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SELF-CONTROL, SOCIAL COGNITIONS, AND AUTOMATIC SOCIAL IMAGES:

INSIGHTS INTO DETERMINANTS OF HEALTHY LIFESTYLE AMONG YOUNG MEN IN MILITARY SERVICE

Marja Kinnunen

ACADEMIC DISSERTATION

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ABSTRACT

Despite being aware of public health guidelines, young men often consume too little fruit and vegetables but too much fast food, are quite inactive, and have relatively poor fitness levels. One predictor of individual differences in health behaviors is the personality trait of self-control. Self-control's association with physical activity, fitness, and chronic disease risk factors has been studied little. Moreover, few studies have addressed the explanatory mechanisms. For example, the effect of self-control on behavior may be explained by more proximal social cognitive factors such as higher self-efficacy or risk perceptions, better outcome expectancies, and higher intention. Among young people, prototypes, i.e. social images of a typical peer performing a certain behavior (e.g. "a healthy eater of my age"), have been shown to be associated with health behaviors. It remains unclear whether the prototypes are different for peers choosing or declining healthy or unhealthy foods. Of possible benefit might be an intervention on young adults' eating by targeting some of these prototype images by a poster campaign. The aims of this study were to examine the following:

1) Is higher self-control associated with improved health behaviors, better physical fitness, and lower Body Mass Index (BMI) (Studies I & II)?
2) Do social cognitive factors (HAPA-model) mediate the association between self-control and eating, i.e. is the healthier eating of people with high self-control actually explained by factors like higher self-efficacy and more planning (Study II)?
3) Are typical healthy and unhealthy peer eaters (prototypes) evaluated differently when they are choosing healthy foods or abstaining from unhealthy foods? And are these prototypes associated with eating (Study III)?
4) Does an intervention of social images promote fruit and vegetable consumption (Study IV)?

The present study is part of the DefenceNutri study that took place between 2007 and 2009 in two brigades in Finland. Data from 1824 Finnish male conscripts (mean age = 20 years) conducting their military service between 2008 and 2009 have been used. Participation at baseline (2008, N = 857; 2009, N = 970) was at the beginning of military service. Also, questionnaire data from eight weeks after baseline in 2008 (79% retention) and six months after baseline in 2008 (68% retention) and 2009 (65% retention) are included. Studies I and III were cross-sectional observational studies. The design of Study II was prospective and that of Study IV was non-randomized controlled intervention.

Measures included Physical fitness from the Defense Forces database, BMI, and height and weight measured by trained field staff. Questionnaire measures included validated scales for eating behavior, trait self-control, social cognitive factors, and prototypes of choosers' and abstainers' healthy and unhealthy peer eaters. Analytical methods included Pearson correlation, multiple regression, Sobel test for mediation analyses, structural equation modeling, and repeated measures ANOVA.

Higher self-control was associated with healthier eating habits (Study II) and higher leisure-time physical activity (Study I). Higher self-control was also associated with better muscle and aerobic fitness and lower BMI (Study I). The association of higher self-control and fruit and vegetable consumption was fully explained (i.e. mediated) by the HAPA-model, i.e. higher fruit and vegetable consumption among participants scoring high in trait self-control was explained by their higher self-efficacy and positive outcome expectancies of healthy eating, as well as higher risk perceptions of unhealthy eating. Participants scoring high in trait self-control also reported higher intentions to eat fruit and vegetables and more planning in their eating behavior. However, the HAPA-model explained (i.e. mediated) only partially the negative association between self-control and fast food consumption (Study II). Results from Study III showed that young men generally perceive healthy-eating peers (whether choosing or abstaining) as more self-regulative and as better-looking than unhealthy eating peers. It was also found that a positive rating of vegetable-choosing peers was associated with higher fruit and vegetable consumption, especially finding a typical vegetable chooser to be more self-regulative or a typical vegetable abstainer to be less self-regulative. Those who rated a typical vegetable abstainer as better looking reported lower fruit and vegetable consumption. The associations of perceptions of a fat-choosing or -abstaining peer with fast food eating were weaker (Study III). The social image of the typical vegetable-choosing or -abstaining peer became unhealthier during the military service (i.e. unhealthy eaters were rated more positively and healthy eaters more negatively). The intervention had some success in diminishing the negative development of images. Also, vegetable consumption declined slightly less in the intervention group. However, as the mean levels of the prototypes did not differ, the mechanism could not be verified through mediation analyses (Study IV).

Whereas high self-control is a relatively enduring trait, the social cognitive factors found to mediate self-control and behavior can be affected. Prototypes play a role in young men's eating behavior, but merely in fruit and vegetable consumption, not in fast food consumption. Targeting prototypes by campaign might require more participatory action from the target population.

