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Association of dietary macronutrient composition and non-alcoholic fatty liver disease in an ageing population: the Rotterdam Study

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Abstract

Objective A healthy lifestyle is the first-line treatment in non-alcoholic fatty liver disease (NAFLD), but specific dietary recommendations are lacking. Therefore, we aimed to determine whether dietary macronutrient composition is associated with NAFLD.

Design Participants from the Rotterdam Study were assessed on (1) average intake of macronutrients (protein, carbohydrate, fat, fibre) using a Food Frequency Questionnaire and (2) NAFLD presence using ultrasonography, in absence of excessive alcohol, steatogenic drugs and viral hepatitis. Macronutrients

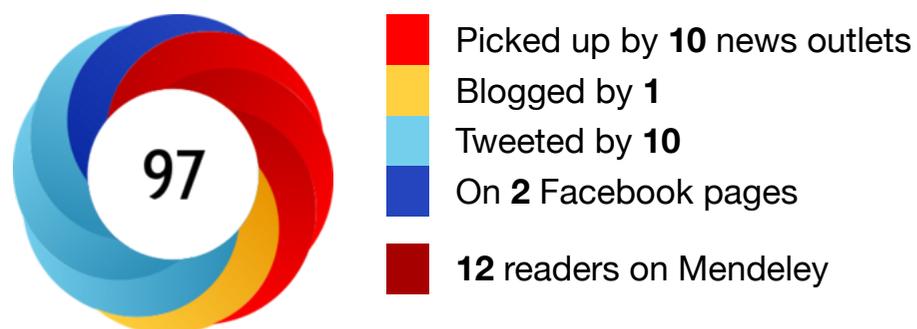
were analysed using the nutrient density method and ranked (Q1–Q4). Logistic regression analyses were adjusted for sociodemographic, lifestyle and metabolic covariates. Moreover, analyses were adjusted for and stratified by body mass index (BMI) (25 kg/m^2). Also, substitution models were built.

Results In total, 3882 participants were included (age 70 ± 9 , 58% female). NAFLD was present in 1337 (34%) participants of whom 132 were lean and 1205 overweight. Total protein was associated with overweight NAFLD after adjustment for sociodemographic and lifestyle covariates ($\text{OR}_{\text{Q4vsQ1}} 1.40$; 95% CI 1.11 to 1.77). This association was driven by animal protein ($\text{OR}_{\text{Q4vsQ1}} 1.54$; 95% CI 1.20 to 1.98). After adjustment for metabolic covariates, only animal protein remained associated with overweight NAFLD ($\text{OR}_{\text{Q4vsQ1}} 1.36$; 95% CI 1.05 to 1.77). Monosaccharides and disaccharides were associated with lower overall NAFLD prevalence ($\text{OR}_{\text{Q4vsQ1}} 0.66$; 95% CI 0.52 to 0.83) but this effect diminished after adjustment for metabolic covariates and BMI. No consistent associations were observed for fat subtypes or fibre. There were no substitution effects.

Conclusion This large population-based study shows that high animal protein intake is associated with NAFLD in overweight, predominantly aged Caucasians, independently of well-known risk factors. Contrary to previous literature, our results do not support a harmful association of monosaccharides and disaccharides with NAFLD.

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Footnotes

Contributors: LJMA: study concept and design, acquisition of data, statistical analysis, analysis and interpretation of data, drafting of the manuscript and finalising the article. JCK-dj: study concept and design, acquisition of nutritional data, analysis and interpretation of data, statistical analysis, critical

revision of the manuscript for important intellectual content and approval of the final article. NSE: imputation procedure and approval of the final article. BJV: study concept and design and approval of the final article. JDS: analysis and interpretation of nutritional data and approval of the final article. RJdK: technical support and approval of final article. MAI: study supervision and approval of the final article. HJM: study concept and design, critical revision of the manuscript for important intellectual content and approval of the final article. JHLA: obtained funding and approval of the final article. OHF: study supervision and approval of the final article. SDM (guarantor): study concept and design, principal investigator of the hepatology department within the Rotterdam Study, analysis and interpretation of data, study supervision, critical revision of the manuscript for important intellectual content and approval of the final article.

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Disclaimer: The manuscript's guarantor affirms that the manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

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Ethics approval: All cohort participants signed a written informed consent at enrolment. The Rotterdam Study has been approved by the institutional review board (Medical Ethics Committee) of the Erasmus MC University Medical Centre Rotterdam and by the review board of The Netherlands Ministry of Health, Welfare and Sports.

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