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Contextual correlates of dietary behaviours in adults across Europe

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Acknowledgements

About the author

THESIS SUMMARY

Unhealthy dietary behaviours are considered to be a major risk factor for mortality, such that in 2017, 11 million deaths were attributed to dietary behaviours such as low intake of whole grains and fruit and vegetables, and high intake of sodium. Dietary behaviour is any behaviour that relates individuals to food, and it captures different dietary aspects such as food choices, eating behaviour, and dietary intake. Both individual factors such as biological (e.g., age, sex) and psychological and social-cognitive factors (e.g., preferences, beliefs and intentions), as well as contextual factors, such as aspects of the social and built environments, can influence dietary behaviours. While individual determinants of dietary behaviours have frequently been investigated, in recent decades attention has shifted to their potential contextual determinants. The general objective of this thesis was to explore how individual-level and environmental-level factors were associated with dietary behaviours in Europe, and how methodological decisions on the definition of exposure to the food environment may influence these associations.

On the individual-level, in Chapter 2, we explored associations between various perceived barriers to healthy eating and dietary behaviours among 5,900 adults from urban regions in five European countries from the SPOTLIGHT study, and examined whether associations differed across regions and socio-demographic backgrounds. We found that individuals who perceived any barrier were less likely to report higher consumption of healthier foods and more likely to report higher consumption of fast food. For example, those who perceived to have a busy lifestyle generally ate less vegetables (odds ratio (OR) = 0.54; 95% confidence interval (CI) = 0.47 – 0.62) and more fast food (OR = 2.07; 95% CI = 1.57 – 2.73) as compared to individuals who reported to not perceive to have a busy lifestyle. The association between various barriers and lower intake of fruit and vegetables was somewhat more pronounced among younger participants and women. Regarding environmental-level factors, little is known about how the food environment is associated with aspects of eating behaviours such as home-cooking - a behaviour that is linked to healthier diets. Therefore, in Chapter 3, we explored the independent and combined associations between residential neighbourhood access to restaurants and grocery stores with home cooking in 5,076 European adults. We found that greater access to restaurants was associated with lower frequency of home cooking (relative risk ratio (RRR) = 0.42; 95%CI = 0.23-0.76), largely independent of access to grocery stores. Most studies in food environment research define exposure to the food environment considering only one type of food retailer, while ignoring the relative influence of a variety of food retailers. In

Chapter 4, we explored the associations of absolute and relative measures using simpler and more complex measures of exposure to food retailers with dietary patterns. We did not find evidence for a relation between the food environment and dietary pattern with any of the measures used. We found some indication that absolute and relative measures of exposure assess different aspects of the food environment. However, potentially due to the lack of significant associations, we did not find evidence that more complex measures of exposure to food retailers produce stronger associations with dietary patterns. This could be further explored in future studies that use different outcomes and focus on different settings. Another common challenge of investigating the impact of the food environment on dietary behaviours is how to define the relevant areas of exposure to the food environment. In the Dutch adult population of 1,245 adult participants from the SPOTLIGHT study, we tested the association of density of restaurants with home cooking using different definitions of residential neighbourhoods in Chapter 5. Unlike our findings in the European SPOTLIGHT population, no significant associations between food environment and home cooking were observed and the effect sizes were negligible. In addition to that, although the exposure in terms of density of restaurants was different according to different neighbourhood definitions, we found no evidence that the area under study (i.e. various buffer sizes, administrative neighbourhood boundaries and a self-defined neighbourhood boundary) influences the association between density of restaurants and home-cooking in a Dutch adult population. Still, concerning relevant areas of exposure to the food environment, changes in the distribution of food retailers across a determined geographical area (foodscape) are likely to influence dietary behaviours. We explored if and how the availability of different food retailers, adjusted for the number of inhabitants per neighbourhood, has changed over a 14 years period in the Netherlands in Chapter 6. We also explored whether this change was different according to neighbourhood socioeconomic status (SES) and urbanisation levels. Including almost all Dutch neighbourhoods between 2004 (n=9,956) and 2018 (n=11,751), we observed a 120% and 35% increase in the counts of food delivery outlets and restaurants respectively, and a 26% decrease in the counts of local shops. Effect modification analyses showed that in more urban and lower SES neighbourhoods an increase in the availability of supermarkets and convenience stores was observed, while a decrease was observed in the less urbanised and higher SES neighbourhoods. In general, the foodscape appears to have changed towards offering a higher supply of convenience and ready-to-eat foods. Finally, in **Chapter 7**, in an elderly Dutch population of 8,104 participants from the EPIC-NL cohort, we explored the association between exposure to the

