SUMMARY

The prevalence of overweight and obesity is increasing worldwide, and various dietary approaches have been pursued in order to reduce body weight and prevent weight gain after weight loss. A dietary strategy that has gained considerable attention is an increased dietary protein content, and substantial evidence now supports improved weight loss and weight loss maintenance after consumption of high-protein diets. The effect of high protein diets has been suggested to be mediated by the highly satiating and thermogenic effect of proteins. As proteins have unique characteristics depending on the content of amino acids and absorption rates it has been speculated whether proteins from different sources affect appetite and diet-induced thermogenesis differently.

Studies that compare protein from vegetable, animal, and fish sources, using whole meals, and at the same time control for macronutrient and fiber content, are limited. The overall aim of this PhD thesis was, therefore, to investigate the acute effects of iso-caloric, macronutrient-balanced, and fiber-matched meals with protein from vegetables, eggs, fish, or meat on components of energy balance (energy intake, appetite sensations, and diet-induced thermogenesis). In two of the three studies, the combined effect of protein source and glycemic index of the accompanying carbohydrates was additionally investigated.

In Study I the objective was to examine if a meal based on vegetable protein from fava beans and split peas would reduce ad libitum energy intake (EI) and appetite sensations compared with iso-caloric, macronutrient-balanced, fiber-matched meals based on animal protein from pork and veal or eggs. Thirty-five healthy men were enrolled in this acute cross-over study. The test meals had an energy content of ~3550 kJ with 19% of energy from protein and were based on fava beans and split peas (28.5 g fiber), pork and veal, or eggs supplemented with pea fiber to control for fiber content (28.5 g fiber), or eggs without supplementation of fiber (6.0 g fiber). Appetite sensations were measured every half hour until an ad libitum meal was served 3 hours after the test meal. Overall, no differences were found in ad libitum EI or appetite sensations between the test meals.

In Study II the objective was to investigate the acute effects of meals containing either salmon or veal in combination with carbohydrates with high or low glycemic index (GI) on diet-induced thermogenesis (DIT), appetite sensations, and EI as well as to examine postprandial responses of ghrelin, plasma amino acids, glucose, and insulin to elucidate potential underlying mechanisms. Twenty-five overweight men and women consumed four iso-caloric, macronutrient-balanced test meals that consisted of salmon with
mashed potatoes (high GI), salmon with wholegrain pasta (low GI), veal with mashed potatoes, and veal with wholegrain pasta. Energy expenditure was measured at baseline and six times postprandially each lasting 25 minutes. Additionally, appetite sensations were measured every half hour. Arterialized venous blood samples were drawn every 20 minutes until an *ad libitum* buffet-style lunch was served 3.5 hours later. We found that salmon with high GI carbohydrates increased DIT compared to macronutrient-balanced meals with salmon and low GI carbohydrates, whereas no difference was observed between meals with veal and high or low GI carbohydrates, or between the meals with salmon and veal. This indicated a combined effect of salmon and high GI carbohydrates on DIT. We proposed that an earlier plasma amino acid peak after the meal with salmon and high GI carbohydrates compared with the meal with salmon and low GI carbohydrates could be responsible for the higher DIT. Protein from salmon and veal did not influence appetite sensations or EI differently. However, the appetite response may be influenced by the combination of protein source and GI, as a difference was seen in prospective food consumption between the meal with salmon and high GI carbohydrates compared with the meal with veal and low GI carbohydrates.

In **Study III** we investigated the acute effects of meals containing either cod or veal in combination with high or low GI carbohydrates on DIT, appetite sensations and EI, as well as ghrelin, glucose, and insulin to elucidate potential underlying mechanisms. The same study design was used as in **Study II**. Twenty-three overweight men and women consumed four iso-caloric, macronutrient-balanced test meals: cod with mashed potatoes (high GI), cod with wholegrain pasta (low GI), veal with mashed potatoes, and veal with wholegrain pasta. We found no differences between meals with cod or veal in combination with carbohydrates with low or high GI on DIT, appetite sensations, or EI.

Overall, data from these three acute meal test studies do not support that protein from vegetable, meat and egg sources, or fish and meat sources, as used in these three studies, *per se* influences appetite sensations or EI differently, or that protein from meat and fish sources influences DIT differently. However, the GI of the accompanying carbohydrates may influence DIT and appetite in combination with specific protein sources.