19		-0.50		-0.22		0.71*
		(0.13)		(0.50)		(0.50)		(0.43)
Socio-demographic variables	No	Yes	No	Yes	No	Yes	No	Yes
Constant	14.41***	15.96***	26.88***	37.56***	40.37***	30.91***	32.75***	31.53***
	(0.08)	(3.03)	(0.26)	(11.11)	(0.29)	(9.05)	(0.33)	(8.84)
N	286	276	286	276	286	276	286	276
Observations	572	552	572	552	572	552	572	552

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We have removed from the sample the 14 participants who responded that they did not know the "NUTRI-SCORE". Socio-demographic variables include age, child age, number of child, Body Mass Index, and education level. We removed 10 participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 6 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

2.6.2 Treatment effect on baskets' nutritional quality

In Table 2.4 we run an OLS model with fixed effects (column 1) to explore the effect of information provision on the baskets' nutritional quality. We conduct a difference-in-difference estimation analysis of the FSA score of the parents' baskets. Our dependent variable is the FSA score of the parent's basket.

The interaction terms *Stage 2* × *Descriptive* and *Stage 2* × *Opinion* have a significant and negative coefficient, confirming our descriptive results: The information provided in our treatments significantly improves the nutritional quality of the parents' basket compared to the control group. This effect is robust even when controlling for socio-demographic variables (columns 2 and 3). Parents who refer to the "Nutri-Score" select food baskets with significantly better nutritional quality (*Nutri-Score reference*). Women make food baskets with significantly better nutritional quality for themselves than men. Parents with healthy eating habits select food baskets with better nutritional quality for themselves (*Third quartile* and *Fourth quartile* in column 2). We find a positive and significant effect in *Food risk lover* and a negative and significant coefficient in *Future food effects*. Moreover, we find some significant results among the socio-demographic variables (see appendix Table 2.A5): *Age*, *Number of children*, and *Education level* have a negative coefficient.

We reject the second part of our hypothesis 3:

Result 2.3b *Both descriptive norm and opinion information significantly improve the nutritional quality of parent's baskets.*

Result 2.3c *Only opinion information significantly improve the nutritional quality of child's baskets.*

Table 2.5 shows the results of the difference-in-difference estimation of the FSA score of the child's baskets. *Stage 2* × *Opinion* has a significant and negative coefficient in all columns, suggesting that the *opinion information* significantly improves

Table 2.4 – Difference-in-difference on the FSA score of parent's baskets.

	FSA score of parent's baskets		
	(1)	(2)	(3)
Stage 2	-0.28	-0.21	-0.21
	(0.42)	(0.45)	(0.45)
Descriptive	0.00	0.72	0.78
	(0.00)	(1.22)	(1.18)
Opinion	0.00	1.14	1.07
	(0.00)	(0.85)	(0.83)
Stage 2 × Descriptive	-1.17**	-1.26**	-1.26**
	(0.58)	(0.61)	(0.61)
Stage 2 × Opinion	-1.30*	-1.33*	-1.33*
	(0.66)	(0.70)	(0.70)
Free day		0.17	0.29
		(0.93)	(0.90)
Nutri-Score reference		-1.19**	-1.16**
		(0.55)	(0.55)
Female		-2.44***	-2.27***
		(0.62)	(0.62)
Parent meeting PNNS' recommendations			
First quartile		Ref	Ref
Second quartile		-1.04	-0.67
		(0.77)	(0.77)
Third quartile		-1.59*	-1.19
		(0.83)	(0.82)
Fourth quartile		-1.99**	-1.34
		(0.90)	(0.90)
Food risk lover			0.22*
			(0.12)
Future food effects			-0.36*
			(0.18)
Socio-demographic variables	No	Yes	Yes
Constant	5.51***	17.95***	18.24***
	(0.13)	(3.72)	(3.63)
N	300	288	288
Observations	600	576	576

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Socio-demographic variables include age, child age, number of child, Body Mass Index, and education level. We removed 12 participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 8 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

the nutritional quality of the child's baskets. This effect is robust when controlling for socio-demographic variables. We do not find any significant effects of the *descriptive norm* on the nutritional quality of children's baskets. Parents who refer to the "Nutri-Score" select food baskets with significantly better nutritional quality only when they make the choice for their own child (column 2). The effect becomes insignificant in column (3). Women select food baskets for their own child with significantly better nutritional quality than men. Parents who have children with healthy eating habits select food baskets with a better nutritional quality only when they make the choice for an unknown random child (otherkid). We find a significant and positive coefficient for *Food risk lover* in column 6 and negative for *Future food effects* in column 3 and 6. [21]

Therefore, the *opinion information* significantly improves the nutritional quality of children's baskets although *descriptive norm* has no significant effect on the nutritional quality of children's baskets.

2.7 Conclusion and discussion

This chapter has two objectives. First, we aim to identify the effects of information provision (a *descriptive norm* and an *opinion information*) on parents' beliefs about the nutritional quality of 15 food items. Second, we examine how these two types of information shape parents' food choices for themselves, their children, and an unknown child. We conduct a lab-in-the-field experiment at the museum "Cité des sciences et de l'industrie" in which we elicit parents' beliefs about the nutritional quality of the food items by asking them to assign a "NUTRI-SCORE" to each food item. Parents are also asked to select 4 items to make hypothetical food baskets, for themselves, and for their own child or an unknown child. Using difference-in-difference regressions to estimate treatment effects, we find that *descriptive norm*

21. See appendix Table 2.A6 for more details in socio-demographic variables.

Table 2.5 – Difference-in-difference on the FSA score child's baskets.

	FSA score of children's baskets					
	Mykid	Mykid	Mykid	Otherkid	Otherkid	Otherkid
	(1)	(2)	(3)	(4)	(5)	(6)
Stage 2	-0.62	-0.70	-0.70	0.86	0.31	0.31
	(0.56)	(0.60)	(0.60)	(0.77)	(0.83)	(0.83)
Descriptive	0.00	1.41	1.48	0.00	-0.47	-1.05
	(0.00)	(2.43)	(2.36)	(0.00)	(2.35)	(2.18)
Opinion	0.00	1.95	1.98	0.00	-0.05	-0.48
	(0.00)	(1.49)	(1.47)	(0.00)	(1.61)	(1.53)
Stage 2 × Descriptive	0.40	0.48	0.48	-1.41	-0.84	-0.84
	(0.84)	(0.89)	(0.89)	(0.97)	(1.03)	(1.04)
Stage 2 × Opinion	-2.32**	-1.90*	-1.90*	-2.86***	-2.25**	-2.25*
	(1.05)	(1.05)	(1.05)	(1.07)	(1.14)	(1.15)
Free day		1.34	1.69		-0.71	-1.37
		(1.88)	(1.79)		(1.86)	(1.70)
Nutri-Score reference		-1.73*	-1.12		-0.81	-1.17
		(1.02)	(1.04)		(1.16)	(1.14)
Female		-2.82**	-2.19**		-1.10	-0.91
		(1.10)	(1.11)		(1.15)	(1.10)
Child meeting PNNS' recommendations						
First quartile		Ref	Ref		Ref	Ref
Second quartile		-1.52	-1.40		-3.42**	-2.51*
		(1.33)	(1.28)		(1.38)	(1.44)
Third quartile		-0.61	-0.24		-4.49***	-3.62**
		(1.42)	(1.35)		(1.44)	(1.43)
Fourth quartile		-1.20	-0.80		-4.99***	-4.79***
		(1.62)	(1.55)		(1.54)	(1.47)
Food risk lover			-0.09			0.50*
			(0.22)			(0.27)
Future food effects			-0.80**			-0.66**
			(0.31)			(0.33)
Socio-demographic variables	No	Yes	Yes	No	Yes	Yes
Constant	7.16***	27.61***	29.94***	7.85***	15.17***	16.72***
	(0.20)	(4.91)	(5.10)	(0.20)	(5.75)	(5.98)
N	151	148	148	149	140	140
Observations	302	296	296	298	280	280

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Socio-demographic variables include age, child age, number of child, Body Mass Index, and education level. We removed 12 participants participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 8 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

significantly reduces parents' overestimation rate of the nutritional quality of food items leading to more accurate guesses of the "NUTRI-SCORE". On the other hand, *opinion information* has no significant effect on parents' beliefs. Both *descriptive norm* and *opinion information* significantly improve the nutritional quality of parents' baskets although the effect of the *descriptive norm* is stronger. The *opinion information* treatment significantly improves the nutritional quality of children's baskets whereas the *descriptive norm* has no significant effect on the nutritional quality of children's baskets. These effects of information provision on parents' beliefs and on the nutritional quality of parents' and children's baskets are robust even when controlling for socio-demographic variables. We also find that parents select food baskets with lower nutritional quality for children than for themselves. We do not find significant differences in the nutritional quality between baskets for their own children and baskets for unknown children. Furthermore, we find that parents tend to underestimate the nutritional quality of items. In other words, they believe that food items have a lower nutritional quality than they actually have.

Our study highlights two main findings. First, parents tend to choose food items of poorer nutritional quality for children, regardless of whether the children are their own. This suggests that parents' choices of less nutritious food for their children are not necessarily driven by a desire to please their own children because they choose foods with poor nutritional quality for children who are not their own. Instead, these choices can be explained by concerns about children's low acceptance of healthy foods and their preference for high-sugar and high-fat foods. Therefore, public interventions are needed to raise awareness among parents about the negative health impacts of prioritizing children's food preferences over their nutritional needs.

Second, we highlight that *descriptive norm* (what others do) has a more significant effect on an individual's own decisions, whereas *opinion information* (what others think) has more impact on the decisions made for another. This result suggests that, in order to improve the nutritional quality of the food items chosen by parents for

their children, public decision-makers should promote the emergence of social norms formulated in the form of opinion information or an injunctive norm rather than a descriptive norm.

Our study has some limitations. Our study takes place in a museum, so probably only people who are used to visit museums have participated. There may therefore be a selection bias, as well as an environment that is different from the usual food shopping environment, such as supermarkets. Due to logistical constraints, we are not able to bring food items and give them to participants at the end of the experiment. The participants' choices of food items are hypothetical and the set of choices is reduced to 15 items. It is possible that parents do not choose in the same way as they would have done in a real food shopping context. Further studies in an environment closer to those in which parents buy food for their family are needed to confirm the results of our study.

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Appendices

Appendix 2.A *Screenshots and additional tables.*

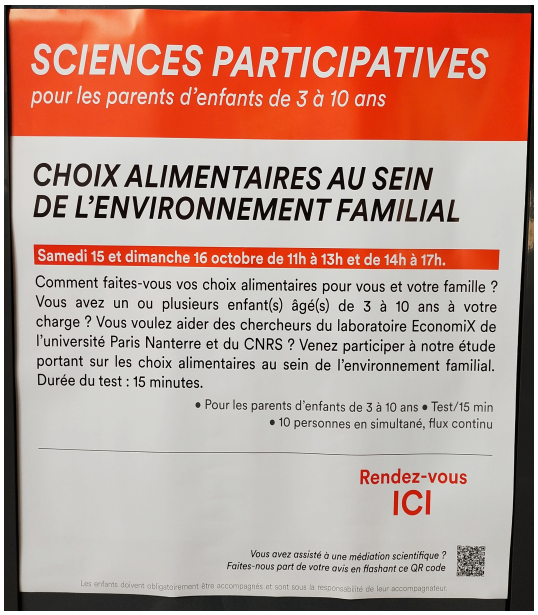
Figure 2.A1 – NUTRI-SCORE image.



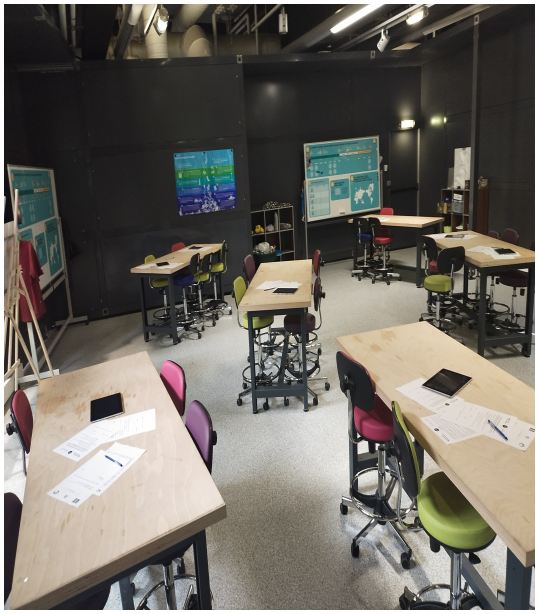
Figure 2.A2 – List of 15 items used.



Figure 2.A3 – Experiment pictures.







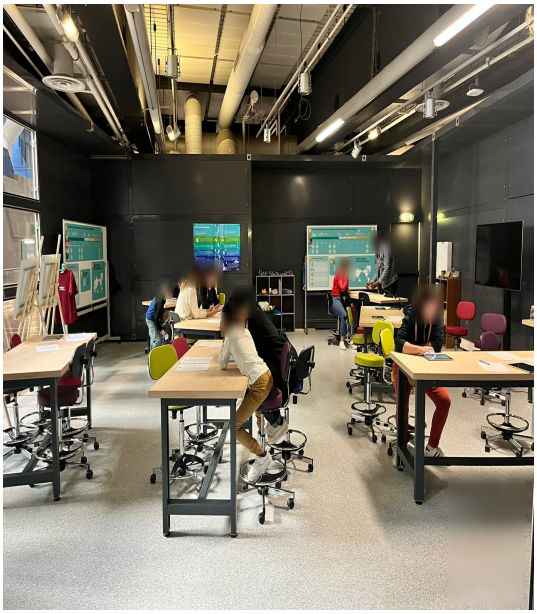


Table 2.A1 – descriptive statistics by free entry or not

Variables	Free entry (1)	No free entry (2)	(1) vs. (2)
Age (mean)	39.29	39.65	0.63
Number of child (mean)	1.61	1.54	0.43
Education level			0.77
No diploma (%)	1.73	2.36	
Cap-bep (%)	6.94	6.30	
High school degree (%)	17.92	11.02	
Bachelor's degree (%)	20.23	19.69	
Master's degree (%)	40.46	48.03	
PhD (%)	3.47	6.30	
Others (%)	9.25	6.30	
Income			0.05
Less than 20000 (%)	13.87	7.87	
Between 20000 and 25000 (%)	11.56	7.09	
Between 25000 and 30000 (%)	10.40	8.66	
Between 30000 and 35000 (%)	4.62	3.94	
Between 35000 and 42000 (%)	10.40	7.87	
Between 42000 and 50000 (%)	9.83	11.02	
Between 50000 and 55000 (%)	4.62	7.09	
Between 55000 and 65000 (%)	6.94	7.09	
Between 65000 and 85000 (%)	5.78	19.69	
More than 85000 (%)	9.83	12.60	
No answer (%)	12.14	7.09	
Gender			0.33
Female (%)	69.94	61.42	
Male (%)	27.75	38.58	
No answer (%)	2.31	0.00	
N	173	127	

Notes: The values reported in the last column for quantitative variables are the p-values obtained from a ttest. For education level, income and gender, the p-values of the Kolmogorov–Smirnov test are reported in the last column.

Table 2.A2 – descriptive statistics of parents' eating habits

Variables	All	C_own	C_other	D_own	D_other	O_own	O_other	C_own vs D_own	C_own vs O_own	C_other vs D_other	C_other vs O_other
Fruits and vegetables								0.75	1.00	0.90	0.95
Never (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Once a week or less (%)	3.00	5.88	2.08	6.00	0.00	0.00	3.92				
Two to three times a week (%)	12.67	7.84	18.75	14.00	10.00	10.00	15.69				
Four to six times a week (%)	24.00	17.65	16.67	24.00	36.00	22.00	27.45				
Every day (%)	60.33	68.63	62.50	56.00	54.00	68.00	52.94				
Dairy products								0.77	1.00	1.00	1.00
Never (%)	0.67	1.96	2.08	0.00	0.00	0.00	0.00				
Once a week or less (%)	6.33	7.84	6.25	6.00	8.00	6.00	3.92				
Two to three times a week (%)	19.33	13.73	1.42	30.00	16.00	24.00	21.57				
Four to six times a week (%)	19.33	19.61	29.17	8.00	24.00	20.00	17.65				
Every day (%)	54	56.86	52.08	56.00	52.00	50.00	56.86				
Starchy food								0.73	1.00	0.35	1.00
Never (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Once a week or less (%)	2.00	1.96	0.00	2.00	2.00	6.00	0.00				
Two to three times a week (%)	13.33	11.76	4.17	20.00	20.00	12.00	11.76				
Four to six times a week (%)	28.00	27.45	29.17	32.00	22.00	30.00	27.45				
Every day (%)	56.00	58.82	66.67	46.00	56.00	52.00	60.78				
Fish and seafood								0.96	0.99	0.04	1.00
Never (%)	5.00	7.84	8.33	6.00	4.00	0.00	3.92				
Once a week or less (%)	55.33	47.06	45.83	58.00	78.00	56.00	47.06				
Two to three times a week (%)	33.33	41.18	33.33	32.00	12.00	42.00	39.22				
Four to six times a week (%)	5.33	3.92	8.33	4.00	6.00	2.00	7.84				
Every day (%)	1.00	0.00	4.17	0.00	0.00	0.00	1.96				
Unprocessed meat								1.00	1.00	1.00	1.00
Never (%)	2.33	1.96	4.17	4.00	0.00	4.00	0.00				
Once a week or less (%)	13.67	13.73	14.58	18.00	14.00	10.00	11.76				
Two to three times a week (%)	49.33	52.94	45.83	48.00	46.00	52.00	50.98				
Four to six times a week (%)	28.00	25.49	29.17	28.00	30.00	28.00	27.45				
Every day (%)	6.67	5.88	6.25	2.00	10.00	6.00	9.80				
Sweetened beverages								0.92	0.92	0.99	0.67
Never (%)	25.00	13.73	25.00	24.00	32.00	24.00	31.37				
Once a week or less (%)	47.00	54.90	41.67	42.00	42.00	54.00	49.02				
Two to three times a week (%)	18.00	19.61	20.83	24.00	22.00	12.00	11.76				
Four to six times a week (%)	4.33	3.92	8.33	4.00	2.00	4.00	3.92				
Every day (%)	5.00	7.84	4.17	6.00	2.00	6.00	3.92				
Processed food								1.00	0.84	0.89	0.96
Never (%)	13.33	15.69	12.50	14.00	16.00	10.00	11.76				
Once a week or less (%)	64.00	54.90	62.50	52.00	70.00	72.00	72.55				
Two to three times a week (%)	19.00	25.49	25.00	28.00	10.00	14.00	11.76				
Four to six times a week (%)	3.00	1.96	0.00	4.00	4.00	4.00	3.92				
Every day (%)	0.67	1.96	0.00	2.00	0.00	0.00	0.00				
Snacking								1.00	1.00	1.00	0.43
Never (%)	16.67	15.69	14.58	16.00	18.00	22.00	13.73				
Very rarely (%)	30.00	33.33	37.50	32.00	30.00	26.00	21.57				
Once or twice a week on average (%)	29.67	29.41	27.08	36.00	32.00	26.00	27.45				
Once a day every day (%)	17.67	15.69	16.67	12.00	12.00	22.00	27.45				
Several times a day every day (%)	6.00	5.88	4.17	4.00	8.00	4.00	9.80				
N	300	51.00	48.00	50.00	50.00	50.00	51.00	-	-	-	-

Notes: The p-values of the Kolmogorov–Smirnov test are reported in the last four columns. Questions were asked about parent's daily eating habits. For snacking, the question asked how often the parent snacked in the past month.