food environment and the consumption of ultra-processed foods (UPF). We used a comprehensive approach to define exposure to the food environment that included the use of both measures of availability of and proximity to different types of food retailers within buffers of different sizes. Furthermore, we used more complex methods for deriving exposure variables, such as street network distances and kernel density estimates. We found that higher consumption of UPF was associated with unhealthier dietary intake. We also found evidence that higher exposure to supermarkets, fast food restaurants, full-service restaurants, convenience stores and candy stores and cafés in the residential neighbourhood was weakly associated with a lower consumption of UPF.

In general, the studies included in this thesis did not generate convincing evidence for a link between the geographically measured food environment and diet in European adults. In addition, despite our efforts to try to capture the complexity of exposure to the food environment using a range of methods such as deriving more complex absolute and relative measures, exploring different neighbourhood definitions and adjusting our analysis for the broader food environment, we could not demonstrate that such methodological decisions result in more consistent associations. Despite the lack of consistent evidence, the potential influence that the food environment exerts on dietary behaviour is well accepted by researchers in the field, and the fact that the body of evidence is not robust does not necessarily have to prevent public health policies and interventions to be implemented. Future research should move from the large focus on the geographic availability of food retailers to embrace other understudied aspects of the food environment such as quality of foods offered in stores, economic accessibility, and food advertisements. An indirect effect of the food environment should also be explored as the relation between the food environment and diet may be mediated by individual level factors related to food choice, such as taste preferences, food preparation skills, use of food retailers and the individual perception of the food environment.

NEDERLANDSE SAMENVATTING

Dutch summary

Ongezonder voedingsgedrag wordt beschouwd als een belangrijke risicofactor voor vroegtijdige sterfte. In 2017 werden 11 miljoen sterfgevallen toegeschreven aan ongezond voedingsgedrag zoals een lage inname van volkorenproducten en fruit en groenten, en een te hoge zoutinname. Voedingsgedrag gaat niet alleen over wat men eet, maar ook over de wisselwerking tussen individuen en voeding, en omvat verschillende aspecten zoals voedselkeuzes, voedingsinname en eetgedrag. Zowel individuele factoren zoals biologische (bijv. leeftijd, geslacht) en psychologische en sociaal-cognitieve factoren (bijv. voorkeuren, overtuigingen en intenties) als contextuele factoren, zoals aspecten van de sociale en bebouwde omgeving kunnen voedingsgedrag beïnvloeden. Individuele determinanten van voedingsgedrag zijn vaak onderzocht en de afgelopen decennia is de aandacht verschoven naar potentiële contextuele determinanten. Het algemene doel van dit proefschrift was om te onderzoeken hoe factoren op individueel niveau en op omgevingsniveau geassocieerd zijn met voedingsgedrag bij volwassenen in Europa, en hoe methodologische beslissingen over de definitie van blootstelling aan de voedselomgeving deze associaties kunnen beïnvloeden.