TIIVISTELMÄ

Huolimatta siitä, että nuoret miehet ovat selvillä terveyssuosituksista, he syövät liian vähän kasviksia ja hedelmiä, liikaa pikaruokaa, liikkuvat vähemmän ja ovat huonommassa fyysisessä kunnossa kuin mikä olisi hyväksi. Yksi yksilöiden välisiä eroja terveyskäyttäytymisessä selittävä tekijä on itsesäätely persoonallisuuden piirteenä. Itsesäätelyn yhteydestä syömiseen, fyysiseen aktiivisuuteen, fyysiseen kuntoon ja kroonisten sairauksien riskitekijöihin tiedetään vähän ja vaikutusmekanismia ei juuri ole tutkittu. Itsesäätelypiirteen positiivinen vaikutus käyttäytymiseen saattaa johtua sellaisista sosiaaliskognitiivisista tekijöistä kuin korkeammasta pystyvyyden tunteesta tai paremmista odotuksista syödä terveellisesti tai liikkua enemmän, korkeammasta riskikäsityksestä epäterveellisen elämän seurauksien suhteen, sekä suuremmasta aikomuksesta tehdä terveellisiä valintoja.

Aiempien tutkimusten mukaan erityisesti nuorilla on vahvoja sosiaalisia mielikuvia (prototyyppejä) tyypillisestä tietyin tavoin käyttäytyvästä ikätoverista (esim. ”tyypillinen ikäiseni terveellinen syöjä”). Näiden prototyyppi-mielikuvien on osoitettu olevan yhteydessä vastaavaan käyttäytymiseen; ihmiset, jotka arvioivat tyypillistä terveellisesti syövää ikätoveriaan positiivisesti, syövät todennäköisemmin itsekin terveellisesti. Terveellinen tai epäterveellinen syöminen voi sisältää ruoasta kieltäytymistä tai ruoan valitsemista. Aikaisemmista tutkimuksista ei tiedetä, luovatko välttäminen tai valitseminen samanlaisia prototyyppi-mielikuvia terveellisestä tai epäterveellisestä syöjästä. Prototyyppien kautta ei tiettävästi ole myöskään yritetty vaikuttaa nuorten syömiseen. Tämän tutkimuksen tavoitteina oli vastata seuraaviin kysymyksiin:

Itsesäätely:

1. Onko korkeampi itsesäätely yhteydessä terveellisempään syömiseen ja useammin harrastettuun vapaa-ajan liikuntaan? (Osatutkimukset I & II)
2. Onko korkeampi itsesäätely yhteydessä parempaan fyysiseen kuntoon ja matalampaan painoindeksiin? (Osatutkimukset I)

Sosiaaliskognitiiviset tekijät:

3. Välittyykö itsesäätelyn vaikutus syömiseen sosiaaliskognitiivisten tekijöiden kautta (HAPA-malli)? Eli selittävätkö esimerkiksi korkeampi pystyvyys ja suunnitelmallisuus itsesäätelyn vaikutuksen syömiseen? (Osatutkimus II)

Automaattiset sosiaaliset mielikuvat:

4. Arvioidaanko tyypilliset ikätoverit (prototyypit) eri tavoin, jos he valitsevat terveellistä tai epäterveellistä ruokaa tai välttävät niitä? (Osatutkimus III)
5. Ovatko yllä mainitut sosiaaliset mielikuvat (prototyypit) yhteydessä syömiseen? (Osatutkimus III)

6. Voidaanko sosiaaliseen mielikuvaan (prototyyppiin) vaikuttamalla parantaa varusmiesten kasvisten syöntiä? (Osatutkimus IV)

Tämä väitöskirja on osa Varusmiesten ruokailutottumukset (VARU) -hanketta. Osatutkimuksissa on tarkasteltu tietoja suomalaisilta vuosina 2008 ja 2009 palvelukseen astuneilta varusmiehiltä (N = 1824, ikäkeskiarvo 20 v.). Alkumittaukset ja -kyselyt toteutettiin ensimmäisen palvelusviikon aikana (2008, N = 857; 2009, N = 970). Vuoden 2008 otoksesta on analysoitu tietoja myös 8 viikkoa palveluksen alusta (osallistumisprosentti 79 %). Molempien vuosien osalta on tutkittu myös 6kk palvelukseen astumisen jälkeen kerättyjä tietoja (osallistumisprosentti laskettuna palvelukseen alkumittauksiin osallistuneista 2008 68 % ja 2009 65 %).
Osatutkimukset I ja III perustuvat poikkileikkausaineistoon, osatutkimus II on pitkittäistutkimus ja osatutkimus IV ei-satunnaistettu kontrolloitu interventiotutkimus. Kuntotestitiedot yhdistettiin aineistoon Puolustusvoimien palvelusrekisteristä ja tutkimuksen kenttätutkijat mittasivat painoindeksiin tarvittavat tiedot. Syöminen, itsesäätely, sosiaaliskognitiiviset tekijät ja eri syöjäprototyypit mitattiin valitoiduilla kyselylomakemittauksilla. Aineisto analysoitiin kvantitatiivisin menetelmin.