Table 2.A3 – descriptive statistics of children's eating habits

Variables	All	C_own	C_other	D_own	D_other	O_own	O_other	C_own vs D_own	C_own vs O_own	C_other vs D_other	C_other vs O_other
Fruits and vegetables								0.44	0.31	0.99	1.00
Never (%)	0.67	0.00	4.17	0.00	0.00	0.00	0.00				
Once a week or less (%)	2.67	1.96	2.08	4.00	2.00	2.00	3.92				
Two to three times a week (%)	12.33	13.73	8.33	10.00	16.00	18.00	7.84				
Four to six times a week (%)	25.67	11.76	25.00	30.00	30.00	26.00	31.37				
Every day (%)	58.67	72.55	60.42	56.00	52.00	54.00	56.86				
Dairy products								1.00	0.99	1.00	1.00
Never (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Once a week or less (%)	1.67	3.92	0.00	0.00	2.00	0.00	3.92				
Two to three times a week (%)	8.33	7.84	4.17	6.00	4.00	20.00	7.84				
Four to six times a week (%)	17.67	13.73	22.92	20.00	22.00	10.00	17.65				
Every day (%)	72.33	74.51	72.92	74.00	72.00	70.00	70.59				
Starchy food								0.42	1.00	0.76	0.93
Never (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Once a week or less (%)	1.00	1.96	0.00	2.00	0.00	2.00	0.00				
Two to three times a week (%)	9.00	5.88	4.17	14.00	12.00	8.00	9.80				
Four to six times a week (%)	29.00	27.45	25.00	36.00	30.00	26.00	29.41				
Every day (%)	61.00	64.71	70.83	48.00	58.00	64.00	60.78				
Fish and seafood								0.87	0.72	0.65	0.92
Never (%)	4.00	3.92	10.42	4.00	4.00	2.00	0.00				
Once a week or less (%)	54.000	45.10	41.67	56.00	62.00	60.00	58.82				
Two to three times a week (%)	34.67	45.10	37.50	36.00	28.00	31.00	21.45				
Four to six times a week (%)	6.33	5.88	6.25	4.00	6.00	4.00	11.76				
Every day (%)	1.00	0.00	4.17	0.00	0.00	0.00	1.96				
Unprocessed meat								1.00	1.00	0.95	0.98
Never (%)	0.67	1.96	2.08	0.00	0.00	0.00	0.00				
Once a week or less (%)	9.00	5.88	12.50	10.00	12.00	8.00	5.88				
Two to three times a week (%)	50.00	56.86	43.75	52.00	46.00	50.00	50.98				
Four to six times a week (%)	32.33	31.37	35.42	34.00	26.00	36.00	31.37				
Every day (%)	8.00	3.92	6.25	4.00	16.00	6.00	11.76				
Sweetened beverages								0.78	1.00	0.58	1.00
Never (%)	20.00	15.69	20.00	28.00	22.00	20.00	13.73				
Once a week or less (%)	51.00	56.86	54.17	46.00	38.00	50.00	60.78				
Two to three times a week (%)	19.33	17.65	10.42	18.00	34.00	18.00	17.65				
Four to six times a week (%)	7.00	5.88	8.33	8.00	6.00	8.00	5.88				
Every day (%)	2.67	3.92	6.25	0.00	0.00	4.00	1.96				
Processed food								0.82	0.82	0.40	0.52
Never (%)	14.33	21.57	14.58	10.00	18.00	10.00	11.76				
Once a week or less (%)	65.33	54.90	54.17	70.00	68.00	72.00	72.55				
Two to three times a week (%)	17.00	19.61	29.17	14.00	10.00	16.00	13.73				
Four to six times a week (%)	2.67	1.96	2.08	4.00	4.00	2.00	1.96				
Every day (%)	0.67	1.96	0.00	2.00	0.00	0.00	0.00				
Snacking								0.55	1.00	1.00	1.00
Never (%)	20.00	21.57	20.83	30.00	18.00	16.00	13.73				
Very rarely (%)	35.33	27.45	31.25	34.00	38.00	40.00	41.18				
Once or twice a week on average (%)	23.00	25.49	27.08	20.00	18.00	24.00	23.53				
Once a day every day (%)	18.33	23.53	18.75	12.00	20.00	18.00	17.65				
Several times a day every day (%)	3.33	1.96	2.08	4.00	6.00	2.00	3.92				
N	300	51.00	48.00	50.00	50.00	50.00	51.00	-	-	-	-

Notes: The p-values of the Kolmogorov–Smirnov test are reported in the last four columns. Questions were asked about child's daily eating habits. For snacking, the question asked how often the child snacked in the past month.

Figure 2.A4 – "NUTRI-SCORE" assignment.

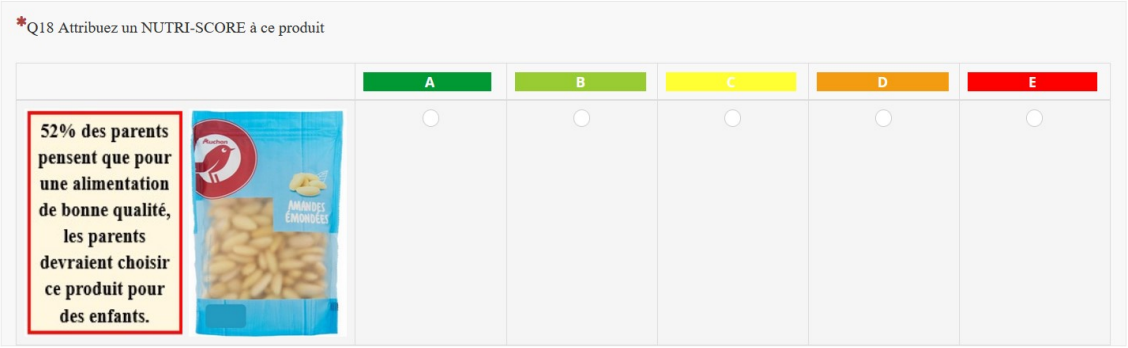
Without information provision



With *descriptive norm*



With *opinion information*



Notes: The instruction was: assign a "NUTRI-SCORE" to this product.

Table 2.A4 – Difference-in-difference on belief accuracy.

	Absolute belief gap (1)	Absolute belief gap (2)	Overestimation rate (3)	Overestimation rate (4)	Underestimation rate (5)	Underestimation rate (6)	Accuracy rate (7)	Accuracy rate (8)
Stage 2	-0.25	-0.31	1.96**	2.12**	-3.09***	-3.18***	1.12	1.06
	(0.27)	(0.29)	(0.80)	(0.86)	(0.94)	(1.00)	(1.13)	(1.21)
Descriptive	0.00	0.49	0.00	1.61	0.00	-1.69	0.00	0.08
	(0.00)	(0.83)	(0.00)	(3.82)	(0.00)	(4.20)	(0.00)	(3.10)
Opinion	0.00	-0.25	0.00	-0.29	0.00	-1.11	0.00	1.40
	(0.00)	(0.57)	(0.00)	(2.37)	(0.00)	(2.52)	(0.00)	(1.90)
Stage 2 × Descriptive	-0.09	-0.05	-2.38*	-2.47*	1.03	1.10	1.35	1.37
	(0.40)	(0.42)	(1.29)	(1.35)	(1.41)	(1.47)	(1.66)	(1.74)
Stage 2 × Opinion	0.30	0.27	-0.76	-0.89	1.74	1.73	-0.98	-0.84
	(0.38)	(0.40)	(1.22)	(1.28)	(1.43)	(1.49)	(1.54)	(1.63)
Free day		0.34		-0.22		-0.88		1.10
		(0.68)		(3.28)		(3.66)		(2.50)
Nutri-Score reference		-0.30		-1.45		2.60		-1.16
		(0.44)		(1.89)		(1.90)		(1.34)
Female		0.11		-4.52***		3.71**		0.81
		(0.42)		(1.75)		(1.64)		(1.41)
Participant's age		0.00		0.06		-0.00		-0.06
		(0.04)		(0.14)		(0.14)		(0.11)
Child age		-0.00		0.31		-0.32		0.02
		(0.10)		(0.41)		(0.41)		(0.33)
Number of child		0.18		-3.85***		3.90***		-0.05
		(0.33)		(1.24)		(1.37)		(1.04)
Body Mass Index								
Normal weight		Ref		Ref		Ref		Ref
Underweight		1.22		8.17		-4.05		-4.12
		(1.60)		(5.26)		(3.05)		(3.53)
Overweight		-0.55		-2.86*		1.34		1.53
		(0.39)		(1.72)		(1.73)		(1.24)
Education level								
No diploma		Ref		Ref		Ref		Ref
Cap-bep		1.13		8.38		-4.07		-4.31
		(2.65)		(9.72)		(6.82)		(6.92)
High school degree		0.07		3.50		0.23		-3.73
		(2.51)		(9.14)		(6.03)		(6.74)
Bachelor's degree		-0.71		1.03		0.96		-1.98
		(2.46)		(9.15)		(5.96)		(6.67)
Master's degree		-0.76		0.00		1.28		-1.28
		(2.47)		(9.07)		(5.81)		(6.63)
PhD		-0.04		-4.81		6.36		-1.54
		(2.67)		(9.54)		(6.58)		(7.22)
Others		0.98		1.23		3.21		-4.44
		(2.53)		(9.66)		(6.41)		(6.87)
Parent meeting PNNS' recommendations								
First quartile		Ref		Ref		Ref		Ref
Second quartile		-0.72		-1.05		-0.65		1.70
		(0.50)		(2.33)		(2.32)		(1.71)
Third quartile		0.22		0.75		1.38		-2.12
		(0.54)		(2.34)		(2.34)		(1.82)
Fourth quartile		0.19		-5.08**		6.50***		-1.42
		(0.51)		(2.43)		(2.52)		(1.79)
Food risk lover		-0.05		-0.26		0.41		-0.15
		(0.10)		(0.39)		(0.42)		(0.30)
Future food effects		-0.19		-0.50		-0.22		0.71*
		(0.13)		(0.50)		(0.50)		(0.43)
Constant	14.41***	15.96***	26.88***	37.56***	40.37***	30.91***	32.75***	31.53***
	(0.08)	(3.03)	(0.26)	(11.11)	(0.29)	(9.05)	(0.33)	(8.84)
N	286	276	286	276	286	276	286	276
Observations	572	552	572	552	572	552	572	552

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We have removed from the sample the 14 participants who responded that they did not know the "NUTRI-SCORE". We removed 10 participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 6 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

Table 2.A5 – Difference-in-difference on the FSA score of parent's baskets.

	FSA score of parent's baskets		
	(1)	(2)	(3)
Stage 2	-0.28	-0.21	-0.21
	(0.42)	(0.45)	(0.45)
Descriptive	0.00	0.72	0.78
	(0.00)	(1.22)	(1.18)
Opinion	0.00	1.14	1.07
	(0.00)	(0.85)	(0.83)
Stage 2 × Descriptive	-1.17**	-1.26**	-1.26**
	(0.58)	(0.61)	(0.61)
Stage 2 × Opinion	-1.30*	-1.33*	-1.33*
	(0.66)	(0.70)	(0.70)
Free day		0.17	0.29
		(0.93)	(0.90)
Nutri-Score reference		-1.19**	-1.16**
		(0.55)	(0.55)
Female		-2.44***	-2.27***
		(0.62)	(0.62)
Participant's age		-0.09*	-0.08
		(0.05)	(0.05)
Child age		-0.16	-0.15
		(0.16)	(0.15)
Number of child		-0.49	-0.42
		(0.43)	(0.42)
Body Mass Index			
Normal weight		Ref	Ref
Underweight		-0.67	-0.59
		(2.11)	(1.89)
Overweight		-0.08	-0.32
		(0.58)	(0.57)
Education level			
No diploma		Ref	Ref
Cap-bep		-3.61	-3.45
		(2.93)	(2.82)
High school degree		-3.59	-3.63
		(2.74)	(2.66)
Bachelor's degree		-5.07*	-4.32
		(2.73)	(2.67)
Master's degree		-3.65	-2.99
		(2.70)	(2.63)
PhD		-4.89*	-4.43
		(2.84)	(2.77)
Others		-3.74	-3.29
		(2.79)	(2.70)
Parent meeting PNNS' recommendations			
First quartile		Ref	Ref
Second quartile		-1.04	-0.67
		(0.77)	(0.77)
Third quartile		-1.59*	-1.19
		(0.83)	(0.82)
Fourth quartile		-1.99**	-1.34
		(0.90)	(0.90)
Food risk lover			0.22*
			(0.12)
Future food effects			-0.36*
			(0.18)
Constant	5.51***	17.95***	18.24***
	(0.13)	(3.72)	(3.63)
N	300	288	288
Observations	600	576	576

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We removed 12 participants participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 8 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

Table 2.A6 – Difference-in-difference on the FSA score child's baskets.

	FSA score of children's baskets					
	Mykid	Mykid	Mykid	Otherkid	Otherkid	Otherkid
	(1)	(2)	(3)	(4)	(5)	(6)
Stage 2	-0.62	-0.70	-0.70	0.86	0.31	0.31
	(0.56)	(0.60)	(0.60)	(0.77)	(0.83)	(0.83)
Descriptive	0.00	1.41	1.48	0.00	-0.47	-1.05
	(0.00)	(2.43)	(2.36)	(0.00)	(2.35)	(2.18)
Opinion	0.00	1.95	1.98	0.00	-0.05	-0.48
	(0.00)	(1.49)	(1.47)	(0.00)	(1.61)	(1.53)
Stage 2 × Descriptive	0.40	0.48	0.48	-1.41	-0.84	-0.84
	(0.84)	(0.89)	(0.89)	(0.97)	(1.03)	(1.04)
Stage 2 × Opinion	-2.32**	-1.90*	-1.90*	-2.86***	-2.25**	-2.25*
	(1.05)	(1.05)	(1.05)	(1.07)	(1.14)	(1.15)
Free day		1.34	1.69		-0.71	-1.37
		(1.88)	(1.79)		(1.86)	(1.70)
Nutri-Score reference		-1.73*	-1.12		-0.81	-1.17
		(1.02)	(1.04)		(1.16)	(1.14)
Female		-2.82**	-2.19**		-1.10	-0.91
		(1.10)	(1.11)		(1.15)	(1.10)
Participant's age		-0.26***	-0.23**		-0.10	-0.10
		(0.10)	(0.10)		(0.09)	(0.08)
Child age		0.18	0.24		0.43	0.43
		(0.22)	(0.22)		(0.33)	(0.32)
Number of child		-1.76**	-1.63**		-1.47*	-0.95
		(0.73)	(0.70)		(0.82)	(0.78)
Body Mass Index						
Normal weight		Ref	Ref		Ref	Ref
Underweight		0.18	0.40		0.00	0.00
		(2.82)	(2.94)		(.)	(.)
Overweight		0.46	0.07		0.77	0.56
		(1.05)	(1.03)		(1.15)	(1.10)
Education level						
No diploma		Ref	Ref		Ref	Ref
Cap-bep		-10.07***	-8.18***		1.23	1.31
		(2.88)	(3.11)		(3.01)	(3.16)
High school degree		-6.17***	-5.98***		-0.19	-0.19
		(2.09)	(2.22)		(2.62)	(2.78)
Bachelor's degree		-8.61***	-7.43***		-0.02	1.62
		(2.09)	(2.27)		(2.94)	(3.07)
Master's degree		-7.68***	-6.61***		0.76	2.65
		(1.89)	(2.08)		(2.70)	(2.85)
PhD		-5.30	-4.75		-0.98	2.02
		(3.40)	(3.26)		(4.42)	(4.13)
Others		-2.42	-1.64		-0.07	0.88
		(2.40)	(2.57)		(2.78)	(2.84)
Child meeting PNNS' recommendations						
First quartile		Ref	Ref		Ref	Ref
Second quartile		-1.52	-1.40		-3.42**	-2.51*
		(1.33)	(1.28)		(1.38)	(1.44)
Third quartile		-0.61	-0.24		-4.49***	-3.62**
		(1.42)	(1.35)		(1.44)	(1.43)
Fourth quartile		-1.20	-0.80		-4.99***	-4.79***
		(1.62)	(1.55)		(1.54)	(1.47)
Food risk lover			-0.09			0.50*
			(0.22)			(0.27)
Future food effects			-0.80**			-0.66**
			(0.31)			(0.33)
Constant	7.16***	27.61***	29.94***	7.85***	15.17***	16.72***
	(0.20)	(4.91)	(5.10)	(0.20)	(5.75)	(5.98)
N	151	148	148	149	140	140
Observations	302	296	296	298	280	280

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We removed 12 participants participants from the columns where we introduce Socio-demographic variables, including 3 who did not give their gender, 8 who did not give either their weight or their height, and 1 who did not give his gender nor his weight and height.

Table 2.A7 – Treatment schedule.