Op individueel niveau hebben we in Hoofdstuk 2 associaties onderzocht tussen verschillende ervaren barrières voor gezond eten bij 5.900 volwassenen uit stedelijke regio's in vijf Europese landen uit de SPOTLIGHT-studie. In deze studie onderzochten we of associaties verschilden tussen de vijf regio's en tussen de verschillende sociaal-demografische kenmerken van de deelnemers. We vonden dat personen die één of meer barrières ervaarden over het algemeen minder gezonde voeding aten en meer ongezonde voeding. Zo aten bijvoorbeeld degenen die een drukke levensstijl hadden over het algemeen minder groenten (odds ratio (OR) = 0,54; 95% betrouwbaarheidsinterval (BI) = 0,47 - 0,62) en meer fastfood (OR = 2,07; 95% BI = 1,57 - 2,73) in vergelijking met personen die aangaven geen drukke levensstijl te hebben. Het verband tussen verschillende barrières en een lagere inname van fruit en groenten was iets sterker bij jongere deelnemers en vrouwen.

Wat betreft omgevingsfactoren is er relatief weinig bekend over hoe de voedselomgeving gerelateerd is aan voedingsgedrag zoals de frequentie van koken (een gedrag dat gekoppeld is aan een gezonder voedingspatroon). Daarom onderzochten we in Hoofdstuk 3 de onafhankelijke en gecombineerde associaties tussen de toegankelijkheid van restaurants en supermarkten in de woonbuurt en de frequentie van koken bij meer dan vijf duizend Europese volwassenen. We vonden dat een betere toegankelijkheid van restaurants gerelateerd was aan een

lagere frequentie van koken (relatieve risicoverhouding (RRR) = 0,42; 95% BI = 0,23-0,76), grotendeels onafhankelijk van de aanwezigheid van supermarkten in de buurt.

De meeste studies in onderzoek naar de voedselomgeving definiëren blootstelling aan de voedselomgeving op een manier waarbij slechts één type detailhandel in levensmiddelen in aanmerking wordt genomen (zoals een snackbar, supermarkt of groenteboer), terwijl de relatieve invloed van een groot aantal detailhandelaren in levensmiddelen bij elkaar niet wordt onderzocht. In Hoofdstuk 4 hebben we de associaties tussen absolute en relatieve maten, en eenvoudige en complexe maten, van de voedselomgeving in relatie tot voedingspatronen onderzocht. We hebben geen bewijs gevonden voor een verband tussen de voedselomgeving en het voedingspatroon met de gebruikte maten. We vonden wel enige indicatie dat absolute en relatieve blootstellingsmaten verschillende aspecten van de voedselomgeving vangen. Het is mogelijk dat we geen bewijs vonden dat complexere blootstellingsmaten een sterkere associatie tussen de voedselomgeving en voedingspatronen opleverde omdat er überhaupt geen significante associaties gevonden werden. Dit kan verder worden onderzocht in toekomstige studies die verschillende uitkomsten gebruiken en zich richten op verschillende blootstellingsmaten.

Een andere veel voorkomende uitdaging bij het onderzoeken van de impact van de voedselomgeving op voedingsgedrag is hoe de relevante geografische gebieden van blootstelling aan de voedselomgeving kunnen worden gedefinieerd. In een populatie van meer dan duizend Nederlandse volwassen testten we de associatie tussen de dichtheid van restaurants en frequentie van koken met behulp van verschillende definities van blootstellingsgebieden (Hoofdstuk 5). In tegenstelling tot onze bevindingen in de Europese SPOTLIGHT-populatie werden er in deze Nederlandse populatie geen significante associaties tussen de voedselomgeving en kookgedrag waargenomen, en waren de effectgroottes te verwaarlozen. En hoewel de blootstelling in termen van dichtheid van restaurants verschillend was volgens verschillende definities van blootstellingsgebieden, vonden we geen bewijs dat het onderzochte gebied (dat wil zeggen verschillende buffergroottes, administratieve buurtgrenzen en een zelf-gedefinieerde buurtgrenzen) van invloed was op het verband tussen de dichtheid van restaurants en kookgedrag.

