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## INTRODUCTION

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Obesity is a growing problem worldwide. According to the World Health Organization (WHO), 1.8 billion adults were overweight in 2008, 500 million of whom even were obese<sup>221</sup>. This is associated with major health consequences as the risk for developing cardiovascular diseases, diabetes, some cancers as well as other diseases rises with increasing body mass index (BMI)<sup>221</sup>. Among others, the WHO recommends a reduced consumption of fat and sugar-rich foods and a greater intake of less energy-dense foods such as fruit and vegetables as well as legumes and whole grains<sup>221</sup>. Cross-sectional studies indicate that people consuming wholegrain foods on a regular basis have a lower BMI compared to non-wholegrain consumers<sup>124</sup> and longitudinal studies report a smaller weight gain over time with increasing wholegrain consumption<sup>124;139;225</sup>. In contrast, this has not been substantiated in intervention studies as indicated by a recent meta-analysis<sup>170</sup>. However, despite the lack of effect on body weight, a small reduction in fat mass upon wholegrain consumption was found<sup>170</sup>. Potential effects of wholegrain intake on body weight may be the consequence of a reduction in appetite sensation and thus a lower energy intake. A number of studies have investigated effects on appetite immediately after wholegrain intake as well as after a subsequent meal. Although the results are not completely consistent, they still indicate a greater satiating capacity of certain wholegrain foods compared to refined grain products. Acute effects are mostly thought to be mediated by the greater volume and dietary fiber content of whole grains, affecting gastric emptying and distension and postprandial glycemic response<sup>97;119;185</sup> whereas second meal effects are suggested to be a consequence of colonic fermentation<sup>91;160</sup>. Whole grains are rich in fermentable components<sup>76</sup> and have been found to increase colonic fermentation<sup>91;109;114</sup>. In the long run, the increased substrate supply upon regular wholegrain consumption may enhance the overall fermentation potential of the colonic microflora<sup>131;228</sup>. During colonic fermentation short-chain fatty acids (SCFA) are produced which bind to specific receptors on intestinal L-cells. Studies indicate that regular consumption of fermentable carbohydrates enhances the secretion of the satiety-inducing hormones glucagon-like peptide-1 (GLP-1) and peptide tyrosine tyrosine (PYY) by L-cells<sup>34;35;164</sup>. This prompts the hypothesis that regular wholegrain consumption may improve overall appetite sensation due to mechanisms based on colonic fermentation. However, so far only one study has investigated the effects of regular wholegrain consumption on overall appetite sensation after a non-wholegrain meal, without finding effects on appetite<sup>24</sup>.

Thus, the inverse association between BMI and wholegrain intake in observational studies may be a consequence of repeatedly occurring acute and second meal effects as well as potential long-term effects on appetite upon regular wholegrain intake.

In this PhD thesis I will investigate the second meal effects of wholegrain intake on appetite as well as effects of regular wholegrain intake on overall appetite and body weight. Furthermore, I will discuss the potential role of colonic fermentation for second meal and long-term effects of wholegrain intake on appetite. Although not directly investigated in this thesis, acute effects of wholegrain on appetite may be relevant for body weight development in the long run. Therefore and in order to give a complete presentation of the effects of wholegrain intake on appetite, I will also present the current evidence and potential mechanisms of acute effects of wholegrain consumption on appetite.