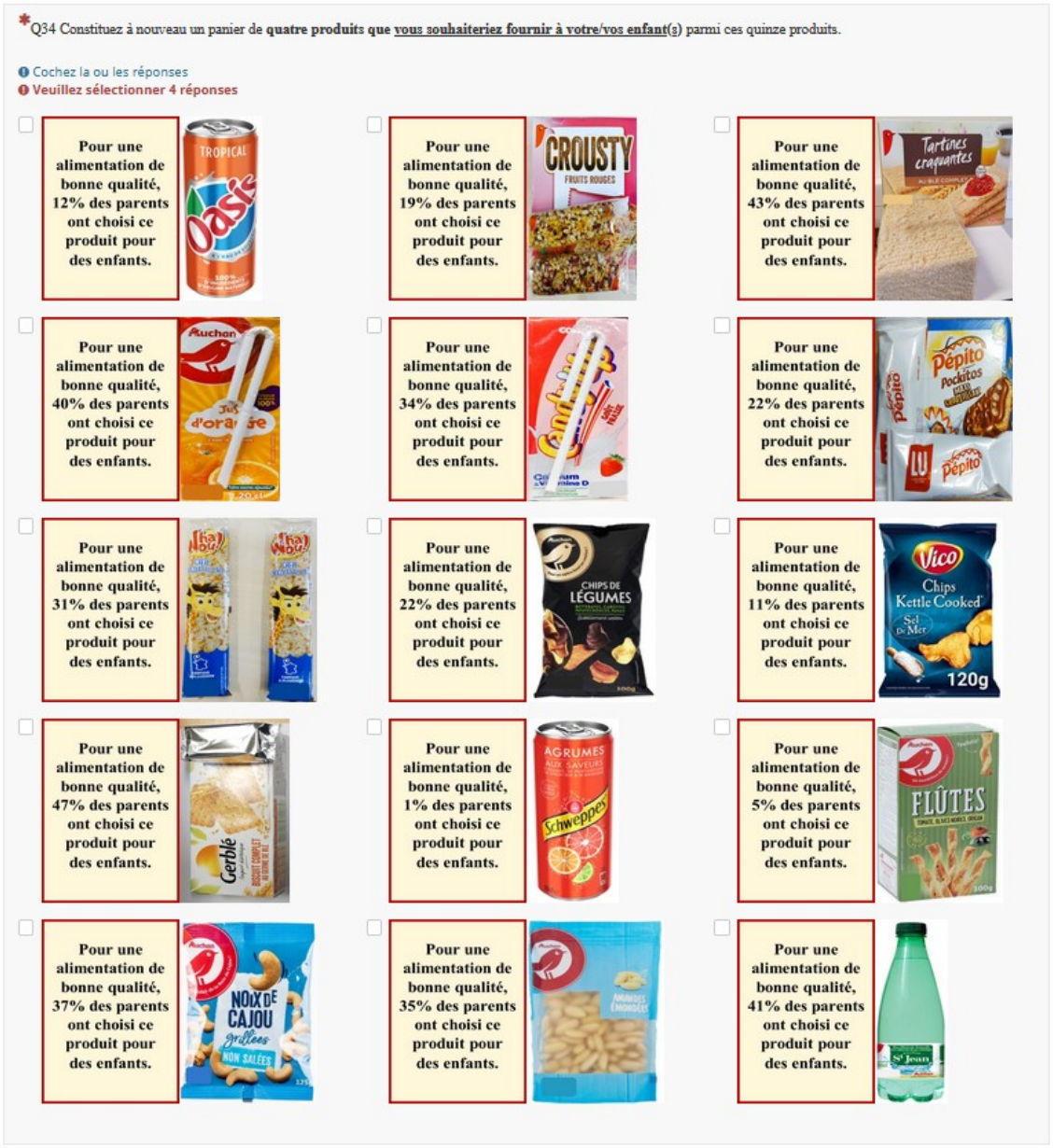
Slots	Day 1 (free entry)	Day 2 (free entry)	Day 3	Day 4	Day 5
10:30 am- 12:00 pm	C_mykid	C_otherkid	-	-	-
11:00 am - 12pm	-	-	I_otherkid	D_otherkid	I_mykid
12:00 - 13:00 pm	C_otherkid	C_mykid	I_otherkid	D_mykid	D_mykid
14:00 - 15:30 pm	I_mykid	I_mykid	D_mykid	I_mykid	D_otherkid
15:30 - 17:00 pm	-	-	D_otherkid	D_mykid	I_otehrkid and D_mykid
15:30 - 17:30 pm	I_otherkid	I_otherkid and C_mykid	-	-	-

Figure 2.A5 – Second basket for parent in *descriptive norm* treatments.



Notes: The instruction was: once again, put together a basket of four of the fifteen products you would like to consume. For the first basket, the instruction was: to put together a basket of four of the fifteen products you would like to consume. The image was the same as in the first basket and in control groups, except that the descriptive norm was not displayed.

Figure 2.A6 – Second basket for child in *descriptive norm* treatments.



Notes: The instruction in "*mykid*" treatments was: Once again, put together a basket of four products that you would like to provide to your child(ren) from these fifteen products. In "*otherkid*" treatments was: once again, put together a basket of four of the fifteen products you would like to provide to another participant's child. The image was the same as in the first basket and in control groups, except that the descriptive norm was not displayed.

Figure 2.A7 – Second basket for parent in *opinion information* treatments.



Notes: The instruction was: once again, put together a basket of four of the fifteen products you would like to consume. For the first basket, the instruction was: to put together a basket of four of the fifteen products you would like to consume. The image was the same as in the first basket and in control groups, except that the opinion information was not displayed.

Figure 2.A8 – Second basket for child in *opinion information* treatments.



Notes: The instruction in "*mykid*" treatments was: Once again, put together a basket of four products that you would like to provide to your child(ren) from these fifteen products. In "*otherkid*" treatments was: once again, put together a basket of four of the fifteen products you would like to provide to another participant's child. The image was the same as in the first basket and in control groups, except that the opinion information was not displayed.

Appendix 2.B *Treatment effect across gender.*

This appendix examines the effects of treatments on our variables of interest by gender. Table 2.B1 shows that the *descriptive norm* has a negative and significant effect on women's overestimation rate and a positive and significant effect on women's accuracy rate. This result suggests that *descriptive norm* significantly reduces women's overestimation of the nutritional quality of items and makes them more accurate in their estimations of the nutritional quality of items compared to control groups. In contrast, the *opinion information* treatment does not have any significant effects on women's beliefs. Both *descriptive norm* and *opinion information* have no significant effect on men's beliefs. Table 2.B2 shows the effects of treatments on the nutritional quality of food baskets by gender. The *descriptive norm* and the *opinion information* have no significant impact on the nutritional quality of the food baskets made by women, whether for themselves or children. For men, the *descriptive norm* only significantly improves the nutritional quality of food baskets they make for themselves and for an unknown random child (otherkid). The *opinion information* does not affect the nutritional quality of food baskets they make for themselves but significantly improves the nutritional quality of food baskets they make for their own child (mykid) and for an unknown random child (otherkid).

Table 2.B1 – Difference-in-difference on belief accuracy by gender.

	Female				Male			
	Absolute belief gap	Overestimation rate	Underestimation rate	Accuracy rate	Absolute belief gap	Overestimation rate	Underestimation rate	Accuracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stage 2	-0.38	2.03**	-3.09***	1.06	0.14	1.52	-2.73	1.21
	(0.33)	(0.99)	(1.09)	(1.41)	(0.48)	(1.50)	(2.20)	(2.11)
Stage 2 × Descriptive	-0.38	-4.67***	0.07	4.60**	0.02	0.76	1.82	-2.58
	(0.52)	(1.65)	(1.74)	(2.16)	(0.65)	(2.10)	(2.73)	(2.69)
Stage 2 × Opinion	0.50	-0.93	1.70	-0.76	-0.28	-0.03	1.49	-1.46
	(0.45)	(1.44)	(1.71)	(1.79)	(0.72)	(2.41)	(2.82)	(3.23)
Constant	14.45***	25.43***	41.83***	32.73***	14.23***	30.11***	36.99***	32.90***
	(0.10)	(0.32)	(0.36)	(0.40)	(0.14)	(0.48)	(0.53)	(0.59)
Observations	378	378	378	378	186	186	186	186

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We have removed from the sample the 14 participants who responded that they did not know the "NUTRI-SCORE".

Table 2.B2 – Difference-in-difference on the FSA by gender.

	Female			Male		
	FSA score			FSA score		
	Parent	Mykid	Otherkid	Parent	Mykid	Otherkid
Stage 2	-0.30	-0.86	0.26	-0.30	0.01	1.36
	(0.55)	(0.67)	(1.06)	(0.59)	(1.04)	(0.85)
Stage 2 × Descriptive	-0.94	1.57	-0.68	-1.44*	-1.03	-2.18*
	(0.78)	(1.11)	(1.33)	(0.83)	(1.35)	(1.14)
Stage 2 × Opinion	-1.24	-1.47	-1.72	-1.42	-4.68**	-4.54***
	(0.79)	(1.21)	(1.44)	(1.27)	(2.03)	(1.29)
Constant	4.73***	6.21***	7.51***	7.22***	9.12***	8.93***
	(0.16)	(0.25)	(0.27)	(0.23)	(0.34)	(0.25)
N	199	100	99	97	50	47
Observations	398	200	198	194	100	94

Notes: Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
We removed 4 participants who did not give their gender.

Appendix 2.C *Treatment of eating habits and the score of following the recommendations of the PNNS.*

The question asked for all food categories except snacking is: on average, how often do you (does your child) eat this category?

◯ every day

◯ 4 to 6 times a week

◯ 2 to 3 times a week

◯ 1 time a week or less

◯ never

All answers are expressed in weekly frequency (number of days per week) as follows (except snacking):

every day = 7; 4 to 6 times a week =5; 2 to 3 times a week = 2.5; 1 time a week or less = 1; never =0.

For **snacking** question asked is: on average, over the past month, have you (has your child) been snacking?

◯ several times a day every day

◯ Once a day, every day

◯ Once or twice a week on average

◯ very rarely

◯ never

All answers are expressed in weekly frequency (number of days per week) as follows: several times a day every day = 10.5 [22]; Once a day, every day = 7; Once or twice a week on average = 2; Very rarely = 0.5; never = 0.

Let's denote by X the weekly quantity consumed by an individual for a given food category, the method used to construct the score of following the recommendations

22. 10.5 = 7 * 1.5, we have multiplied the 7 times a week by 1.5 and not by 2 or more to avoid the weighted score (overall eating habits score) of the participants being biased by snacking.

Table 2.C1 – Summary of score construction

Food categories	PNNS recommendations	Score of food categories
Fruits and vegetable	5 fruits and vegetables a day	$score_{f\&v} = \frac{X}{7}$
Dairy products	2 dairy foods a day	$score_{milk} = \frac{X}{7}$
Starchy food	at least one starchy food a day	$score_{starchy} = \frac{X}{7}$
Fish and seafood	twice a week	$score_{f\&s} = \begin{cases} \frac{X}{2} & if \quad X \leq 2 \\ \frac{2-X}{2} & if \quad X > 2 \end{cases}$
Unprocessed meat	around 3 or 4 steaks a week	$score_{meat} = \begin{cases} \frac{X}{4} & if \quad X \leq 4 \\ \frac{4-X}{4} & if \quad X > 4 \end{cases}$
Sweetened beverages	no more than one glass a day	$score_{sweet} = \frac{1-X}{7}$
Processed food	avoid eating processed foods	$score_{processed} = \frac{-X}{7}$
Snacking	avoid snacking	$score_{snack} = \frac{-X}{7}$

of the PNNS is summarized in the table below.

Score of meeting the recommendations of the PNNS $= score_{f\&v} + score_{milk} + score_{starchy} + score_{f\&s} + score_{meat} + score_{sweet} + score_{processed} + score_{snack}$

Appendix 2.D *Instructions*

Questionnaire sur choix alimentaires au sein de l'environnement familial et le rôle des normes sociales

Treatment OpinionOwn : traitement opinion panier pour soi et panier pour son enfant (ID 12)

Début du questionnaire

Titre du questionnaire : Bienvenue et merci d'avoir accepté de participer à cette étude

Description et message d'accueil

Cette étude est menée par des chercheurs de l'Université Paris Nanterre.

Dans ce projet de recherche, nous souhaitons étudier les choix alimentaires.

À la fin de cette étude, vous recevrez une rémunération fixe de 3€ et une rémunération variable qui dépendra de vos réponses.

Les données collectées dans cette étude seront traitées et publiées dans un seul but scientifique. Les données sont entièrement anonymisées dès le début de l'étude. Aucun des chercheurs ne pourra associer vos réponses à votre identité.

Nous vous remercions de bien vouloir répondre à ce questionnaire avec le plus grand soin.

Partie 1 : identification et question de contrôle d'éligibilité

Q011 Afin de pouvoir vous remettre le montant de votre paiement à la fin de l'expérience, nous vous demandons de saisir le code d'identification qui vous a été remis.

Q002 Combien d'enfant(s) à votre charge âgé(s) de 3 à 10 ans avez-vous ?

- ○ 0 enfant (1)
- ○ 1 enfant (2)
- ○ 2 enfants (3)
- ○ 3 enfants (4)
- ○ 4 enfants (5)
- ○ 5 enfants (6)
- ○ 6 enfants (7)
- ○ 7 enfants (8)
- ○ 8enfants et plus (9)

Afficher « **Fin de l'expérience ! »** Si Q002 = (1) 0 enfants

Fin de l'expérience !

Merci d'avoir pris le temps de répondre à ce questionnaire. Malheureusement, vous n'êtes pas éligibles pour participer à l'étude.

Partie 2 : responsabilité des courses au sein de la famille et connaissance du nutri-score

Q001 En moyenne, à quelle fréquence faites-vous les courses pour l'achat des produits alimentaires de **votre famille** ?

- ○ Je fais toutes les courses (1)
- ○ Je fais la plupart des courses (2)
- ○ Je fais moins de la moitié des courses (3)
- ○ Je ne fais pas les courses (4)

Q012 Connaissez-vous le NUTRI-SCORE (image ci-dessous) ou avez-vous déjà entendu parler du NUTRI-SCORE ?



- ◯ Oui (1)
- ◯ Non (2)

Partie 3 : test de connaissance du nutri-score et utilisation du nutri-score comme repère

Nous vous demandons de répondre à ces questions qui portent sur votre niveau de connaissance concernant l'utilisation du NUTRI-SCORE.

Q013 Le NUTRI-SCORE est un système d'étiquetage nutritionnel à cinq niveaux, allant de A à E et du vert au rouge, établi en fonction de la valeur nutritionnelle d'un produit alimentaire. Cochez la/les bonne(s) réponse(s) :

◯ Un produit avec un NUTRI-SCORE **B** a une meilleure valeur nutritionnelle qu'un produit avec un NUTRI-SCORE **D**

◯ Un produit avec un NUTRI-SCORE **C** a une meilleure valeur nutritionnelle qu'un produit avec un NUTRI-SCORE **A**

◯ Un produit avec un NUTRI-SCORE **D** a une meilleure valeur nutritionnelle qu'un produit avec un NUTRI-SCORE **E**

◯ Un produit avec un NUTRI-SCORE **E** a une meilleure valeur nutritionnelle qu'un produit avec un NUTRI-SCORE **B**

Q014 Vous référez-vous au NUTRI-SCORE pour vos achats de produits alimentaires (quand il est visible sur le produit) ?

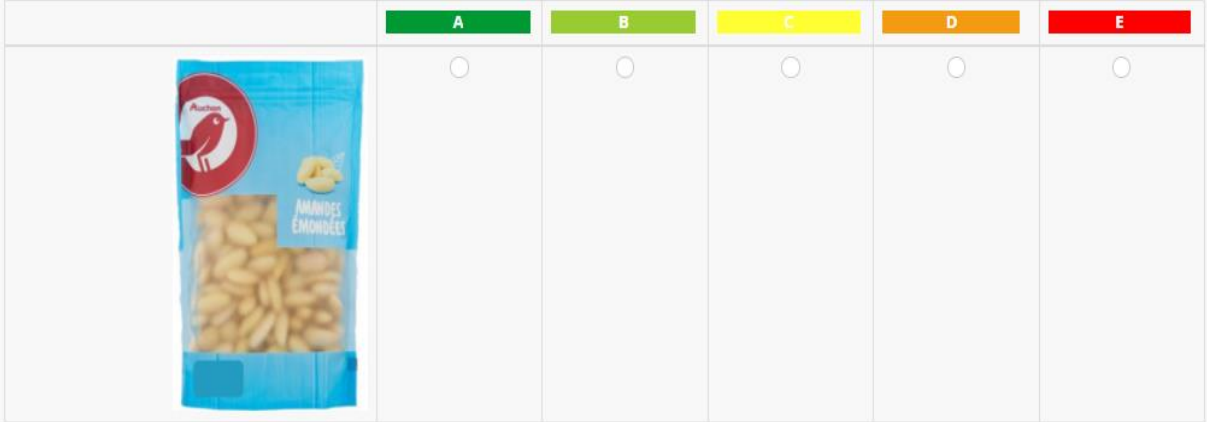
◯ Oui (1)

◯ Non (2)

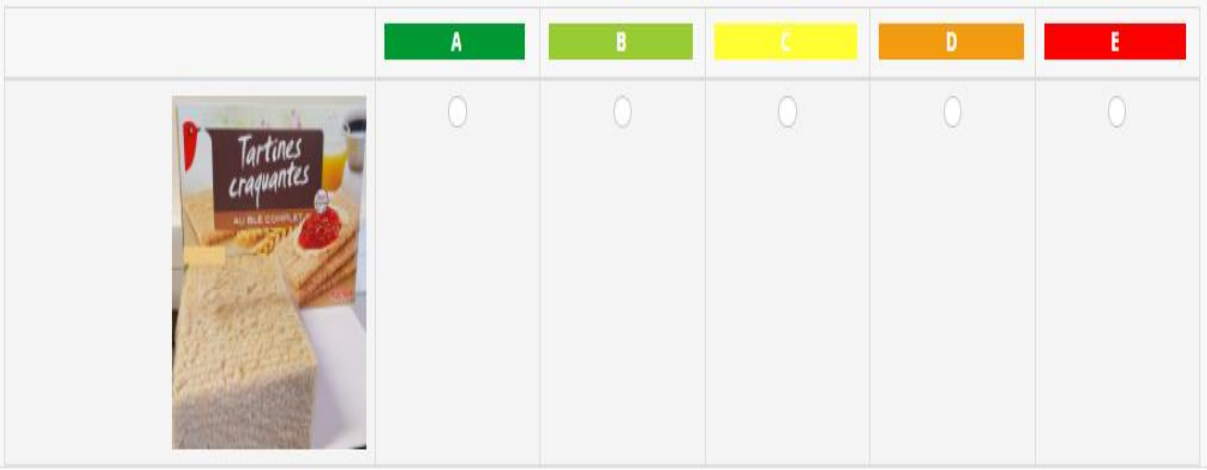
Partie 4 : Première élicitation des croyances **(**Attribution de NUTRI-SCORE)

Nous vous demandons d'attribuer un NUTRI-SCORE à chacun des 15 produits selon vos croyances sur la valeur nutritionnelle des produits. Vous gagnez 0.30€ si le NUTRI-SCORE que vous attribuez au produit est le bon et 0€ si non. Vous avez donc la possibilité de gagner jusqu'à 4.5€ si vous attribuez le bon NUTRI-SCORE à tous les 15 produits.

Q1 Attribuez un NUTRI-SCORE à ce produit.