Toch is het waarschijnlijk dat veranderingen in de voedselomgeving van invloed is op voedingsgedragingen. We hebben in Hoofdstuk 6 onderzocht of en hoe de beschikbaarheid van verschillende levensmiddelenwinkels, gecorrigeerd voor het aantal inwoners per buurt, in een periode van 14 jaar in Nederland is veranderd. We hebben ook onderzocht of deze verandering verschilde naargelang de sociaaleconomische status (SES) en het verstedelijkingsniveau van de wijk. Een analyse waarbij bijna alle Nederlandse buurten tussen 2004 (n = 9,956) en 2018 (n = 11.751) zijn geanalyseerd toonde een toename van 120% en 35% in respectievelijk

het aantal horecagelegenheden en restaurants aan, en een daling van 26% in het aantal lokale winkels zoals bakkers en slaggers. Een analyse van effectmodificatie toonde aan dat in meer stedelijke gebieden en lagere SES-buurtten een toename van de beschikbaarheid van supermarkten en gemakswinkels werd waargenomen, terwijl een daling werd waargenomen in de minder verstedelijkte en hogere SES-buurtten. Over het algemeen lijkt de voedselomgeving op zo'n manier te zijn veranderd dat er een groter aanbod van gemak- en kant-en-klaar voedsel beschikbaar is gekomen.

Tot slot hebben we in Hoofdstuk 7 bij een oudere Nederlandse bevolking van 8.104 deelnemers uit het EPIC-NL cohort de relatie onderzocht tussen blootstelling aan de voedselomgeving en de consumptie van ultrabewerkte voeding. We hebben een grondige aanpak gebruikt om de blootstelling aan de voedselomgeving te definiëren, waarbij we zowel maten voor beschikbaarheid als van nabijheid tot verschillende soorten voedselretailers hebben gebruikt, en dit binnen buffers van verschillende groottes. Verder hebben we complexe methoden gebruikt om blootstellingsmaten te definiëren, zoals netwerk-afstanden en schattingen van zogenaamde 'kernel densities'. We vonden dat hogere consumptie van ultrabewerkt voedsel geassocieerd was met ongezonde voedingsinname. We hebben ook bewijs gevonden dat een hogere blootstelling aan supermarkten, fastfoodrestaurants, full-service restaurants, gemakswinkels en snoepwinkels en cafés in de woonwijk zwak geassocieerd was met een lagere consumptie van ultrabewerkt voedsel.

Over het algemeen hebben de studies in dit proefschrift geen overtuigend bewijs opgeleverd voor een verband tussen de geografisch gemeten voedselomgeving en voedingsgedrag bij Europese volwassenen. Ondanks onze inspanningen om de complexiteit van blootstelling aan de voedselomgeving te onderzoeken met behulp van een aantal verschillende methoden, zoals het afleiden van complexere absolute en relatieve maatregelen, het verkennen van verschillende blootstellingsdefinities en het corrigeren van onze analyses voor de bredere voedselomgeving, konden we niet aantonen dat dergelijke methodologische beslissingen leiden tot meer consistente associaties. Ondanks het ontbreken van consistent bewijs is er algemene consensus over de potentiële invloed van de voedselomgeving op voedingsgedrag, en het feit dat het bewijsmateriaal niet robuust is, hoeft niet noodzakelijkerwijs te voorkomen dat beleid en interventies zich richten op de voedselomgeving. In de toekomst zou de focus van onderzoek zich moeten verplaatsen van de geografische beschikbaarheid van voedselretailers naar andere, minder onderzochte aspecten van de voedselomgeving, zoals de kwaliteit van voedsel dat wordt aangeboden in winkels, economische toegankelijkheid en marketing van ongezond voedsel. Een indirect effect van de voedselomgeving moet ook worden onderzocht, omdat de relatie tussen de voedselomgeving en het voedingspatroon kan worden verklaard door individuele factoren, zoals smaakvoorkeuren, voedselbereidingsvaardigheden, gebruik van voedselretailers en percepties van de voedselomgeving.