Korkeampi itsesäätely oli yhteydessä terveellisempään syömiseen (osatutkimus II) ja useammin harrastettuun vapaa-ajan liikuntaan (osatutkimus I). Korkeampi itsesäätely oli yhteydessä myös parempaan lihas- ja aerobiseen kuntoon sekä matalampaan painoindeksiin (osatutkimus I). Korkeamman itsesäätelyn ja syömisen välinen yhteys selittyi kasvisten ja hedelmien syönnin osalta kokonaan HAPA-mallilla, ts. korkeamman itsesäätelykyvyn omaavien tutkittavien korkeampi kasvisten ja hedelmien kulutus selittyi korkeammalla pystyvyyden tunteella ja tulosodotuksilla terveellistä syömistä kohtaan. He raportoivat myös korkeampia riskikäsityksiä epäterveellisestä syömisestä, suurempia aikomuksia syödä kasviksia ja hedelmiä sekä suunnittelivat enemmän syömistään. Pikaruoan syömisen osalta HAPA-malli kuitenkin selitti vain osittain itsesäätelyn ja syömisen välisen yhteyden (osatutkimus II).

Osatutkimus II:n tulokset osoittivat, että nuoret miehet pitivät terveellistä syöjää (terveellisesti valitsevaa ja epäterveellisestä kieltäytyvää) muita parempana itsesäätelijänä ja myös paremman näköisenä kuin epäterveellistä syöjää. Positiivisempi mielikuva tyypillisestä kasviksia valitsevasta varusmiestoverista oli yhteydessä korkeampaan hedelmien ja kasvisten käyttöön ja positiivisempi kuva tyypillisestä kasviksia välttävästä varusmiehestä vähempään hedelmien ja kasvisten käyttöön. Mielikuvat tyypillisestä rasvaisia ruokia välttävästä tai niitä valitsevasta varusmiehestä olivat vähiten yhteydessä pikaruoan syömiseen (osatutkimus III).

Interventio onnistui osittain jarruttamaan sekä prototyyppien, että kasvisten syönnissä palveluksen aikana tapahtuvaa negatiivista kehitystä. Intervention vaikuttavuutta ei kuitenkaan voitu todentaa, koska tutkimusryhmien välillä ei ollut tasoeroja (osatutkimus IV).

Itsesäätely on sellainen persoonallisuuden piirre, johon on vaikea vaikuttaa. Tämä tutkimus kuitenkin osoitti, että itsesäätelyn vaikutus syömiseen selittyy ainakin osittain sosiaaliskognitiivisilla tekijöillä, joihin puolestaan tiedetään voivan vaikuttaa. Nuorten miesten mielikuva terveellisistä epäterveellisistä syöjistä on yhteydessä etenkin kasvisten ja hedelmien syömiseen. Mielikuvien, prototyyppien, kautta vaikuttaminen vaatinee kuitenkin kohderyhmän osallistavaa tutkimusta.

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LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications, referred to in the text by their Roman numerals:

I Kinnunen MI, Suihko J, Hankonen N, Absetz P. & Jallinoja P. Self-Control is Associated with Physical Activity and Fitness among Young Males. Behav Med. 2012;38(3):83-89.

II Hankonen, N., Kinnunen, M., Absetz, P. & Jallinoja, P. Why Do People High in Self-Control Eat More Healthily? Social Cognitions as Mediators. Ann Behav Med. 2014;47:242-248.

III Kinnunen, M., Hankonen, N., Haukkala, A., Renner, B., Bingham, C., Jallinoja, P. & Absetz, P. Healthy eaters beat unhealthy eaters in prototype evaluation among males, but abstinence may pose a risk for social standing. Health Psychology and Behavioral Medicine, (2015) 3, 323–336.

IV Kinnunen, M.I., Jallinoja, P., Haukkala, A. Hankonen, N., Bingham, C., Uutela, A. & Absetz.P. Does intervening on social image of a healthy eating peer increase vegetable consumption among young men? (under review)

ABBREVIATIONS

BMI	Body Mass Index
CFI	Comparative fit index
FF	Fast Food
FV	Fruit and vegetables
HAPA	Health Action Process Approach
LTPA	Leisure-time physical activity
OCE	Outcome expectancies
RMSEA	Root mean square error of approximation
RQ	Research question
TLI	Tucker-Lewis index
VC	Vegetable consumption

1 INTRODUCTION

The aerobic fitness of young Finnish men has decreased dramatically during the last 20 years. At the same time, body mass index (BMI) has increased (Santtila et al., 2006). These changes have attributed to lower levels of leisure-time physical activity (LTPA) (Santtila et al., 2006). There has been much discussion about increased screen time and sedentary lifestyle (Owen, Sparling, Healy, Dunstan, & Matthews, 2010). It is also known that the eating habits of young men in Finland are far from the national recommendations (Bingham et al., 2010).