Q2 Attribuez un NUTRI-SCORE à ce produit



Q3 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q4 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q5 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q6 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q7 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q8 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q9 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q10 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q11 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q12 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q13 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q14 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
	○	○	○	○	○

Q15 Attribuez un NUTRI-SCORE à ce produit

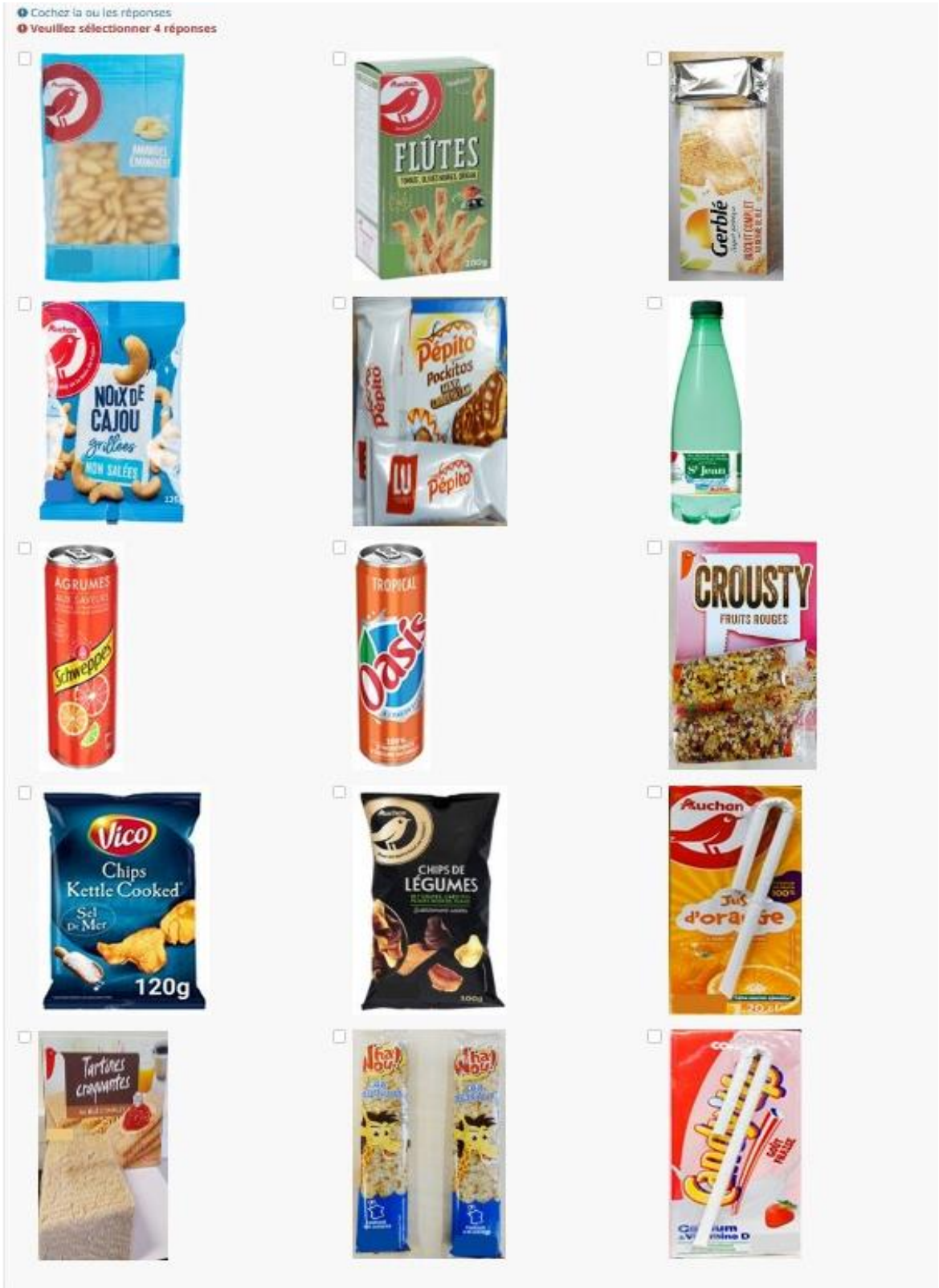
	A	B	C	D	E
	○	○	○	○	○

Partie 5 : Constitution d'un premier panier pour soi et d'un premier panier pour son enfant

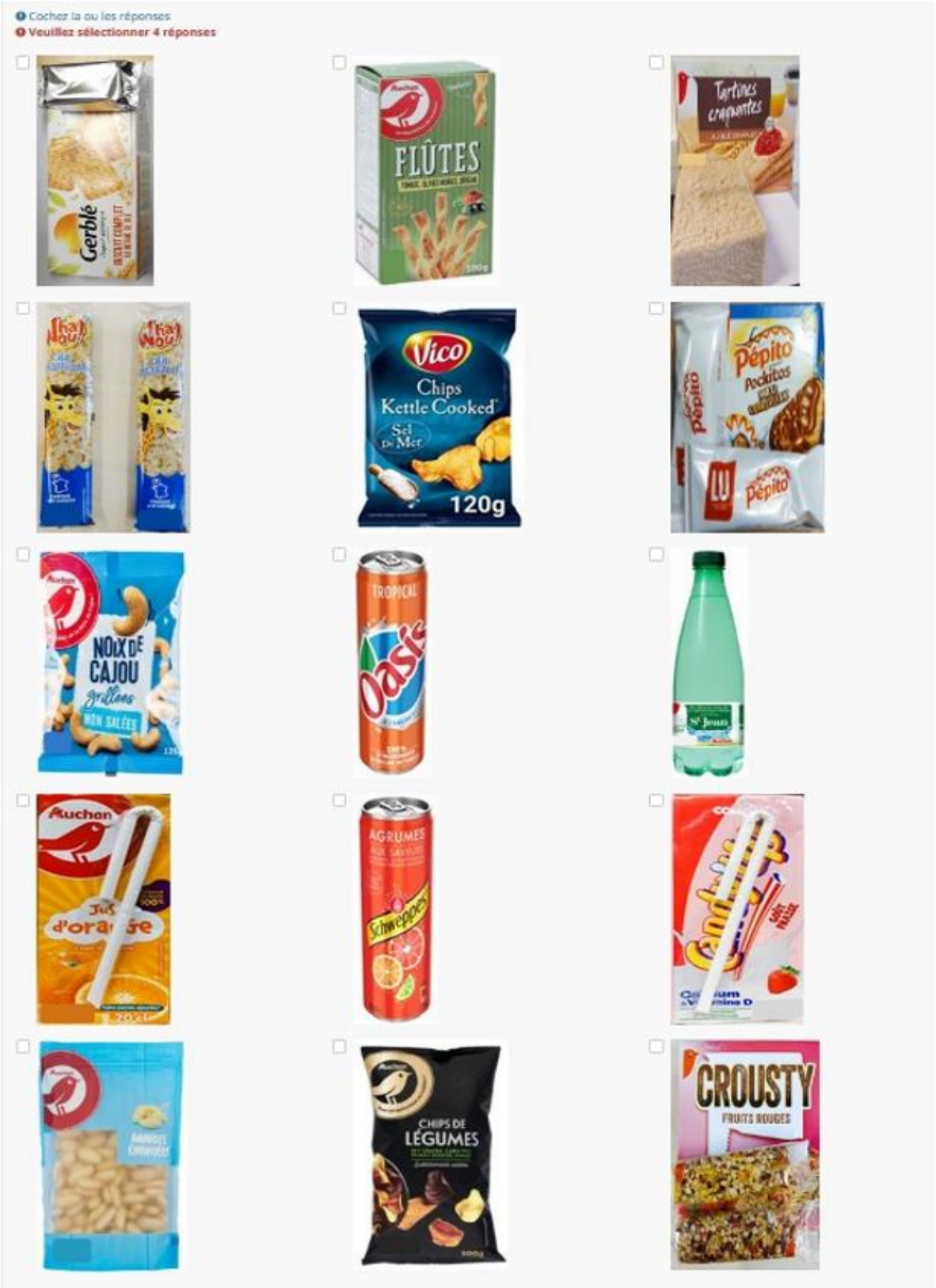
Vous devez maintenant constituer **un premier** panier (panier pour soi) de quatre produits que **vous souhaiteriez consommer** et **un premier** panier (panier pour enfant) de quatre produits que vous souhaiteriez **fournir à votre/vos enfant(s)** parmi ces quinze produits.

Nous vous demandons de faire votre choix de produits comme vous le feriez dans une situation réelle d'achat de produits alimentaires.

Q16 Constituez un panier de **quatre produits que <u>vous</u> souhaiteriez consommer** parmi ces quinze produits.



Q17 Constituez un panier de **quatre produits que vous souhaiteriez <u>fournir à votre/vos enfant(s)</u>** parmi ces quinze produits.



Partie 6 : deuxième élicitation des croyances **(**Attribution de NUTRI-SCORE)

Nous vous demandons **<u>à nouveau</u>** d'attribuer un NUTRI-SCORE à chacun des 15 produits selon vos croyances sur la valeur nutritionnelle des produits. Vous gagnez 0.30€ si le NUTRI-SCORE que vous attribuez au produit est le bon et 0€ si non. Vous avez donc la possibilité de gagner jusqu'à 4.5€ si vous attribuez le bon NUTRI-SCORE à tous les 15 produits.

Nous avons demandé à des parents leurs avis sur la qualité nutritionnelle des 15 produits. À côté de chaque produit, vous trouverez la moyenne de ces avis dans un encadré rouge.

Q18 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
52% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q19 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
69% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q20 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
52% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q21 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
50% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q22 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
83% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q23 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
44% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q24 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
15% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q25 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
19% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q26 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
38% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q27 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
31% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q28 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
17% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q29 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
2% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q30 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
25% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q31 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
10% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Q32 Attribuez un NUTRI-SCORE à ce produit

	A	B	C	D	E
15% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants. 	○	○	○	○	○

Partie 7 : Constitution d'un second panier pour soi et d'un second panier pour son enfant

Vous devez **à nouveau** constituer **un deuxième** panier (panier pour soi) de quatre produits que **vous souhaiteriez consommer** et **un deuxième** panier (panier pour enfant) de quatre produits que vous souhaiteriez **fournir à votre/vos enfant(s)** parmi ces quinze produits.

Nous vous demandons de faire votre choix de produits comme vous le feriez dans une situation réelle d'achat de produits alimentaires.

Nous avons demandé à des parents et à des adultes leurs avis sur la qualité nutritionnelle des 15 produits. À côté de chaque produit, vous trouverez la moyenne de ces avis dans un encadré rouge.

Q33 Constituez à nouveau un panier de **quatre produits que <u>vous</u> souhaiteriez consommer** parmi ces quinze produits.



Q34 Constituez à nouveau un panier de **quatre produits que <u>vous souhaiteriez fournir à votre/vos enfant(s)</u>** parmi ces quinze produits.

Cochez la ou les réponses
Veuillez sélectionner 4 réponses

☐ 44% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 38% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 15% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 17% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 19% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 2% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 25% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 31% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 83% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 50% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 10% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 52% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 15% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 52% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



☐ 69% des parents pensent que pour une alimentation de bonne qualité, les parents devraient choisir ce produit pour des enfants.



Partie 8 : attitude vis-à-vis du risque et préférences pour le temps

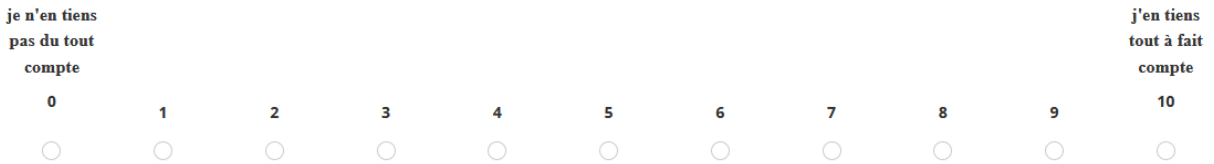
Q35 Sur une échelle de **0** à 10, vous considérez-vous plutôt comme quelqu'un de patient, ou inversement comme quelqu'un d'impatient, pressé ?

La valeur **0** signifie : "**tout à fait impatient**" et la valeur 10 signifie : " **tout à fait patient** "



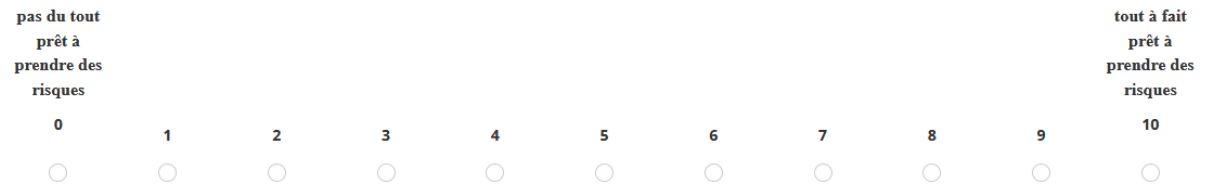
Q35b Lorsqu'il s'agit de faire des choix alimentaires, sur une échelle de **0** à 10, tenez-vous compte des effets futurs possibles de l'alimentation sur votre santé ?

La valeur **0** signifie : "**je ne tiens pas du tout compte des effets futurs possibles de l'alimentation sur ma santé**" et la valeur **10** signifie : " **je tiens tout à fait compte des effets futurs possibles de l'alimentation sur ma santé**"



Q36 Sur une échelle de **0** à 10, vous considérez-vous **<u>généralement</u>** plutôt comme quelqu'un qui est prêt à prendre des risques ou plutôt comme quelqu'un qui cherche à éviter de prendre des risques ?

La valeur **0** signifie : "**pas du tout prêt à prendre des risques**" et la valeur **10** signifie : " **tout à fait prêt à prendre des risques** "



Q36b Lorsqu'il s'agit de risques liés à l'alimentation, sur une échelle de **0** à 10, vous considérez-vous plutôt comme quelqu'un qui est prêt à prendre des risques ou plutôt comme quelqu'un qui cherche à éviter de prendre des risques ?

La valeur **0** signifie : "**pas du tout prêt à prendre des risques**" et la valeur **10** signifie : " **tout à fait prêt à prendre des risques** "

pas du tout prêt à prendre des risques										tout à fait prêt à prendre des risques
0	1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○	○

Partie 9 : Habitudes de consommation alimentaire

Les questions suivantes portent sur **vos** habitudes alimentaires quotidiennes, ainsi que celles de **votre/vos enfant(s) à votre charge**.

Q37 En moyenne, à quelle fréquence mangez-vous des **fruits et légumes** ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q37b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) des **fruits et légumes** ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q38 En moyenne, à quelle fréquence mangez-vous des **produits laitiers** (yaourt, formage…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q38b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) des **produits laitiers** (yaourt, formage…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q39 En moyenne, à quelle fréquence mangez-vous **des féculents** (pain, pâtes, riz, pommes de terre, légumineuses…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q39b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) **des féculents** (pain, pâtes, riz, pommes de terre, légumineuses…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q40 En moyenne, à quelle fréquence mangez-vous du **poisson** ou autres **produits de la mer frais** ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q40b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) du **poisson** ou autres **produits de la mer frais** ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q41 En moyenne, à quelle fréquence mangez-vous de la **viande non transformée** (par exemple steak, steak haché pur bœuf, blanc de poulet, poulet rôti, rôti de bœuf, etc.) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q41b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) de la **viande non transformée** (par exemple steak, steak haché pur bœuf, blanc de poulet, poulet rôti, rôti de bœuf, etc.) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q42 En moyenne, à quelle fréquence buvez-vous des **boissons sucrées** (sodas, oasis, ice tea…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q42b En moyenne, à quelle fréquence votre/vos enfant(s) boit/boivent t-il(s) des **boissons sucrées** (sodas, oasis, ice tea…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q43 En moyenne, à quelle fréquence mangez-vous des **produits transformés** achetés au supermarché ou à l'extérieur (burger, frites, pizza, kebab etc…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q43b En moyenne, à quelle fréquence votre/vos enfant(s) mange(nt) t-il(s) des **produits transformés** achetés au supermarché ou à l'extérieur (burger, frites, pizza, kebab etc…) ?

- ○ Tous les jours (1)
- ○ 4 à 6 fois par semaine (2)
- ○ 2 à 3 fois par semaine (3)
- ○ 1 fois par semaine ou moins (4)
- ○ Jamais (5)

Q44 Le grignotage est défini comme la consommation d'aliments et/ou boissons caloriques entre les trois repas principaux de la journée (petit déjeuner, déjeuné, dîner).

En moyenne, ce dernier mois, avez-vous grignoté ?

- ○ Plusieurs fois par jour tous les jours (1)
- ○ Une fois par jour tous les jours (2)
- ○ Une à deux fois par semaine en moyenne (3)
- ○ Très rarement (4)
- ○ Jamais (5)

Afficher Q44a si Q44 ≠ jamais (5)

Q44a Si vous grignotez, que mangez-vous la plupart du temps (boissons, aliments) ?

Q45 En moyenne, ce dernier mois, votre/vos enfant(s) a/ont t-il(s) grignoté ?

- ○ Plusieurs fois par jour tous les jours (1)
- ○ Une fois par jour tous les jours (2)
- ○ Une à deux fois par semaine en moyenne (3)
- ○ Très rarement (4)
- ○ Jamais (5)

Afficher Q45a si Q45 ≠ Jamais (5)

Q45a Si votre/vos enfant(s) grignote(nt), qu'est-ce qu'il(s) mange(nt) la plupart du temps (boissons, aliments) ?

Q46 Avez-vous ou un membre de votre famille a-t-il un régime alimentaire particulier ?

- ○ Oui (1)
- ○ Non (2)

Afficher Q46a si Q46 = Oui (1)

Q46a Vous avez répondu que vous ou un membre de votre famille a un régime alimentaire particulier, de qui s'agit-il ? (Plusieurs réponses sont possibles)

- ○ Moi-même (1)
- ○ Un de mes enfants (2)
- ○ Mon conjoint (3)

Afficher Q46b si Q46 = Oui (1)

Q46b Si un membre de votre famille a un régime alimentaire particulier, de quelle nature est ce régime ? (Plusieurs réponses sont possibles)

- ○ Végétarien (1)
- ○ Végan (2)
- ○ Allergies (3)
- ○ Motif religieux (4)
- ○ Autre _____ (5)

Partie 10 : questions sociodémographiques

Pour la qualité de cette étude, nous vous demandons de répondre aux questions suivantes. Nous vous rappelons que ce questionnaire est anonyme et que les données collectées ne seront utilisées que pour les besoins de l'étude.

Q47 Êtes-vous ?

- ○ Un homme (1)
- ○ Une femme (2)
- ○ Ne se prononce pas (3)

Q48 Quel est votre âge ?

Q49 Vivez-vous ? (Merci de cocher l'ensemble des réponses qui vous concerne. Plusieurs réponses sont possibles.)

- ○ Seul (e) (1)
- ○ En couple (2)
- ○ Avec vos enfants (3)
- ○ Avec d'autres membres de votre famille (4)
- ○ Avec un colocataire (5)
- ○ Autre _____ (6)

Q50 Quel âge a votre enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50 si Q002= 1 enfant)

Menu déroulant 3 à 10 ans

Q50a Quel âge a votre premier enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50a si Q002>= 2 enfants)

Menu déroulant 3 à 10 ans

Q50b Quel âge a votre deuxième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50b si Q002>= 2 enfants)

Menu déroulant 3 à 10 ans

Q50c Quel âge a votre troisième enfant âgé de 3 à 10 ans à votre charge ? Quel âge a votre deuxième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50c si Q002>= 3 enfants)

Menu déroulant 3 à 10 ans

Q50d Quel âge a votre quatrième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50d si Q002>= 4 enfants)

Menu déroulant 3 à 10 ans

Q50e Quel âge a votre cinquième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50e si Q002>= 5 enfants)

Menu déroulant 3 à 10 ans

Q50f Quel âge a votre sixième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50f si Q002>= 6 enfants)

Menu déroulant 3 à 10 ans

Q50g Quel âge a votre septième enfant âgé de 3 à 10 ans à votre charge ? (afficher Q50g si Q002>= 7 enfants)

Menu déroulant 3 à 10 ans

Q51 De combien de personnes est constituée votre famille (vous + conjoint.e (éventuel.le) + nombre d'enfant en charge) ?