PORTUGUESE SUMMARY

Resumo

Comportamentos dietéticos não saudáveis são considerados um importante fator de risco para mortalidade. Em 2017, 11 milhões de mortes foram atribuídas à comportamentos dietéticos como baixo consumo de grãos integrais, frutas e vegetais, e alto consumo de sódio. Comportamento dietético pode ser definido como qualquer relação dos indivíduos com a comida e inclui diferentes aspectos dietéticos como escolhas alimentares, comportamento alimentar e ingestão alimentar. Tanto fatores individuais como os biológicos (e.g., idade e sexo), assim como fatores contextuais, como aspectos do ambiente social e construído, podem influenciar comportamentos dietéticos. Enquanto os determinantes individuais do comportamento dietético têm sido investigados frequentemente, nas últimas décadas, a atenção tem sido dirigida para seus potenciais determinantes contextuais. O objetivo geral desta tese foi explorar como fatores individuais e ambientais do comportamento dietético associam-se com comportamentos dietéticos em adultos Europeus, e como decisões metodológicas na definição da exposição ao ambiente alimentar podem influenciar essas associações.

Com relação aos fatores individuais, no Capítulo 2, usando dados do estudo SPOTLIGHT, foram analisadas associações entre diferentes barreiras percebidas para alimentação saudável e comportamento dietético entre 5.900 adultos de regiões urbanas em cinco países europeus. Procurou-se investigar se essas associações eram diferentes entre as cinco regiões e entre diferentes características sociodemográficas. Foi encontrado que indivíduos que percebiam qualquer barreira para uma alimentação saudável reportavam menos frequentemente um alto consumo de alimentos saudáveis, como por exemplo frutas, vegetais e peixe, e mais frequentemente um alto consumo de *fastfood*. Por exemplo, aqueles que consideravam ter um estilo de vida conturbado, em comparação com aqueles que não consideravam ter tal estilo de vida, consumiam menos vegetais (razão de odds (RO) = 0,54%; Intervalo de confiança de 95% (IC 95%) = 0,47 o 0,62) e mais *fastfood* (RO = 2,07; IC 95% = 1,57 - 2,73). Associações entre diversas barreiras percebidas para alimentação saudável e menos consumo de frutas e vegetais foram um pouco mais evidentes entre participantes mais jovens e mulheres. Com relação aos fatores ambientais (contextuais), pouco se sabe sobre como o ambiente alimentar é associado com aspectos do comportamento dietético como por exemplo, cozinhar em casa, um comportamento que tem sido associado

