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## **Abating abdominal adiposity: Modifiable lifestyle risk factors for visceral and liver fat deposition**

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# Abating Abdominal Adiposity

*Modifiable lifestyle risk factors for visceral and  
liver fat deposition*

Esther Winters-van Eekelen

# Abating Abdominal Adiposity

*Modifiable lifestyle risk factors for visceral and liver fat deposition*

Proefschrift

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**Esther van Eekelen**

geboren te Breda  
in 1992

## **Abating Abdominal Adiposity**

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Voor mijn ouders

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## ABSTRACT

The prevalence of obesity is increasing in most places in the world. In particular abdominal obesity is a well-established risk factor for cardiometabolic diseases. This excess risk due to abdominal obesity is due to fat in the visceral area and in and around the organs (ectopic fat), such as in the liver. The main aim of this thesis was therefore to study whether lifestyle changes can reduce the amount of visceral fat and liver fat.

Firstly, from a systematic review and meta-analysis of randomized controlled trials we concluded that a diet high in proteins decreases liver fat compared with a diet high in carbohydrates. A diet high in fat, however did not lead to changes in liver fat compared with a diet high in carbohydrates. Within fat types, saturated fat led to more liver fat accumulation than unsaturated fat. Secondly, we studied diet at multiple levels in the Netherlands Epidemiology of Obesity study, which is a population based cohort study of middle-aged men and women in the Leiden area with directly assessed measured of adiposity. When studying food groups rather than nutrients, we observed that consumption of sweet snacks was positively associated with liver fat content, also after we took total body fat into account. Likewise, consumption of fruit and vegetables and plant-based fats and oils was associated with a reduced amount of visceral fat. Adherence to the current Dutch dietary guidelines, as indicated by a high score on the 15-component Dutch Healthy Diet Index, was associated with less total body fat, less visceral fat and less liver fat. The associations with visceral fat and liver fat remained present after adjustment for total body fat, which suggests that the associations are indeed specific for visceral and liver fat rather than merely representing associations with overall adiposity. These associations were not driven by one component in particular, which stresses the importance of an overall healthy diet. When we studied alcohol intake separate from other dietary components, each additional serving of alcohol per day was also associated with an increase in liver fat. Furthermore, when one alcoholic serving is replaced with a non-alcoholic one, liver fat is also reduced. However, when alcoholic beverages were replaced with sugar sweetened beverages of the same caloric content, liver fat amounts were the same, whereas replacement with milk was associated with a reduced amount of liver fat. Lastly, we observed that objectively measured sedentary time was associated with an increase in total body fat, visceral fat and liver fat. Replacing 30 minutes of sedentary time per day with moderate to vigorous physical activity, but not light physical activity was associated with reduced total body fat, visceral fat and liver fat. These associations with visceral fat and liver fat disappeared after additional adjustment for total body fat, which indicates there is no extra effect on visceral fat and liver fat beyond effects via total body fat.

The results described in this thesis strongly hint towards the importance of considering diet as a whole, instead of focusing on separate components, which is in line with the current dietary guidelines. Sedentary behaviour should be replaced with moderate to vigorous physical activity rather than light physical activity. Alcohol should not be replaced with sugar sweetened beverages, but rather with milk, coffee or tea.