- ○ 1 personne (1)
- ○ 2 personnes (2)
- ○ 3 personnes (3)
- ○ 4 personnes (4)
- ○ 5 personnes (5)
- ○ 6 personnes (5)
- ○ 7 personnes (7)
- ○ 8 personnes et plus (8)

Q52 Veuillez indiquer votre taille en centimètre (cm). (non obligatoire)

Q53 Veuillez indiquer votre poids en kilogramme (Kg). (non obligatoire)

Q54 Quelle est votre niveau d'étude ?

- ○ Aucun diplôme (1)
- ○ BEPC (2)
- ○ CAP, BEP (3)
- ○ Baccalauréat (4)
- ○ Licence (5)
- ○ Master (6)
- ○ Doctorat (7)
- ○ Autre _____ (8)

Q55 Êtes-vous ?

- ○ Salarié(e) en CDD (1)
- ○ Salarié(e) en CDI (2)
- ○ Au chômage (3)
- ○ Autre _____ (4)

Q56 Dans quelle tranche de revenus se situent les **revenus totaux annuels** imposables de **votre ménage ?**

- ○ Moins de 20 000 euros (1)
- ○ De 20 000 à moins de 25 000 euros (2)
- ○ De 25 000 à moins de 30 000 euros (3)
- ○ De 30 000 à moins de 35 000 euros (4)
- ○ De 35 000 à moins de 42 000 euros (5)

- ○ De 42 000 à moins de 50 000 euros (6)
- ○ De 50 000 à moins de 55 000 euros (7)
- ○ De 55 000 à moins de 65 000 euros (8)
- ○ De 65 000 à moins de 85 000 euros (9)
- ○ 85 000 euros ou plus (10)
- ○ Ne souhaite pas répondre (11)

Q57 Avez-vous un/des commentaire(s) sur l'étude ? Vous pouvez également indiquer votre adresse email si vous souhaitez être contacté pour avoir les résultats de l'étude.

Q58 Souhaiteriez-vous être contactés pour participer à d'autres études ?

- ○ Oui (1)
- ○ Non (2)

Afficher **Q58a** si **Q58** = Oui (1)

Q58a Veuillez saisir votre adresse email afin d'être contacté pour participer à d'autres études.

Récapitulatif des paiements (détermination automatique des montants)

Votre rémunération fixe pour votre participation à cette étude est de 3 €

Votre gain pour l'attribution des Nutri-Score est de : calcul intégré dans le programme

Votre rémunération totale pour l'étude est de : somme des deux premières valeurs

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Message de fin :

Nous vous remercions d'avoir participé à cette étude !

Chapter 3

Targeting the Inter-generational Transmission of Food Preferences: the Influence of Public Decision-Makers

3.1 Introduction

Cultural traits and preferences are passed from generation to generation and this may explain the persistence over time and heterogeneity over space of different cultural traits and preferences. The cultural transmission approach argues that parents invest in socializing their offspring to their cultural traits. Parents may be motivated to pass their own preferences to their offspring if they belief that their own preferences are the best for their children to have. Therefore, parents can exert a direct transmission effort to influence their children's process of preference formation. However, it is the pervasive evidence of the resilience of ethnic and religious traits across generations (Bisin and Verdier, 2000), the impact of political regime on preferences (Necker and Voskort, 2014), the effect of cultural traits on economic development (Tabellini, 2010), culture and institutions co-evolution (Touré, 2021), that motivates a large fraction of the theoretical and empirical literature on cultural transmission (see Bisin and Verdier (2011) and Bisin and Verdier (2022) for survey). Nevertheless, the inter-generational transmission of food preferences should be studied due to the correlation between parents' and children's eating habits and the increase in diet-related non-communicable diseases. Indeed, it is well known that eating unhealthy foods increases the risk of non-communicable diseases, which in turn leads to huge public health costs. Consequently, understanding how food habits are formed and the practices that can be used to modify them might help public decision-makers to limit the spread of unhealthy eating habits and therefore the risk of non-communicable diseases. Dietary habits are established at an early age and therefore parents can influence the dietary habits of their children through their food patterns. Even if a parent with unhealthy eating habits is aware that it is harmful to pass on an unhealthy food preference to their child, their eating patterns and feeding practices will expose the child to unhealthy items, which may give the child the opportunity to eat unhealthily. Although children's eating behaviors are difficult to modify directly, parental feeding practices are potentially a good target for public interventions to

prevent children's unhealthy eating patterns.

There are now various public policies designed to improve people's eating habits, such as taxes on unhealthy goods, the use of nutritional labels, and information campaigns. Nevertheless, unhealthy eating habits persist and are one of the main causes of the growing trend in obesity worldwide. This chapter constructs a theoretical model of the transmission of food preferences which accounts for the persistence of unhealthy food preferences even if individuals are aware of the harms of unhealthy eating. We investigate in this chapter how the policymaker can influence the distribution of food preferences in the population in a framework where parents transmit their food preferences to their children through their behavior and eating patterns.

Parents' food patterns have an influence on children's overall diet quality and children's food preferences. Indeed, the family is an important social context where children learn and adopt eating behaviors. Specifically, parents play the role of health promoters, role models, and educators in the lives of children and they can shape children's food preferences. Empirical evidence suggests that parents' dietary intake and feeding practices influence children's eating habits (Mahmood et al., 2021; Yee et al., 2017; Wang et al., 2011; Arcan et al., 2007). It may be in a parent's interest to have a child with their own food preferences. Having the same food preferences as their child makes it easier for a parent to prepare and share food within the family. Hence, the family environment remains one of the first and most fundamental contexts in which children's eating behaviors are formed.

However, parents are not the only people who can have an influence on children's food preferences. Children may be influenced by the external environment in their eating behaviors. When they grow up and enter adolescence, children begin to experience peer effects in their eating behaviors through a friendship social network. Peer effects have an important influence on children's eating behaviors (Ragelienė and Grønhøj, 2021; Chung et al., 2017). Stok et al. (2015) investigate associations

of subjective peer norms with adolescents' healthy eating intentions and intake of healthy and unhealthy food. They find that adolescents intend to eat more healthily when their peers encourage them to eat healthily, but also when their peers discourage them from eating unhealthily. In contrast, a child whose network consists of peers with unhealthy eating habits will tend to develop unhealthy eating habits (Fortin and Yazbeck, 2015).

The interaction of the family and external environments on the formation of children's food preferences implies that the establishment of food preferences can be studied as a dynamic process. This dynamic can lead to the existence and persistence of unhealthy eating habits as well as in the cultural transmission (Bisin and Verdier, 2000) where the population dynamics converge to a heterogeneous limit distribution in which minorities are never completely assimilated.

In this chapter, we assume that parents transmit their food preferences to their children via their behavior and eating patterns. The parent's influence in shaping the child's food preferences goes through monitoring the availability and accessibility of food items to the child. Indeed, parents create food options through food purchasing and preparation and directly influence children's food choices and intake. Parents may use food availability and accessibility to influence their child's consumption. Empirical evidence suggests that the availability and accessibility of a certain type of food for children can boost their consumption of that food (Blanchette and Brug, 2005; Yee et al., 2017). Children are more likely to eat foods that are available and easily accessible (Patrick and Nicklas, 2005). Wyse et al. (2011) find positive associations between children's fruit and vegetable consumption and fruit and vegetable availability and accessibility at home. Moreover, Boles et al. (2019) find that home food availability of both healthy and unhealthy foods is positively associated with children's dietary intake. For family meals away from home, parents may also make decisions about whether they eat out, where to eat, and can select their child's meal.

We develop a model of inter-generational transmission of food preferences in which parents transmit their own food preferences to their children through their food practices. We consider two types of parents: parents with healthy food preferences and parents with unhealthy food preferences. Parents with healthy food preferences have healthy food practices, while parents with unhealthy food preferences have unhealthy food practices. Parents care about their children's food preferences and also have a concern for the public health that is influenced by their food practices. The transmission of food preferences is a mechanism that interacts vertical transmission (inside the family) and oblique transmission (outside the family, in society at large). We find that, even if people fully care about public health, the mechanism of food preference transmission leads to a heterogeneous population where unhealthy food preferences persist. In this setup, we show that public interventions (public good provision and nutritional education program) induce a distribution of food preferences which converge to an homogeneous population with healthy food preferences.

This chapter contributes to the literature studying the inter-generational transmission of cultural traits and preferences. Papers looking at the inter-generational transmission of cultural traits (Bisin and Verdier, 2000, 2001; Montgomery, 2010; Prummer and Siedlarek, 2017) and preferences (Bezin, 2015) consider that parents' or leaders' transmission decisions are motivated by their desire to transmit their cultural traits or preferences. In addition to the parent's desire to have a child with the same food preferences, we consider that parents also care about the future public health their children will have in adulthood. Thus, parents with healthy food preferences are always willing to make efforts to transmit their food preferences, whereas parents with unhealthy food preferences face a trade-off between transmitting their food preferences and improving future public health. This consideration of the future public health by parents allows us to study the dynamics of food preferences as a function of the weight given by parents to the public health in their decision-making process. Thanks to this approach, we find a central result of the literature on the

transmission of cultural traits which is that the transmission process leads to a heterogeneous population in which all cultural traits exist. Furthermore, we show in this chapter that it is possible to achieve an homogeneous population in which only healthy food preferences exist through public policies.

The remainder of the chapter is organized as follows. Section 3.2 presents the literature review. The model is described in Section 3.3. The individual transmission effort is determined in Section 3.4. In Section 3.5, we analyse the public policies implications. Finally, Section 3.6 concludes.

3.2 Related literature

Our chapter is related to the literature on cultural transmission and, in particular, on the transmission of preferences. The model of cultural transmission has been introduced in economics by Bisin and Verdier (2000, 2001), allowing for endogenous socialization choices on the part of parents. Bisin and Verdier (2000, 2001) model the transmission of cultural traits as a mechanism that interacts socialization inside the family and socialization outside the family, in society at large, via imitation and learning from particular role models like teachers, peers, etc. In other words, they assume that children of a given period are born without any particular cultural trait and subsequently acquire either the cultural trait of their parent or one that exists in the society. If the transmission of cultural traits is assumed to be endogenous, Bisin and Verdier (2000) find that the dynamics of the distribution of cultural traits in the population converge to an heterogeneous population in which minorities are never completely assimilated. The cultural transmission model of Bisin and Verdier (2000, 2001), with a single dichotomous cultural trait, has been extended to a model with multiple cultural traits (Montgomery, 2010; Bisin et al., 2009). These extensions suggest that culturally heterogeneous stationary distributions tend to be supported in the multiple cultural traits case as well.

Our chapter is also related to papers analyzing the role of leaders in a cultural transmission model where leaders hold some political power that allows them to further their own cultural traits (Hauk and Mueller, 2015; Prummer and Siedlarek, 2017). Verdier and Zenou (2015) study the population dynamics of preference traits in a model of inter-generational cultural transmission with cultural leaders who interact with opposite objectives. They show that the presence of leaders can prevent the full assimilation or full integration of the population. However, our current framework differs from those in that the public authority (which plays the role of the leader) does not have predefined food preferences and therefore does not seek to spread its own preferences. The regulator's objective of improving public health benefits to all individuals regardless of their food preferences. Consequently, the regulator seeks to encourage parents with healthy food preferences to increase their healthy feeding practice efforts and to discourage the unhealthy feeding practice efforts of parents with unhealthy food preferences.

Our chapter is then related to the literature analyzing the role of specific public good provision on cultural transmission model. Verdier and Zenou (2018) propose a model where they study the dynamics of cultural traits in a model of inter-generational cultural transmission with public good provision. However, our modeling of the public good is different from theirs. They consider that each individual derives utility from a public good specific to their own cultural trait. So the public good in question (religious good) is interpreted as a club good since it is non-rivalrous but excludable. It benefits only to individuals who have the cultural trait. In our model, the public good is non-rivalrous and non-excludable. Any individual can benefit from it if they decide to get healthy food. In other words, everyone benefits from the provision of the public good, which allows the regulator to influence parents' feeding practice efforts, whatever their food preferences.

Finally, our chapter is related to the literature on inter-generational transmission of preferences. Bezin (2015) develops a model in which the future environmental

quality depends on private contributions and green parents act pro-environmentally to socialize their children into environmentally friendly attitudes. She shows that there exists an interior equilibrium in which some, but not all, green agents contribute to improve the environment quality. Our model is, however, quite different from hers along two several dimensions. First, in her model, only green parents make socialization efforts through their contributions and the alternative preference trait (brown) is present by default. Secondly, only green parents derive utility from the quality of the environment. In our model, all parents make feeding practice efforts to socialize their children to their own food preferences. All parents also derive utility from future public health, which depends on their feeding practice efforts. The effect of public policies (taxes and education programs) on the inter-generational transmission of preferences is also documented in the literature. Bezin (2019) develops a model which formalizes the interplay between the formation of green consumer preferences and clean technologies where green preferences are formed through cultural transmission and innovation responds to profit incentives and market size effects. She examines the implications of environmental taxes and environmental education and find that the two policies are either complements or substitutes depending on the substitutability between clean and dirty goods.

3.3 Model

3.3.1 Transmission mechanism of food preferences

As in Bisin and Verdier (2000, 2001), we model the transmission of food preferences as a mechanism that interacts vertical transmission (inside the family) and oblique transmission (outside the family, in society at large). Suppose that there are two types of food preferences in the population: parents with preferences for healthy food who have healthy food practices, denoted by h, and parents with preferences for unhealthy food who have unhealthy food practices, denoted by u. The fraction of individuals

with preference $i \in \{h, u\}$ at time t is denoted by q_t^i. Families are composed of one parent and a child. All children are born without defined food preferences and are first exposed to their parent's food preferences. The parent influences his or her child's food preferences by making the feeding practice effort τ. The feeding practice effort τ can be understood as the frequency with which the child is exposed to a type of food. With probability τ^i, equal to the frequency with which the child of a parent with food preference $I \in \{h, u\}$ is exposed to a diet of type i, the parent successfully passes his/her food preference to his/her child (i.e. vertical transmission). If a child from a family with food preference i does not directly acquire his/her parent's food preference, which occurs with probability $1 - \tau^i$, he/she then becomes subject to a second stage of influence by the social environment of his/her parent (i.e. oblique transmission). In that case, the child is matched to a role model chosen randomly in the population so that he/she acquires preference i with probability q_t^i and preference $j \neq i$ with probability $q_t^j = 1 - q_t^i$, $j \neq i; j, i \in \{h, u\}$. To simplify the notations, we will denote the fraction of individuals with preference for healthy food at time t by q_t. Then $(1 - q_t)$ is the fraction of individuals with preference for unhealthy food. The preference transmission probabilities are given by:

$$P^{hh} = \tau^h + (1 - \tau^h)q_t, \tag{3.1}$$

$$P^{uu} = \tau^u + (1 - \tau^u)(1 - q_t), \tag{3.2}$$

$$P^{uh} = (1 - \tau^u)q_t, \tag{3.3}$$

$$P^{hu} = (1 - \tau^h)(1 - q_t). \tag{3.4}$$

with $P^{ij}, i \neq j \in \{h, u\}$ is the probability that a child from a family with food preference i acquires the food preference j.

The process of preference evolution follows an inter-generational model of food preference transmission. Using (3.1) and (3.3), the food preferences dynamics of q_t is then given by:

$$q_{t+1} = q_t P^{hh} + (1 - q_t)P^{uh} = q_t[\tau^h + (1 - \tau^h)q_t] + (1 - q_t)[(1 - \tau^u)q_t]$$

$$\Rightarrow q_{t+1} = q_t\tau^h + {q_t}^2 - {q_t}^2\tau^h + q_t - q_t\tau^u - {q_t}^2 + {q_t}^2\tau^u$$

$$\Rightarrow q_{t+1} = q_t(\tau^h - \tau^u) - {q_t}^2(\tau^h - \tau^u) + q_t$$

$$\Rightarrow q_{t+1} = q_t(\tau^h - \tau^u)(1 - q_t) + q_t$$

$$\Rightarrow q_{t+1} - q_t = q_t(\tau^h - \tau^u)(1 - q_t). \tag{3.5}$$

3.3.2 Parent's payoff and public health

We assume that parents care about their children's food preferences and get a certain payoff according to the type of food preference their child acquires. Let $V^i(F^i)$ denote the payoff a parent with preferences i gets if their child acquires food preferences F^i, where $i \in \{h, u\}$. We consider the following payoff structure:

$V^h(F^h) = v^{hh}$,

$V^h(F^u) = v^{hu}$,

$V^u(F^h) = v^{uh}$,

$V^u(F^u) = v^{uu}$.

We assume that $v^{ii} > v^{ij}$ whenever i, $j \in \{h, u\}$, with $i \neq j$. The hypothesis that the parent's payoff is greater when their child acquires their own food preference than if they acquire another food preference can be understood as follows. Consider, for example, that individuals may have preferences for vegan and non-vegan food items. If a parent with a preference for non-vegan (vegan) food items has a child who prefers vegan (non-vegan) food items, then this parent will have to purchase vegan (non-vegan) food items for their child. They will also have to give up their preferred menus and prepare menus with vegan (non-vegan) food items so that they can share the same food with their child at mealtime, or to prepare different menus for themselves and their child. This situation requires extra preparation time for the parent or a change in their initial eating habits compared to the situation where the child would have acquired the same food preferences as the parent. This reduces the payoff to this parent with a preference for non-vegan (vegan) items. A parent with a preference for vegan may also have a psychological cost due to the fact that their child eats non-vegan food items (less healthy and less environmentally friendly).The same thinking can be applied to other food items categories, such as organic and non-organic food items. If a parent and his/her child do not have the same food preferences, there may be a clash between their food preferences when it comes to decide the content of the family meals. This clash of food preferences will force both parties to engage in a process of negotiation to find a possible favorable outcome. This reduces the parent's payoff compared to a situation where his/her child acquires his/her own food preferences.

Parent i can choose their feeding practice effort τ^i, at some cost. Let $C^i(\tau^i)$ denote the transmission cost, where τ^i is the probability of direct transmission of the parent's food preference with preference i. We assume that the cost of transmitting

food preferences to children is higher for parents with healthy food preferences than for parents with unhealthy food preferences. The intuition behind this assumption is that children's acceptance of unhealthy foods (with a high sugar content, for example) is higher than their acceptance of healthy foods. For example, it's easier for a parent to give a child candy bars than fruits. So it takes longer for a parent to convince their child to eat healthily than to eat unhealthily.