com dietas mais saudáveis. Portanto, no capítulo 3, foram analisadas associações independentes e combinadas entre o acesso a restaurantes e pontos de vendas de alimentos com o hábito de cozinhar em casa entre 5.076 adultos europeus. Um maior acesso a restaurantes foi associado com menor frequência de consumo de comida preparada em casa (razão de risco relativo (RRR) = 0,42; CI95% = 0,23 – 0,76), esse resultado foi independente do acesso a pontos de venda de alimentos, como supermercados. A maioria dos estudos no campo de pesquisa sobre o ambiente alimentar define medidas de exposição levando em conta apenas um tipo de estabelecimento alimentar, ignorando a influência relativa exercida por uma variedade de estabelecimentos. No capítulo 4, foi analisada a associação entre o ambiente alimentar e padrões alimentares. Foram utilizadas medidas de exposição absolutas e relativas, e também medidas simples e complexas. Não foi encontrada evidência para uma associação entre o ambiente alimentar e padrões alimentares com nenhuma das medidas de exposição utilizadas. Houve uma indicação de que medidas de exposição absolutas e relativas medem aspectos diferentes do ambiente alimentar. No entanto, provavelmente devido à falta de associações significativas, não foram encontradas evidências de que medidas mais complexas de exposição ao ambiente alimentar produzam associações mais robustas com padrões alimentares. O uso de medidas mais complexas de exposição ao ambiente alimentar poderia ser explorado em futuros estudos usando desfechos diferentes e em outros contextos. Outro desafio frequentemente encontrado na investigação sobre a influência do ambiente no comportamento alimentar é como definir relevantes áreas de exposição ao ambiente alimentar. Usando dados da população holandesa participante no estudo SPOTLIGHT (n=1.245), foi testada a associação entre a densidade de restaurantes e a frequência de consumo de refeições preparadas em casa, usando definições distintas para bairros residenciais (Capítulo 5). Diferente dos resultados encontrados com a amostra completa do estudo SPOTLIGHT (com participantes de cinco países europeus), não foram encontradas associações significantes entre o ambiente alimentar e o consumo de refeições preparadas em casa, além disso, as medidas de efeito mostraram-se irrisórias. Ainda, embora exposições com relação à densidade de restaurantes tenham sido diferentes conforme as distintas definições de bairros, não foram encontradas evidências de que a área de estudo (i.e., múltiplos tamanhos de buffers, limites de bairros oficiais, e limites de bairros autodefinidos) influencia as associações entre o ambiente alimentar e consumo de refeições preparadas em casa na população holandesa. Com relação a relevantes áreas de exposição ao ambiente alimentar, mudanças temporais na distribuição de estabelecimentos alimentares sobre uma determinada área geográfica (panorama alimentar), potencialmente influencia o comportamento alimentar. No Capítulo 6, foi avaliado como a disponibilidade de

diferentes tipos de estabelecimentos alimentares, ajustada pelo número de habitantes por bairros, mudou em um período de 14 anos na Holanda. Também foi examinado se essa mudança foi diferente de acordo com os níveis socioeconômico e de urbanização dos bairros. Em uma análise que incluiu quase a totalidade dos bairros holandeses entre 2008 (n=9.956) e 2014 (n=11.751), foi observado um aumento de 120% na disponibilidade de estabelecimentos de entrega de refeições e 35% na disponibilidade de restaurantes. A disponibilidade de comércio local de alimentos, caracterizado por peixarias, açougues, padarias e hortifrúteis, diminuiu 26%. Análise de modificação de efeito identificou um aumento na disponibilidade de supermercados e lojas de conveniência em áreas urbanas e de menor nível socioeconômico. Por outro lado, uma diminuição na disponibilidade desses estabelecimentos foi observada em áreas menos urbanizadas e de maior nível socioeconômico. Em geral, o panorama alimentar (foodscape) parece ter mudado na direção de uma maior oferta de alimentos de conveniência e de rápido preparo/consumo. Por último, no capítulo 7, em uma população de adultos holandeses (n=8.104) participantes da coorte EPIC-NL, foi analisada a associação entre exposição ao ambiente alimentar e o consumo de alimentos ultraprocessados. Foi utilizada uma abordagem bastante compreensiva para definir exposição ao ambiente alimentar. Essa abordagem incluiu o uso de medidas de disponibilidade e também distância a vários tipos de locais de comercialização de alimentos, usando buffers de diferentes tamanhos. Além disso, foram utilizados métodos mais complexos para obtenção das medidas de exposição, como por exemplo, distâncias usando rede de ruas e densidade Kernel. Um maior consumo de alimentos ultraprocessados associou-se com um consumo alimentar menos saudável. Foi encontrada também uma fraca associação entre uma maior exposição a supermercados, restaurantes, restaurantes de *fastfood*, lojas de conveniência e cafeterias nos bairros residenciais, e menor consumo de alimentos ultraprocessados.