We assume that $C^i(\tau^i)$ is a quadratic transmission costs:

$C^h(\tau^h) = \frac{1+c^h}{2}\tau^{h2}$ and $C^u(\tau^u) = \frac{1+c^u}{2}\tau^{u2}$, with $c^u < c^h$ is the part of the transmission cost that relates to the type of food (healthy or unhealthy) that the parent wants to make available and accessible to their child. We assume that it is more costly to transmit healthy food preferences than unhealthy ones ($c^u < c^h$). Indeed, the low acceptance of healthy foods by children and their preferences for unhealthy foods makes the transmission of healthy food preferences more challenging. Parents report several barriers to the establishment of healthy diets for children, such as children's dislike of vegetables, parents' limited time for food preparation and avoiding parent–child conflicts (Arthur et al., 2023; Donin et al., 2024). In contrast, it is well documented that children prefer unhealthy foods like foods with a sweet taste (Sobek et al., 2020; Kostecka et al., 2021).

We assume that the distribution of food preferences in the population constitutes an externality on public health. Specifically, a preference for healthy food leads to a higher consumption of healthy food and therefore to a higher public health in the long-run. In contrast, a preference for unhealthy food leads to a higher consumption of unhealthy food that may cause overweight or obesity in the long-run, which usually comes with health problems. These negative effects of the consumption of unhealthy food on health leads to a poor public health. More precisely, the public health function in period $t+1$ is given by:

$$H(q_{t+1}) = q_{t+1}\overline{H} + (1 - q_{t+1})\underline{H}, \tag{3.6}$$

where $\overline{H}$ and $\underline{H}$ are the health outcomes in adulthood of children who acquire healthy and unhealthy food preferences respectively, with $\overline{H} > \underline{H}$, which means that children in period t who acquire healthy food preferences will have better health in $t+1$ than children in period t who acquire unhealthy food preferences.

We assume that parents care about the public health condition their children will have when they become adults and derive utility from it as well. Formally, the expected utility of a parent with preferences i is then:

$$U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i) + \alpha^i H(q_{t+1}), \tag{3.7}$$

with $\alpha^i \in [0; 1]$ the weight that the parent i gives to the public health condition their children will have in adulthood in its utility function. The parameter α^i can be interpreted as a degree of parental altruism regarding the future public health condition their children will have in adulthood. If $\alpha^i = 0$, this means that the parent i is not altruistic and does not care about the future public health condition.

3.4 Individual feeding practice effort and food preferences dynamics

3.4.1 Analysis of dynamics

We assume that parents care about the effect of their feeding practice on public health. Then the parent i chooses their feeding practice effort (τ^i) that maximizes their expected utility (3.7) under the constraints of the preference transmission probabilities (3.1 to 3.4):

$$\max_{\tau^i} \quad U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i) + \alpha^i H(q_{t+1}) \tag{3.8}$$

$$s.t. \quad \begin{cases} P^{hh} = \tau^h + (1-\tau^h)q_t \\ P^{hu} = (1-\tau^h)(1-q_t) \\ P^{uu} = \tau^u + (1-\tau^u)(1-q_t) \\ P^{uh} = (1-\tau^u)q_t \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1-q_t) \\ H(q_{t+1}) = q_{t+1}\overline{H} + (1-q_{t+1})\underline{H} \end{cases} \text{, with } i \neq j;\ i,j \in \{h,u\}.$$

The first order conditions are given by:

$$\text{For } i = h: \qquad (1-q_t)(v^{hh} - v^{hu}) + \alpha^h q_t(1-q_t)(\overline{H} - \underline{H}) - (1+c^h)\tau^h = 0.$$

$$\text{For } i = u: \qquad q_t(v^{uu} - v^{uh}) + \alpha^u q_t(1-q_t)(\underline{H} - \overline{H}) - (1+c^u)\tau^u = 0.$$

then:

$$\tau^{h*} = \frac{(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H} - \underline{H})}{1+c^h}, \tag{3.9}$$

$$\tau^{u*} = \frac{q_t\Delta v^u + \alpha^u q_t(1-q_t)(\underline{H} - \overline{H})}{1+c^u}, \tag{3.10}$$

where $\Delta v^i = v^{ii} - v^{ij}, i \neq j;\ i,j \in \{h,u\}$ is the parent i's "intolerance", i.e. the subjective utility gain of parent i of having a child with the same food preferences. In other words, Δv^i is the parent i's relative value of a child with the same food preferences as theirs.

Equations (3.9) and (3.10) give the feeding practice effort done by each parent. The feeding practice effort of parents with healthy food preferences is positive. If the weight that parents with unhealthy food preferences give to public health in their

Table 3.1 – Comparative statics

Parameters	Preference for healthy food (effects on τ^h)	Parameters	Preference for unhealthy food (effects on τ^u)
Δv^h	$+$	Δv^u	$+$
q_t	$-\ \ if\ \ q_t \geq \frac{1}{2}$ $\pm\ \ if\ \ q_t < \frac{1}{2}$	q_t	$+\ \ if\ \ q_t \geq \frac{1}{2}$ $\pm\ \ if\ \ q_t < \frac{1}{2}$
α^h	$+$	α^u	-
c^h	-	c^u	-

utility function is very low ($\alpha^u \to 0$), then they will make a positive feeding practice effort.

Results of the comparative statics, at a given period t, with respect to the parent's subjective utility gain to transmit their own food preferences (Δv^i), the fraction of individuals with preference for the healthy food (q_t), and the weight the parent gives to public health in their utility function are summarized in table 3.1 [1].

The individual feeding practice effort increases with the parent's subjective utility gain of having a child with the same food preferences (Δv^i). The more a parent wants to transmit their food preferences to their child, the more they will make feeding practice efforts. The individual feeding practice effort of parents with healthy food preferences increases with the weight they give to public health, whereas the individual feeding practice effort of parents with unhealthy food preferences decreases with the weight they give to public health (α^i). The sign of the effect of the proportion of individuals with healthy food preferences on parents' levels of feeding practice effort depends on the composition of the population. If the proportion of individuals with healthy food preferences is high ($q_t \geq \frac{1}{2}$), parents with unhealthy food preferences increase their feeding practice effort, while parents with healthy food preferences reduce their feeding practice effort. On the other hand, if the proportion of individuals with healthy food preferences is low ($q_t \leq \frac{1}{2}$), the effects of the fraction of individuals with preference for healthy food on both parents' feeding practice efforts are ambiguous.

1. See Appendix 3.A for proof of the comparative statics.

Using equations (3.9) and (3.10), the dynamics of the fraction of the population with healthy food preferences (equation 3.5) under individual feeding practice effort is given by:

$$q_{t+1} - q_t = q_t(1-q_t)\left[\frac{(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H}-\underline{H})}{1+c^h} - \frac{q_t\Delta v^u + \alpha^u q_t(1-q_t)(\underline{H}-\overline{H})}{1+c^u}\right] \quad (3.11)$$

We obtain the stationary states by setting $q_{t+1} - q_t = 0$. Equation (3.11) shows that there are three stationary states in the evolution of food preferences dynamics. Two stationary states with perfectly homogeneous food preferences in the population ($q^* = 0$ and $q^* = 1$) and one interior stationary state (q^*) in which both food preferences coexist in the population.

Proposition 3.1

(i) Food preferences dynamics described by equation (3.11) has three stationary states: 0 ; 1 and one interior stationary state q^*,

(ii) The interior stationary state in which both food preferences coexist in the population is the unique stable stationary state.

Proof. See Appendix 3.B

Intuitively, if the proportion of individuals with healthy food preferences is very high, parents with healthy food preferences will make less effort to directly transmit their own food preferences to their children, since their children will acquire with high probability the predominant food preferences. In contrast, parents with unhealthy food preferences who belong to the minority will make more feeding practice efforts to transmit their own food preferences to their children. Vertical transmission and oblique transmission operate as substitutes in the process of food preference transmission. The parents with the majority food preferences in the population will always make less feeding practice efforts than the parents with the minority food preferences. Consequently, the mechanism of food preference transmission leads to a heterogeneous society where there will be both food preferences.

Let's consider the case where parents are well calibrated about the weight they attribute to public health (i.e., $\alpha^i = 1$). More precisely, we assume that parents perfectly care about the effect of their feeding practice on the future public health conditions their children will have in adulthood.

Then, at the optimum equations (3.9) and (3.10) become:

$$\tau^{h*} = \frac{(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H} - \underline{H})}{1+c^h}, \tag{3.12}$$

$$\tau^{u*} = \frac{q_t \Delta v^u + q_t(1-q_t)(\underline{H} - \overline{H})}{1+c^u}, \tag{3.13}$$

$$\text{with} \quad \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j;\ i,j \in \{h,u\}.$$

The comparison of equations (3.9) and (3.10) to equations (3.12) and (3.13) shows that for any $\alpha^i < 1$, parents with healthy food preferences make less individual feeding practice effort, whereas those with unhealthy food preferences make more individual feeding practice effort compared to the feeding practice effort they should make if they were well calibrated about the weight they attribute to public health. However, the levels of feeding practice efforts parents make in the case they are well calibrated ($\alpha^i = 1$) do not lead to an homogeneous society in which the entire population will have healthy food preferences (see Figure 3.1).

Proposition 3.2 *The interior stationary state will persist even if parents are well calibrated about the weight they attribute to public health, ($\alpha^i = 1, \forall i$).*

Intuitively, even if parents with unhealthy food preferences perfectly care about the future public health conditions their children will have in adulthood, their feeding practices will always make unhealthy items available to their children. Thus, the likelihood of their children developing a preference for these unhealthy items remains strictly positive.

Furthermore, from equation (3.13) if the "intolerance" of parents with unhealthy food preferences (Δv^u) is very high ($\Delta v^u > |(1-q_t)(\underline{H} - \overline{H})|$), they will have relatively higher incentives to transmit their food preferences to their children. Then, their feeding practice effort will be always positive and increasing as they become a minority in society. This mechanism leads to a heterogeneous population where unhealthy food preferences always persist.

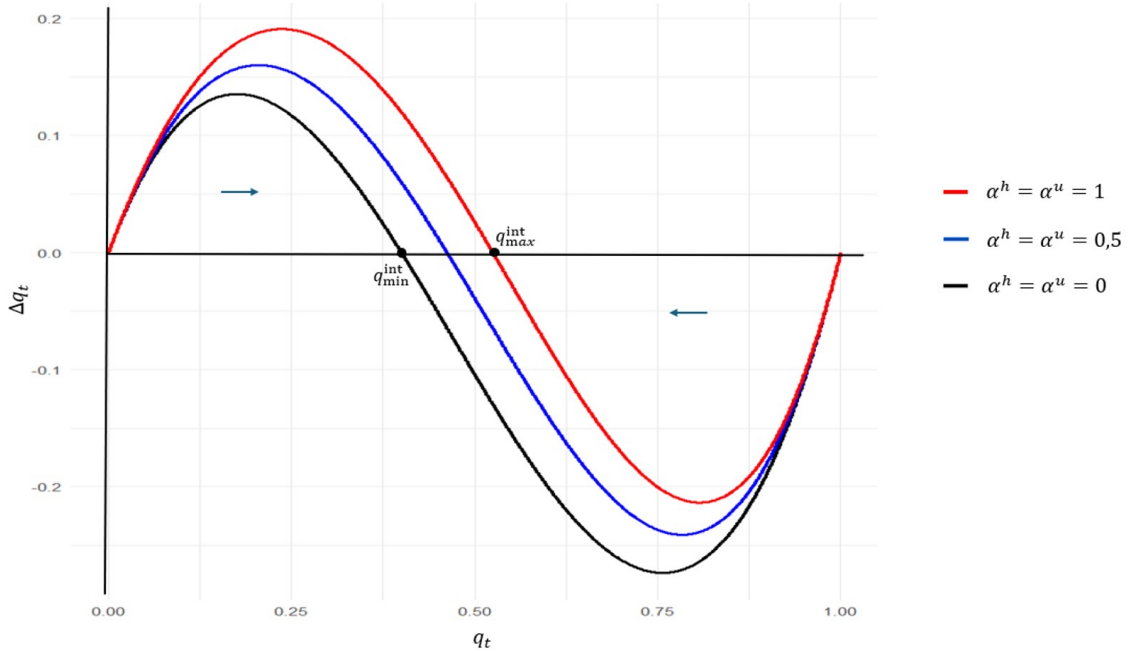
3.4.2 Numerical example

We run numerical examples to identify the interior stable stationary state and how it varies as a function of the weight given to public health by parents (see Figures 3.1 and 3.2). We will also use these same predefined values (in Table 3.2) to study the impact of public policies on this stable stationary state.

Table 3.2 – Predefined values of parameters

Parameters	Predefined values
Δv^h	10
Δv^u	10
$\overline{H}$	20
$\underline{H}$	15
c^u	3
c^h	5

Figure 3.1 – Stationary states of food preferences dynamics under individual feeding practices

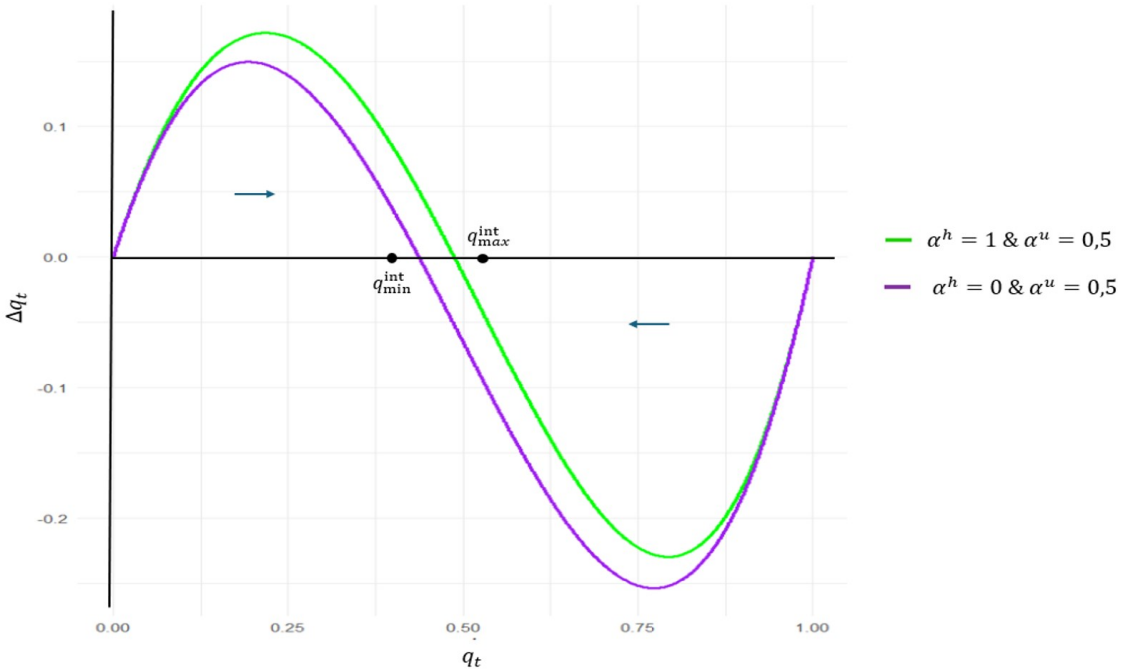


Notes: The Stationary states of the dynamics of food preferences are represented for the same weight given to public health by parents ($\alpha^h = \alpha^u$).

Figure 3.1 shows the three stationary states of food preference dynamics when both parents give the same weight ($\alpha^h = \alpha^u$) to public health (intersection between the curve and the horizontal axis). The basin of attraction of the dynamics of food preferences is at the interior stationary state in which both food preferences coexist in the population. The lowest proportion of individuals with healthy food preferences at the stable stationary state (q^{int}_{min}) is reached when parents do not care about the future public health condition their children will have in adulthood (i.e $\alpha^h = \alpha^u = 0$). If parents fully care about the future public health condition (i.e $\alpha^h = \alpha^u = 1$), then the highest proportion of individuals with healthy food preferences at the stable stationary state (q^{int}_{max}) is achieved. For any other configuration of weights given to public health by parents ($\alpha^h \neq \alpha^u$), the stable steady state is somewhere between these two proportions of individuals with healthy food preferences (see Figure 3.2). These graphs illustrate our proposition 3.2, which suggests that the dynamic of food preferences does not converge to an homogeneous steady state even if the parents are

well calibrated about the weight they attribute to public health.

Figure 3.2 – Stationary states of food preference dynamics under individual feeding practices



Notes: The Stationary states of the dynamics of food preferences are represented for different weights given to public health by parents ($\alpha^h \neq \alpha^u$).

Public interventions are required to achieve an homogeneous society with healthy food preferences. One possible solution would be to address parents' feeding practices either by altering their subjective utility gain of having a child with the same food preferences or by raising their feeding practice effort cost.

3.5 Public policies

In this section, we investigate the case of two public policies. Firstly, a policy of providing public good which modifies parents' payoff, and secondly, a nutritional education program which modifies the transmission costs of parents.

3.5.1 Public good provision

Suppose that the central planner holds some political power to influence the feeding practice of parents and thus the dynamics of the population. More precisely, we assume that the objective of the central planner is to promote the diffusion of healthy food preferences among the population. Thus, he provides a public good G that can only be used to make healthy food available and accessible to parents and children. An example of this type of public good can be the fruits and vegetables voucher, which can only be used for the purchase of fruits and vegetables. Indeed, the feeding practice effort of parents in our model refers to the availability and accessibility to children of food items. So the provision of a fruits and vegetables voucher will lead to greater availability and accessibility for children to fruits and vegetables.

We assume that the public good is financed by a tax on parents' unhealthy feeding practices. Let's note by θ the tax rate. The utility of parents with unhealthy eating habits will be reduced by $\theta\tau^u$. The tax proceeds are used to finance the provision of the public good. Then, the quantity of public good provided by the regulator is therefore given by $G = (1 - q_t)\theta\tau^u$.

Since the public good can be used by anyone who wants to consume healthily, a parent can use it to make more healthy items available and accessible to their child. Therefore, parents who have healthy food preferences will have more interest to reinforce their feeding practices by making more healthy items available to their children in order to fully use the public good. In contrast, parents with unhealthy food preferences will have an interest to modify their feeding practices by making available to their children less unhealthy and more healthy items in order to benefit from the public good even if only to make healthy items available and accessible to the child. Therefore, the additional payoff that a parent obtains if their child acquires a preference for healthy food with the provision of the public good will be greater than the additional payoff that a parent obtains if their child acquires a preference

for unhealthy food. We normalize to zero the additional payoff that a parent gets if their child acquires a preference for unhealthy food with the provision of the public good. The payoff structure of parents then becomes:

$$V^h(F^h) = v^{hh} + \beta^h G,$$

$$V^h(F^u) = v^{hu},$$

$$V^u(F^h) = v^{uh} + \beta^u G,$$

$$V^u(F^u) = v^{uu},$$

with β^i, the value that parent i attributes to the public good. $\beta^i = 0$ means that the parent does not give any importance to the public good. If we go back to our example of the fruits and vegetables voucher, $\beta^i = 0$ means that the parent i does not derive any additional satisfaction from receiving the voucher.

Under the public good supply, the maximization problem for a parent i becomes:

$$\max_{\tau^i} \quad U^i(\tau^i) = P^{ii}(v^{ii} + \beta^i G) + P^{ij}(v^{ij} + \beta^i G) - C^i(\tau^i) + \alpha^i H(q_{t+1})$$

$$s.t. \quad \begin{cases} P^{hh} = \tau^h + (1-\tau^h)q_t \\ P^{hu} = (1-\tau^h)(1-q_t) \\ P^{uu} = \tau^u + (1-\tau^u)(1-q_t) \\ P^{uh} = (1-\tau^u)q_t \qquad \text{, with } i \neq j;\ i,j \in \{h,u\}. \\ G = (1-q_t)\theta\tau^u \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1-q_t) \\ H(q_{t+1}) = q_{t+1}\overline{H} + (1-q_{t+1})\underline{H} \end{cases}$$

The first order conditions are given by:

For $i = h$:

$$(1 - q_t)\left[\Delta v^h + \beta^h(1 - q_t)\theta\tau^u\right] + \alpha^h q_t(1 - q_t)(\overline{H} - \underline{H}) - (1 + c^h)\tau^h = 0.$$

For $i = u$:

$$q_t\Delta v^u + \beta^u(1 - q_t)q_t\theta + \alpha^u q_t(1 - q_t)(\underline{H} - \overline{H}) - \left[2q_t\theta\beta^u(1 - q_t) + (1 + c^u)\right]\tau^u = 0,$$

then:

$$\tau_G^{h*} = \frac{(1 - q_t)\left[\Delta v^h + \beta^h(1 - q_t)\theta\tau^{u*}\right] + \alpha^h q_t(1 - q_t)(\overline{H} - \underline{H})}{1 + c^h}, \tag{3.14}$$

$$\tau_G^{u*} = \frac{q_t\Delta v^u + \beta^u q_t(1 - q_t)\theta + \alpha^u q_t(1 - q_t)(\underline{H} - \overline{H}) - \theta}{2q_t\beta^u(1 - q_t)\theta + (1 + c^u)},$$

$$\text{with} \quad \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j;\ i, j \in \{h, u\},$$

Equations (3.14) and (3.15) give the feeding practice effort provided by each type of parents as a function of the public good.

Using equations (3.14) and (3.15), we can then rewrite the food preferences dynamics of equation (3.5) under the public good provision as:

$$q_{t+1} - q_t \;=\; q_t(1 - q_t)\left[\tau_G^{h*} - \tau_G^{u*}\right]. \tag{3.15}$$

Proposition 3.3 *There exists a level of tax on unhealthy feeding practice that leads to an homogeneous population with healthy food preferences.*

Proof. See Appendix 3.C

Parents with healthy food preferences will have more incentive to transmit their

own food preferences to their children their own food preferences, to derive maximum benefit from the public good. Their "intolerance" and the satisfaction they derive from the public good have a positive impact on their feeding practice effort. On the other hand, for parents with unhealthy food preferences, the tax they pay has a negative impact on their feeding practice efforts. Then there is a level of tax on unhealthy feeding practices for which they will no longer make unhealthy items available to their children. Hence, the process of food preference transmission will only be shaped by the oblique transmission and the feeding practice effort of parents with healthy food preferences. Consequently, the mechanism of food preferences transmission will lead to an homogeneous population with healthy food preferences (see Figure 3.3).

We now turn to the question of the optimal tax on unhealthy feeding practice and the optimal level of public good. The central planner's objective is to improve the public health through the provision of the public good. Anticipating the feeding practice efforts of both types of parents with the provision of the public good, the central planner chooses the level of tax on unhealthy feeding practice θ that maximizes public health function. His problem is to determine the level of tax on unhealthy feeding practice that will lead to the best state of public health. His program is as follows:

$$\max_{\theta} \quad H(q_{t+1}) = q_{t+1}\overline{H} + (1 - q_{t+1})\underline{H}. \tag{3.16}$$

The solution is given by [2]:

$$\theta^* = \Delta v^u. \tag{3.17}$$

We deduce the optimal level of public good:

2. See Appendix 3.D

$$G^* = (1 - q_t)\Delta v^u \tau^u. \tag{3.18}$$

The optimal tax on unhealthy feeding practices should be equal to the subjective utility gain of having a child with the same food preferences of a parent with unhealthy food preferences.

3.5.2 Nutritional education program

Instead of assuming that the central planner provides a public good, one could assume that they implement a nutritional education program to favour the transmission of healthy preferences. One way of understanding this type of program is to think about nutritional education at school, which teaches children the benefits of eating healthily and the harms of eating unhealthily and encourages them to develop healthy food preferences. The nutritional education therefore acts as a complement to the feeding practice of parents with healthy food preferences by reducing the cost of their feeding practice effort (less time spent teaching healthy preferences at home to encourage the child to consume a healthy item, for example). In contrast, the nutritional education goes against the feeding practice of parents with unhealthy food preferences by increasing the cost of their feeding practice effort (more teaching of unhealthy food preferences is needed at home to convince the child to consume an unhealthy item, for example).

Let's assume that the implementation of the nutritional education program generates an additional transmission cost (for parents with unhealthy food preferences) and a reduction of the transmission cost (for parents with healthy food preferences). Specifically, the transmission costs become: $C^h(\tau^h, \epsilon) = \frac{1+c^h}{2(1+\epsilon)}(\tau^h)^2$, for parents with healthy food preferences, and $C^u(\tau^u, \epsilon) = \frac{1+c^u+\epsilon}{2}(\tau^u)^2$, for parents with unhealthy food preferences. The parameter ϵ might be interpreted as the intensity (or effi-

cacy) of the nutritional education program. Intuitively, the nutritional education program will lower children's barriers for eating healthy foods, such as their dislike of vegetables, and reduce their temptation to consume unhealthy foods.

The more intense the nutrition education program (ϵ is high), the more children will be aware of the benefits of healthy eating and the harms of unhealthy eating on their future health. This will increase children's willingness to eat healthy foods, making feeding practices easier (less costly) for parents who want to provide them healthy foods, and more difficult (more costly) for parents wishing to feed them with unhealthy foods.

Under the implementation of the nutritional education program, the maximization problem for a parent i becomes:

$$\max_{\tau^i} \quad U^i(\tau^i) = P^{ii}v^{ii} + P^{ij}v^{ij} - C^i(\tau^i, \epsilon) + \alpha^i H(q_{t+1}) \tag{3.19}$$

$$s.t. \quad \begin{cases} P^{hh} = \tau^h + (1-\tau^h)q_t \\ P^{hu} = (1-\tau^h)(1-q_t) \\ P^{uu} = \tau^u + (1-\tau^u)(1-q_t) \\ P^{uh} = (1-\tau^u)q_t \\ q_{t+1} = q_t + q_t(\tau^h - \tau^u)(1-q_t) \\ H(q_{t+1}) = q_{t+1}\overline{H} + (1-q_{t+1})\underline{H} \end{cases} \text{, with } i \neq j \in \{h, u\}.$$

The first order conditions are given by:

$$\text{For } i = h: \qquad (1-q_t)(v^{hh} - v^{hu}) + \alpha^h q_t(1-q_t)(\overline{H} - \underline{H}) - \frac{1+c^h}{1+\epsilon}\tau^h = 0,$$

$$\text{For } i = u: \qquad q_t(v^{uu} - v^{uh}) + \alpha^u q_t(1-q_t)(\underline{H} - \overline{H}) - (1+c^u+\epsilon)\tau^u = 0,$$

then:

$$\tau_{\epsilon}^{h*} = \frac{(1+\epsilon)\big[(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H}-\underline{H})\big]}{1+c^h}, \tag{3.20}$$

$$\tau_{\epsilon}^{u*} = \frac{q_t\Delta v^u + \alpha^u q_t(1-q_t)(\underline{H}-\overline{H})}{1+c^u+\epsilon}, \tag{3.21}$$

$$\text{with} \quad \Delta v^i = v^{ii} - v^{ij}, \quad i \neq j \in \{h,u\}.$$

Under the implementation of the nutritional education program, equations (3.20) and (3.21) give the feeding practice effort made by each parent.

Using equations (3.20) and (3.21), we can then rewrite the food preferences dynamics of equation (3.5) under the implementation of the nutritional education program as:

$$\begin{aligned} q_{t+1} - q_t = \quad & q_t(1-q_t)\left[\frac{(1+\epsilon)\big[(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H}-\underline{H})\big]}{1+c^h}\right] \\ & -q_t(1-q_t)\left[\frac{q_t\Delta v^u + \alpha^u q_t(1-q_t)(\underline{H}-\overline{H})}{1+c^u+\epsilon}\right]. \end{aligned} \tag{3.22}$$

Proposition 3.4 *Nutritional education program leads to an homogeneous population with healthy food preferences.*

Proof. See Appendix 3.E

The intuition goes as follows. When the nutritional education program is intense (ϵ is high), children become more and more aware of the benefits of healthy food and the harms of unhealthy food. As a result, their acceptance of healthy food may increase. Therefore, parents with healthy food preferences should be able to offer more healthy items to their children. Indeed if it is easier for parents with healthy food preferences to give their children healthy items, they will do so more and more.

In contrast, it becomes more difficult for parents with unhealthy food preferences to provide unhealthy items to their children. They will give less and less unhealthy items to their children. Then, Children will be more likely to develop preferences for healthy foods. This mechanism leads to an homogeneous population with healthy food preferences (see Figure 3.4).

One question that may arise here concerns the optimal intensity (efficacy) ϵ of the nutritional education program. The nutritional education program can only be considered as effective if it allows to achieve the best public health outcome. To determine the optimal intensity (efficacy) ϵ, the central planner's program will be given by:

$$\max_{\epsilon} \quad H(q_{t+1}) = q_{t+1}\overline{H} + (1 - q_{t+1})\underline{H}. \tag{3.23}$$

The optimal intensity (efficacy) ϵ of the nutritional education program is such that the subjective utility gain of a parent with unhealthy food preferences of having a child with the same food preferences (their "intolerance") is equal to zero $(\Delta v^u = 0)$ [3]. The intuition behind this is that the nutrition education program should make the transmission process very costly for parents with unhealthy food preferences, such that their intolerance is totally eliminated. In other words, they become indifferent (in terms of payoff obtained) between having a child with their own food preferences and having a child with healthy food preferences ($v^{uu} = v^{uh}$).

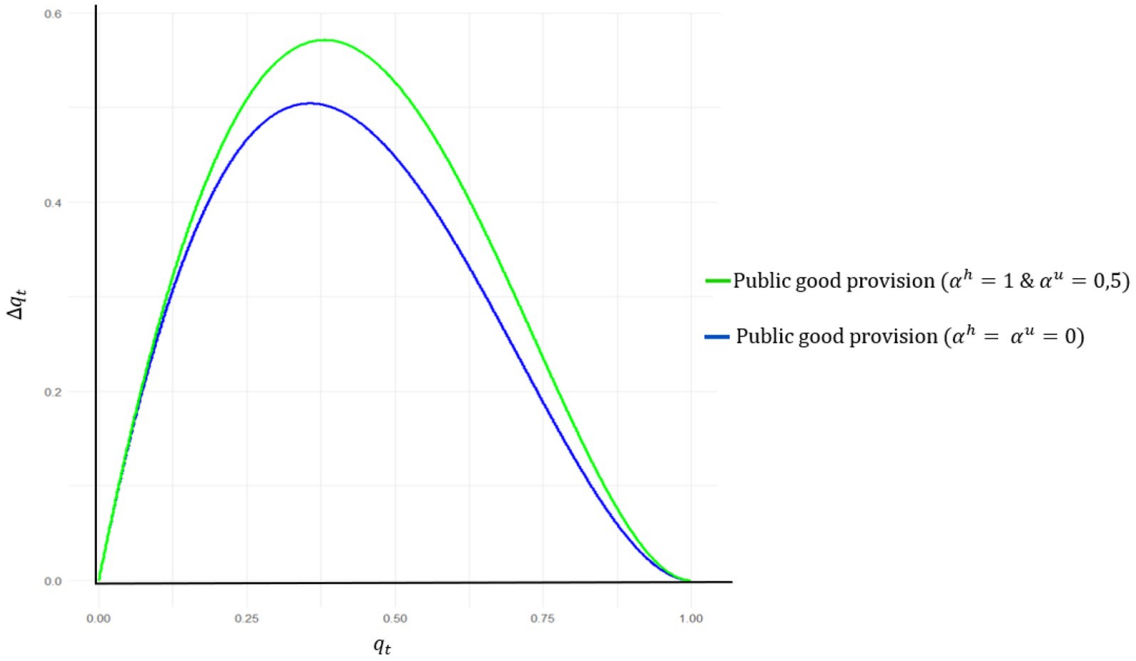
3.5.3 Numerical example

We run numerical examples to identify the stationary states under public good provision and nutritional education program implementation (see Figures 3.3 and 3.4). We use the same predefined values (in Table 3.2) to study the impact of public policies

3. See Appendix 3.F

on stationary states.

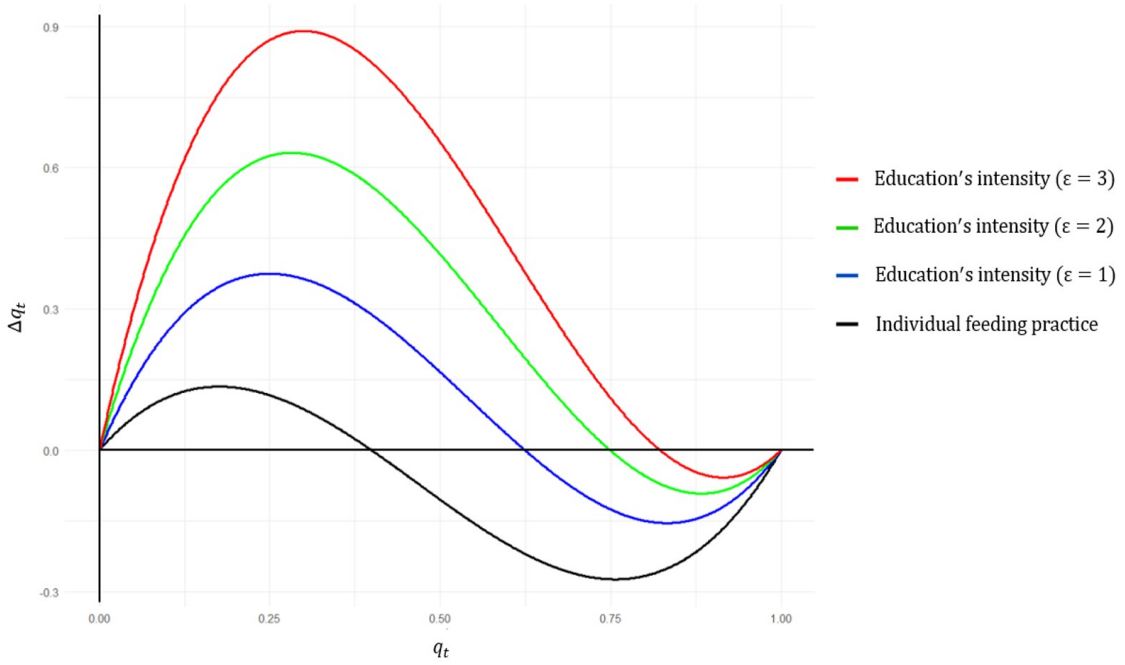
Figure 3.3 – Stationary states of food preferences dynamics under public good provision



Notes: The Stationary states of the dynamics of food preferences are represented for the same weight given to public good ($\beta^h = \beta^u = 0.25$) and different weights given to public health (α^i) by parents.

We can see in Figure 3.3 that the provision of the public good removes the stable interior stationary state towards which the dynamics were converging. The provision of public goods leads the dynamics of food preferences to converge to the stationary state with a perfectly homogeneous food preference where the whole population has healthy food preferences.

Figure 3.4 – Stationary states of food preferences dynamics under nutritional education program vs. individual feeding practices



Notes: The Stationary states of the dynamics of food preferences are represented for the same weight given to public health by parents in the individual feeding practice ($\alpha^h = \alpha^u = 0$) and for different intensities of the nutritional education program: $\epsilon = 1 \quad \epsilon = 2 \quad \epsilon = 3$.

Figure 3.4 shows that under the implementation of the nutritional education program, the stable interior stationary state converges to the stationary state where all people have healthy food preferences as the program intensity increases.

3.6 Conclusion

This chapter proposes a theoretical model of the inter-generational transmission of food preferences. Our point is that parents transmit their own food preferences to their children through their food practices but also have a concern for the public health conditions. The public health depends on the distribution of food preferences across the population, which is influenced by the feeding practices of parents. Then, parents are facing a trade-off between transmitting their own food preferences and improving public health. Our model highlights the persistence of unhealthy food preferences even if individuals are aware of the harms of unhealthy eating.

We consider two types of parents: parents with healthy food preferences and parents with unhealthy food preferences. We find that the mechanism of food preference transmission leads to a heterogeneous population where unhealthy food preferences persist, even if they fully care about the public health. We show that public interventions (public good provision and nutritional education program) induce to a distribution of food preferences which converge to an homogeneous population with healthy food preferences.

Our model of food preferences transmission can be extended to include consumption of both healthy and unhealthy food. Indeed, it could be assumed that children acquire food preferences through the consumption of food and not just by exposure (availability and accessibility). In this case, the parents' feeding practice effort would be, for example, the quantity of each type of food (healthy and unhealthy) they provide to their children. Thanks to this extension, it would be quite possible to examine the implications of other types of public policy such as taxes on unhealthy food. Our two public policies can also be experimentally tested. For example, the evaluation of a nutritional education program is possible with the implementation within a school of an intervention policy whose objective will be to raise children's awareness of the benefits of eating healthily and the harmful effects of unhealthy eating. An alternative policy to the nutrition education program could be to raise parents' awareness about the benefits of healthy eating and the harms of unhealthy eating, thereby changing their feeding practices. These extensions are left for future research.