Em geral, os estudos incluídos nessa tese não fornecem forte evidência para uma associação entre o ambiente alimentar medido geograficamente e hábitos alimentares de adultos europeus. Além disso, apesar dos nossos esforços em tentar expressar a complexidade da exposição ao ambiente alimentar usando um variedade de métodos para a obtenção de medidas absolutas e relativas que fossem mais complexas; explorando diferentes tipos de definição de bairros; e ajustando as análises pelo amplo ambiente alimentar (i.e., presença de distintos tipos de locais de comercialização de alimentos), não foi possível demonstrar que tais decisões metodológicas resultariam em associações mais consistentes. Apesar da falta de evidências consistentes nesta tese, a possível influência que o ambiente

alimentar exerce no comportamento alimentar individual é bem aceita por pesquisadores neste campo de pesquisa. Além disso, o fato de que a literatura disponível não é suficientemente robusta não significa que intervenções e políticas de saúde pública não devam ser planejadas e executadas a fim de promover um ambiente alimentar mais saudável. Pesquisas futuras devem avançar de um foco atual na disponibilidade geográfica de estabelecimentos de comercialização de alimentos, para explorar outros aspectos menos estudados do ambiente alimentar como análise da qualidade dos alimentos oferecidos ao consumidor, acessibilidade econômica e estratégias de *marketing* de alimentos. Além disso, a relação entre o ambiente alimentar e hábitos alimentares pode ser mediada por fatores individuais relacionados às escolhas alimentares como por exemplo, preferências sensoriais, habilidades culinárias, uso dos estabelecimentos alimentares e percepções individuais do ambiente alimentar. Desta forma, um possível efeito indireto do ambiente alimentar também deve ser explorado.

LIST OF PUBLICATIONS

Published articles as of August 2019

1. **Pinho MGM**, Mackenbach JD, Charreire H, Oppert J-M, Rutter H, Beulens JWJ, et al. Comparing different residential neighbourhood definitions in the association between density of restaurants and home-cooking among Dutch adults. *Nutrients* 2019; 11(8): 1796.
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3. de Groot R, Hoenink JC, Mackenbach JD, den Braver NR, **Pinho MGM**, Brassinga D et al. The association between population density and blood lipid levels in Dutch blood donors. *International journal of health geographics*. 2019;18(1):3.
4. Mackenbach JD, **de Pinho MGM**, Faber E, Den Braver N, De Groot R, Charreire H et al. Exploring the cross-sectional association between outdoor recreational facilities and leisure-time physical activity: the role of usage and residential self-selection. *International Journal of Behavioral Nutrition and Physical Activity*. 2018;15(1):55.
5. **Pinho MGM**, Mackenbach J, Charreire H, Oppert J-M, Bárdos H, Glonti K et al. Exploring the relationship between perceived barriers to healthy eating and dietary behaviours in European adults. *European journal of nutrition*. 2018;57(5):1761-70.
6. **Pinho MGM**, Mackenbach J, Oppert J, Charreire H, Bárdos H, Rutter H et al. Exploring absolute and relative measures of exposure to food environments in relation to dietary patterns among European adults. *Public health nutrition*. 2018:1-11.

7. **Pinho MGM**, Mackenbach JD, Charreire H, Oppert J-M, Bardos H, Rutter H et al. Spatial access to restaurants and grocery stores in relation to frequency of home cooking. *International Journal of Behavioral Nutrition and Physical Activity*. 2018;15(1):6.
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10. Adami F, Benedet J, da Silva Lopes A, **de Pinho MGM**, dos Santos Figueiredo FW, da Silva Paiva L et al. Body Mass Index and Height Growth Curves are influenced by Sexual Maturation Status in Brazil: Cross-Sectional Study. *International Archives of Medicine*. 2015;8.

Manuscripts in preparation or submitted

MGM Pinho; J Lakerveld, M Harbers, I Sluijs, R Vermeulen, et al. The residential food environment and ultra-processed food consumption in the Netherlands.

MGM Pinho, NR den Braver, JD Mackenbach, J Beulens, J Brug, J Lakerveld. Recent changes in the Dutch foodscape.