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Appendices

Appendix 3.A *Comparative statics in table 3.1*

From equations (3.9) end (3.10), we obtain:

$$\frac{\partial \tau^{h*}}{\partial \Delta v^h} = \frac{1-q_t}{1+c^h} \geq 0 \tag{3.A1}$$

$$\frac{\partial \tau^{u*}}{\partial \Delta v^u} = \frac{q_t}{1+c^u} \geq 0 \tag{3.A2}$$

$$\frac{\partial \tau^{h*}}{\partial \alpha^h} = \frac{q_t(1-q_t)(\overline{H}-\underline{H})}{1+c^h} \geq 0 \tag{3.A3}$$

$$\frac{\partial \tau^{u*}}{\partial \alpha^u} = \frac{q_t(1-q_t)(\underline{H}-\overline{H})}{1+c^u} \leq 0 \tag{3.A4}$$

$$\frac{\partial \tau^{h*}}{\partial c^h} = -\frac{(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H}-\underline{H})}{(1+c^h)^2} \leq 0 \tag{3.A5}$$

$$\frac{\partial \tau^{u*}}{\partial c^u} = -\frac{q_t \Delta v^u + \alpha^u q_t(1-q_t)(\underline{H}-\overline{H})}{(1+c^u)^2} \leq 0 \tag{3.A6}$$

$$\frac{\partial \tau^{h*}}{\partial q_t} = \frac{-\Delta v^h + \alpha^h(\overline{H}-\underline{H})(1-2q_t)}{1+c^h} \tag{3.A7}$$

The first term of equation (3.A7) is negative and the second term is negative if $q_t \geq \frac{1}{2}$. *If* $q_t < \frac{1}{2}$, *the sign of equation (3.A7) is ambiguous.*

$$\Rightarrow \frac{\partial \tau^{h*}}{\partial q_t} \begin{cases} < 0 & if \quad q_t \geq \frac{1}{2} \\ \lesseqgtr 0 & if \quad q_t < \frac{1}{2} \end{cases} \tag{3.A8}$$

$$\frac{\partial \tau^{u*}}{\partial q_t} = \frac{\Delta v^u + \alpha^u(\underline{H} - \overline{H})(1 - 2q_t)}{1 + c^u} \tag{3.A9}$$

The first term of equation (3.A9) is positive and the second term is positive if $q_t \geq \frac{1}{2}$. *If* $q_t < \frac{1}{2}$, *the sign of equation (3.A9) is ambiguous.*

$$\Rightarrow \frac{\partial \tau^{u*}}{\partial q_t} \begin{cases} > 0 & if \quad q_t \geq \frac{1}{2} \\ \lesseqgtr 0 & if \quad q_t < \frac{1}{2} \end{cases} \tag{3.A10}$$

Appendix 3.B *Proof of Proposition 3.1*

Equation (3.11) is obtain from equation (3.5) by using equations (3.9) and (3.10). Then it can be rewritten as follows:

$$q_{t+1} - q_t = q_t(1 - q_t)(\tau^{h*} - \tau^{u*}) \tag{3.B1}$$

Obviously, (0, 1) are stationary states of (3.B1), as well as all q which solve the equation $\tau^{h*} - \tau^{u*} = 0$. $\tau^{h*} - \tau^{u*} = 0$ *is a second-degree equation whose solutions are obtain from:*

$$\frac{(1-q_t)\Delta v^h + \alpha^h q_t(1-q_t)(\overline{H}-\underline{H})}{1+c^h} - \frac{q_t\Delta v^u + \alpha^u q_t(1-q_t)(\underline{H}-\overline{H})}{1+c^u} = 0 \tag{3.B2}$$

$$\Rightarrow \big[(1-q_t)\Delta v^h+\alpha^h q_t(1-q_t)(\overline{H}-\underline{H})\big](1+c^u)-\big[q_t\Delta v^u+\alpha^u q_t(1-q_t)(\underline{H}-\overline{H})\big](1+c^h)=0$$

$$\begin{aligned}\Rightarrow\ &\big[\Delta v^h - q_t\Delta v^h + \alpha^h q_t(\overline{H}-\underline{H}) - \alpha^h {q_t}^2(\overline{H}-\underline{H})\big](1+c^u)\\ &-\big[q_t\Delta v^u + \alpha^u q_t(\underline{H}-\overline{H}) - \alpha^u {q_t}^2(\underline{H}-\overline{H})\big](1+c^h)=0\end{aligned}$$

$$\begin{aligned}\Rightarrow\ \ &(1+c^u)\Delta v^h + q_t\left[(\overline{H}-\underline{H})\big[\alpha^h(1+c^u)+\alpha^u(1+c^h)\big] - \Delta v^h(1+c^u) - \Delta v^u(1+c^h)\right]\\ &-{q_t}^2\left[(\overline{H}-\underline{H})\big[\alpha^h(1+c^u)+\alpha^u(1+c^h)\big]\right]=0\end{aligned}$$

$$\begin{aligned}\nabla &= \left[(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)\right]^2 \\ &\quad +4\left[(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]\right](1+c^u)\Delta v^h > 0\end{aligned}$$

∇ *is positive, which means that the equation (3.B2) has two solutions.*

$$q_1 = \frac{-\left[(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)\right]-\sqrt{\nabla}}{-2(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]} > 0$$

$$q_2 = \frac{-\left[(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)\right]+\sqrt{\nabla}}{-2(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]} < 0$$

$q^* = q_2 < 0$ *is not considered as a stationary state* ($q \in [0;1]$). q_1 *must be less than* 1 *to be considered as a solution of equation (3.B2).*

$$\begin{aligned}q_1 < 1 \Rightarrow\ & -\left[(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)\right]-\sqrt{\nabla} > \\ & -2(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]\end{aligned}$$

$$\Rightarrow\ -\left[-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)\right]-\sqrt{\nabla} > -(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]$$

$$\Rightarrow\ -\sqrt{\nabla} > -(\overline{H}-\underline{H})\left[\alpha^h(1+c^u)+\alpha^u(1+c^h)\right]-\Delta v^h(1+c^u)-\Delta v^u(1+c^h)$$

$$\Rightarrow \quad \sqrt{\nabla} < (\overline{H} - \underline{H})\big[\alpha^h(1+c^u) + \alpha^u(1+c^h)\big] + \Delta v^h(1+c^u) + \Delta v^u(1+c^h)$$

$$\Rightarrow \quad \nabla < \big[(\overline{H} - \underline{H})\big[\alpha^h(1+c^u) + \alpha^u(1+c^h)\big] + \Delta v^h(1+c^u) + \Delta v^u(1+c^h)\big]^2$$

$$\Rightarrow \Delta v^u(1+c^h) > 0 \tag{3.B3}$$

Inequality (3.B3) is always verified. Then the three stationary states of equation (3.11) are: $q^* = 0, \quad q^* = 1$ *and* $q^* = q_1$.

Let's note $q_{t+1} - q_t = \Delta q$, *and examine how the dynamics of food preferences equation (3.11) evolve according to the values of* q.

$$\partial \Delta q / \partial q\big|_{q=0} = \tau^{h*}(0) - \tau^{u*}(0) = \Delta v^h > 0$$

with $\tau^{i*}(0)$ *is the value of* τ^{i*} *if* $q = 0, i \in \{h, u\}$

$$\partial \Delta q / \partial q\big|_{q=1} = \tau^{h*}(1) - \tau^{u*}(1) = -\Delta v^u < 0$$

with $\tau^{i*}(1)$ *is the value of* τ^{i*} *if* $q = 1, i \in \{h, u\}$

If the proportion of individuals with healthy food preferences is very low ($q \to 0$), *only parents with healthy food preferences will make feeding practice efforts. The feeding practice effort of parents with healthy food preferences will progressively in-*

crease the proportion of individuals with healthy food preferences in the population. Then, the stationary state $q^* = 0$ is unstable. On the other hand, if the proportion of individuals with healthy food preferences is very high ($q \to 1$), only parents with unhealthy food preferences will make feeding practice efforts. The feeding practice effort of parents with unhealthy food preferences will progressively decrease the proportion of individuals with healthy food preferences in the population. Therefore, the stationary state $q^* = 1$ is also unstable. Consequently, parents' feeding practice efforts imply that the basin of attraction of the dynamics of food preferences is at $q^* \in]0;1[$. As a result, parents' feeding practice efforts move the dynamics of food preferences away from full homogeneity: $q^* = 0$ and $q^* = 1$ are locally unstable stationary states of equation (3.11).

Appendix 3.C *Proof of Proposition 3.3*

From equations (3.14) and (3.15) we obtain:

$$\frac{\partial \tau_G^{h*}}{\partial \theta} = \frac{(1-q_t)^2 \beta^h \tau^{u*}}{1+c^h} \geq 0 \tag{3.C1}$$

and

$$\frac{\partial \tau_G^{u*}}{\partial \theta} = \frac{-2q_t(1-q_t)\left[q_t \Delta v^u + \alpha^u \beta^u q_t (1-q_t)(\underline{H} - \overline{H})\right] - (1+c^u)}{\left[2q_t \beta^u (1-q_t)\theta + (1+c^u)\right]^2} \leq 0 \tag{3.C2}$$

The provision of the public good financed by a tax on unhealthy feeding practices will increase the feeding practice effort of parents with healthy food preferences and decrease the feeding practice effort of parents with unhealthy food preferences. These effects of the provision of the public good on the parents' feeding practice efforts will always raise the proportion of individuals with healthy food preferences regardless of the composition of the population. The interior stable stationary state will tend

towards 1 ($q^* = 1$).

Appendix 3.D *Proof of the optimal tax on unhealthy feeding practices and the optimal level of public good (equations 3.17 and 3.18)*

The public health function reaches its maximum at $q_{t+1} = 1$. The optimal level of public good is therefore such that the interior stationary state converges and becomes merged with the homogeneous state $q^* = 1$. In other words, we should have $\tau_G^{h*} - \tau_G^{u*} = 0$ if $q_t = 1$

$$\Rightarrow \frac{\Delta v^u - \theta}{1 + c^u} = 0 \tag{3.D1}$$

$$\Rightarrow \theta^* = \Delta v^u \tag{3.D2}$$

And

$$G^* = (1 - q_t)\Delta v^u \tau^u \tag{3.D3}$$

Appendix 3.E *Proof of Proposition 3.4*

Indeed, whatever the proportion of individuals with healthy food preferences in the population (q_t), we have from equations (3.20) and (3.21):

$$\frac{\partial \tau_\epsilon^{h*}}{\partial \epsilon} = \frac{(1 - q_t)\Delta v^h + \alpha^h q_t (1 - q_t)(\overline{H} - \underline{H})}{1 + c^h} \geq 0 \tag{3.E1}$$

and

$$\frac{\partial \tau_{\epsilon}^{u*}}{\partial \epsilon} = -\frac{q_t \Delta v^u + \alpha^u q_t (1-q_t)(\underline{H} - \overline{H})}{(1+c^u+\epsilon)^2} \leq 0 \tag{3.E2}$$

The feeding practice effort of parents with healthy food preferences increases with the intensity of the nutritional education program, while that of parents with unhealthy food preferences decreases with the intensity of the nutritional education program. As a result, with the nutritional education program, the proportion of individuals with healthy food preferences will be continuously increasing. Then, the dynamics of food preferences will tend towards to an homogeneous population with healthy food preferences.

Appendix 3.F *Proof of the optimal intensity (efficacy) ϵ of the nutritional education program*

The public health function reaches its maximum at $q_{t+1} = 1$. The optimal intensity (efficacy) is therefore such that the interior stationary state converges and becomes merged with the homogeneous state $q^* = 1$. Meaning, we should have $\tau_{\epsilon}^{h*} - \tau_{\epsilon}^{u*} = 0$ if $q_t = 1$

$$\Rightarrow \frac{-\Delta v^u}{1+c^u+\epsilon} = 0 \tag{3.F1}$$

$$\Rightarrow \Delta v^u = 0 \tag{3.F2}$$

Conclusion générale

Cette thèse évalue l'efficacité de différents instruments de politiques publiques visant à promouvoir une alimentation « saine » dans l'environnement familial, chez les enfants, afin de prévenir les problèmes de santé liés à l'alimentation, tels que ceux liés à l'obésité ou le surpoids. Pour cela, nous utilisons des modélisations théoriques et une expérience de terrain. Cette thèse apporte une meilleure compréhension des effets des instruments de politiques publiques sur les choix alimentaires au sein de la famille. Elle aborde trois questions principales en lien avec les conséquences des décisions alimentaires des parents ainsi que leurs pratiques alimentaires sur la santé et les habitudes alimentaires de leurs enfants. Comment une politique de taxation de la consommation de biens « malsains » et une politique mixte basée sur l'utilisation simultanée d'une taxe sur la consommation de biens « malsains » et de nudges peuvent-elles améliorer la qualité nutritionnelle des régimes alimentaires des familles (Chapitre 1) ? Quel est l'impact des normes sociales sur les croyances des parents concernant la qualité nutritionnelle des aliments ? Comment les normes sociales influencent-elles les choix alimentaires des parents, lorsqu'il s'agit des choix pour eux-mêmes, pour leur propre enfant ou pour un enfant inconnu (Chapitre 2) ? Comment le décideur public peut-il influencer la distribution des préférences alimentaires au sein de la population dans un contexte où les parents transmettent leurs préférences alimentaires à leurs enfants par le biais de leurs habitudes et comportements alimentaires (Chapitre 3) ?

Dans le premier chapitre, nous évaluons l'efficacité d'une taxe sur la consommation

de bien « malsain » et d'une politique mixte alliant à la fois taxation et nudge sur les décisions alimentaires des parents. En modélisant théoriquement les choix alimentaires des parents, nous montrons que la taxation de la consommation du bien « malsain » permet d'atteindre l'optimum de premier rang si et seulement s'il est possible de mettre en œuvre une politique de taxation ciblée. Nous montrons ensuite que l'utilisation du nudge en soutien à la taxe permet d'atteindre l'optimum de premier rang tout en fixant une taxe uniforme.

Dans le deuxième chapitre, nous étudions l'effet des normes sociales sur les croyances des parents concernant la qualité nutritionnelle des aliments ainsi que sur leurs choix alimentaires pour eux-mêmes, pour leur propre enfant et pour un enfant inconnu. Par le biais d'une expérience de type « lab-in-the-field », nous testons l'effet d'une norme descriptive et une information d'opinion sur la qualité nutritionnelle des paniers constitués par les parents et sur leurs croyances concernant la qualité nutritionnelle des items. Nous trouvons que la norme descriptive réduit significativement la tendance des parents à surestimer la qualité nutritionnelle des aliments, tandis que l'information d'opinion n'a pas d'effets significatifs sur les croyances des parents. De plus, nous trouvons que la norme descriptive et l'information d'opinion améliorent de manière significative la qualité nutritionnelle des paniers alimentaires des parents. Nous trouvons également que seule l'information d'opinion a un impact significatif et positif sur la qualité nutritionnelle des paniers alimentaires des enfants.

Enfin, dans le troisième chapitre, nous nous intéressons à la transmission intergénérationnelle des préférences alimentaires. Nous étudions, à l'aide d'un modèle théorique, comment le décideur public peut-il influencer la distribution des préférences alimentaires au sein de la population. Nous supposons que le mécanisme de la transmission des préférences alimentaires fait intervenir la transmission verticale (au sein de la famille) et la transmission oblique (en dehors de la famille, dans la société en général). Nous trouvons que, même si les parents se soucient pleinement de la santé publique, le mécanisme de transmission des préférences alimentaires conduit à une

population hétérogène où les préférences alimentaires « malsaines » persistent. Nous montrons que des interventions publiques (fourniture d'un bien public et programme d'éducation nutritionnelle) permettent de faire converger la distribution des préférences alimentaires vers une population homogène avec des préférences alimentaires « saines ».

Les résultats de cette thèse suggèrent que des interventions publiques permettent d'améliorer les régimes alimentaires au sein de l'environnement familial, ce qui pourrait permettre de lutter contre la montée de l'obésité et du surpoids chez les enfants. Ainsi, en termes de recommandations de politiques publiques, il est nécessaire pour les pouvoirs publics d'agir sur plusieurs niveaux afin d'orienter les choix alimentaires.

Il serait important de mettre en place des taxes sur les aliments considérés comme « malsains », en ciblant particulièrement les produits les plus nocifs pour la santé future des enfants. Ces taxes peuvent être combinées avec d'autres instruments non-économiques tels que les nudges afin de renforcer leur efficacité. Il est donc recommandé de développer des interventions de nudge, telles que des campagnes d'information ou des étiquetages nutritionnels pour mettre en avant les aliments « sains », en complément de la taxation des aliments « malsains ». Un exemple de politique publique combinant taxation et nudge pourrait consister à instaurer une taxe sur les aliments « malsains » tout en renforçant cette mesure par un étiquetage nutritionnel clair et informatif mettant en avant la qualité nutritionnelle des aliments. La formulation des messages véhiculant des informations sur les recommandations en termes d'alimentation sous forme de normes sociales peut être également envisagée pour de potentiels effets de conformisme alimentaire. Il serait intéressant d'incorporer des campagnes publiques qui mettent en avant les comportements alimentaires positifs des pairs ou de la communauté. Par exemple, des messages du type « 90 % des parents choisissent des fruits et légumes pour les collations de leurs enfants » pourraient être diffusés pour influencer positivement les croyances et les choix alimentaires. En outre, il est recommandé d'investir dans des programmes d'éducation nutritionnelle

destinés aux enfants dès le plus jeune âge, ainsi qu'à leurs parents afin d'influencer positivement la formation des préférnces alimentaires des enfants. De plus, la fourniture des chèques alimentaires pourrait contribuer à établir des préférences alimentaires « saines » et durables au sein de la population.

Plusieurs extensions et prolongements des travaux de recherche abordés dans cette thèse sont possibles. D'abord, le premier chapitre étudie les effets d'une taxe et d'un nudge sur les régimes alimentaires des familles. Néanmoins, ce modèle prend en compte seulement les effets de l'alimentation sur la santé future des enfants. Il serait pertinent d'inclure la possibilité de considérer à la fois la santé future des parents et celle des enfants dans un modèle à trois périodes : l'enfance, l'âge adulte et la retraite. Cela permettrait d'enrichir le modèle en dissociant la consommation des parents de celle des enfants. De plus, les résultats de ce chapitre suggèrent une complémentarité potentielle entre la taxe et le nudge. Des études expérimentales pourraient être envisagées pour tester la complémentarité entre ces deux instruments de politiques publiques. Ensuite, le deuxième chapitre illustre l'influence des normes sociales sur les choix alimentaires des parents. Il serait intéressant de reproduire cette expérience dans un cadre plus proche des lieux d'achat habituels, avec une réelle mise à disposition des aliments. Le troisième chapitre met en évidence l'impact de l'environnement familial et de la société sur la formation des habitudes alimentaires des enfants. Il serait pertinent de tester, avec des expérimentations, différentes formes de programmes d'éducation nutritionnelle, à la fois dans les écoles et dans l'enironnement familial, pour voir quelles approches sont les plus efficaces pour modifier durablement les préférences alimentaires des enfants.

Enfin, une approche plus globale qui prend en compte les systèmes alimentaires dans leur ensemble, y compris les systèmes de production, les aspects environnementaux et d'éthique, pourrait compléter les perspectives actuelles et ouvrir de nouvelles pistes pour la recherche et l'élaboration de politiques publiques. Il est essentiel de prendre en compte tous les facteurs susceptibles d'influencer les choix alimentaires

pour créer un environnement globalement favorable à une alimentation « saine ».