C Canalia, **MGM Pinho**, J Lakerveld, JD Mackenbach. Validity and reliability of commercially available data on food retailers in the Netherlands.

PHD PORTFOLIO

	Courses	ECTs
2018	Exposure Assessment in Nutrition Research	1,5
2018	Clinimetrics: assessing measurement properties of health measurement instruments	0,79
2017	A Built Environment for a Healthy and Sustainable Future	0,9
2017	Causal Inference	1,4
2017	Missing data: consequences and solutions	0,64
2017	Mixed Models	3
2016	Writing a Scientific Article	3
2016	GIS for Public Health	1,43
2016	Biostatistics	3
2015	Geologistics	3
2015	Research Integrity - Biomedical Sciences	2
Conferences and other scientific meetings		
2018	3rd Annual Meeting of the Amsterdam Public Health Research Institute	1
2018	17th Annual Meeting of the International Society of Behavioral Nutrition and Physical Activity (ISBNPA 2018)	2
2017	17th International Medical Geography Symposium (IMGS 2017)	2
2017	16th Annual Meeting of the International Society of Behavioral Nutrition and Physical Activity (ISBNPA 2017)	2
2016	2016 European Obesity Summit	2
2016	RESEARCH SEMINAR: Measuring the obesogenic environment - lessons from the Spotlight project	0,3
2015	SPOTLIGHT full-consortium meeting	0,5

Education		ECTs
2019	Supervision of Master student Cesare Canalia - Master Health Sciences. Title master thesis: Validity and reliability of commercially available data on food retailers in the Netherlands	1
2017	Supervision of Master student Eline Faber - Master Health Sciences Title master thesis: Do we overestimate the beneficial impact of outdoor recreational facilities on leisure-time physical activity? Exploring bias due to self-selection. Education for the Epidemiology and Biostatistics Department in 2018 Education for the Epidemiology and Biostatistics Department in 2017 Education for the Epidemiology and Biostatistics Department in 2016	1 0,27 2,04 0,6
Other activities		
Peer review for scientific journal:		
<ul style="list-style-type: none"> • Public Health Nutrition, Nutrients, and Behavioral Sciences 		
Intervision meetings of the Amsterdam Public Health Research Institute		
Member of The Nutrition Society		
Member of the Netherlands Association for the Study of Obesity – NASO		
Member of the International Society of Behavioral Nutrition and Physical Activity.		
Co-founder of the Upstream Team		

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ABOUT THE AUTHOR



Maria Gabriela Matias de Pinho was born on September 9th, 1988 in Florianópolis, a fascinating island in the south of Brazil. She was named after her paternal and maternal grandmothers, while also being given their two surnames: Matias from her mother's and de Pinho from her father's family. As much as she loves her name and its origin, she understands it can get complicated in international contexts. Luckily, it is not uncommon in the Netherlands for people to officially use their nickname. Thus, since week one in the low lands, she goes by her nickname - Gabi.

In 2008, Gabi started a 5 years Bachelor program in Nutrition at the Federal University of Santa Catarina (UFSC). During this period, she got involved in various academic activities and develop a strong interest for Public Health. In 2013, she was admitted to a research Master in Nutrition in the same university. She was among the three best candidates in the program application, being awarded a scholarship to support her during the two years of her master studies. During her master, she had the opportunity to work on different research projects focused on the prevention of non-communicable diseases. At this point, she became very enthusiastic about epidemiology, and strove to further developed her scientific skills.

Seeking to build a strong academic career, Gabi moved from Brazil to the Netherlands as she was granted a fully funded PhD abroad, by the Brazilian National Council for Scientific and Technological Development (CNPq). In October 2015, she started her PhD project on the Contextual Correlates of Dietary Behaviours in Adults Across Europe, at the Department of Epidemiology and Biostatistics, and the Amsterdam Public Health research institute. Gabi considers herself lucky enough to have had the chance to not only grow as a research scholar, but also have fun while conducting her PhD project.