Although a healthy diet is seen as including a variety of foods, some key components have been recognized. The consumption of fruits and vegetables, for instance, has a dose-response effect on all-cause mortality (Wang et al., 2014) and significantly lowers the risk of type 2 diabetes (Li, Fan, Zhang, Hou, & Tang, 2014) and cardiovascular diseases (Zhan et al., 2015). Consumption of fast foods, by contrast, is linked to poorer nutritional content (An & Liu, 2015) and severe obesity (Garcia, Sunil, & Hinojosa, 2012). Two behaviors linked to undesirable outcomes, i.e. low fruit and vegetable consumption and high fast food consumption, are prevalent among young men (Bauer, Larson, Nelson, Story, & Neumark-Sztainer, 2009; Bingham et al., 2010).

In Finland, every man is liable for military service and nearly 80% of each age cohort completes the service, typically stepping into service in the year that they turn 20 (Defence Command Public Information Division, 2013). Therefore, military service provides a unique environment to explore and target young men from different socioeconomic backgrounds. This doctoral dissertation is part of the DefenceNutri intervention study to promote healthy eating among Finnish conscripts.

Eating behavior is influenced by both environmental opportunities, e.g. supply of healthy food, and by socio-psychological factors, i.e. factors leading to an individual choosing ("demanding") healthy foods. The DefenceNutri study has investigated eating and its determinants among conscripts (Bingham et al., 2011; Jallinoja et al., 2011) and has included an environmental intervention to improve military conscripts' eating by promoting the supply of healthy foods in the garrison area, an intervention that has been described elsewhere (Bingham et al., 2012). This dissertation focuses on examining the individual psychological and psychosocial determinants of young men's eating behavior, LTPA, physical fitness, and BMI and also investigates the effects of a "Demand" intervention aiming to influence these.

Young people are often not very concerned about their health and have low risk perceptions. Youths are also more likely to be image-conscious. Images of a typical peer (prototype) behaving in a certain way have been

found to associated with various health behaviors such as smoking, drinking alcohol, and eating (Andrews, Hampson, Barckley, Gerrard, & Gibbons, 2008; Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008; Gerrits et al., 2010). The Prototype-willingness model has been designed and applied to explain adolescents' behavior. Military conscripts are merely young adults than adolescents. However, when entering to military service they are thrown to fairly closed social world surrounded by hundreds of same-sex peers. The military culture values masculine (unhealthy) eating norms, and eating is viewed merely as a functional way to deal with hunger (Hoikkala, Salasuo, & Ojajärvi, 2009). Food choices are not often rational, but may be more automatically triggered. Prototypes of typical peers conducting certain behavior may predict subsequent behavior better than one's intentions (Gerrard et al., 2008).

Personality trait self-control has been found to be associated with various positive outcomes, such as better interpersonal skills, higher academic achievement, and less binge eating, in an individual's life (Tangney, Baumeister, & Boone, 2004). Self-control has also been described to be positively associated with healthier eating among young people (Junger & van Kampen, 2010; Wills, Isasi, Mendoza, & Ainette, 2007). Despite of the various positive associations of trait self-control and behaviors, the mechanism underlying the impact of self-control on behavior remains unclear.

This dissertation examines whether higher self-control is associated with healthier eating, more physical activity, better fitness, and lower BMI among young men. Also, it was examined whether the effect on higher self-control on behavior could be explained by the "rational route", in this case by social cognitive factors that can be promoted through social cognitions. In other words, it was explored whether people with higher self-control actually experience higher self-efficacy for healthier eating, have better outcome expectancies of healthy eating, higher risk perceptions, and higher intentions and more planning. In terms of prototypes, it was examined whether young men hold similar prototypes of typical peers who are either healthy food choosers (choose vegetables), healthy food abstainers (abstain from vegetables), unhealthy food choosers (choose fast foods), and unhealthy food abstainers (abstain from fast foods). It was also explored whether these prototypes are associated with one's own eating behavior. This dissertation also includes an evaluation of an intervention that targeted the vegetable-eating conscript by focusing on eater prototypes. Before getting into the results, the theoretical and conceptual frameworks as well as the relevant literature are introduced.

2 THEORETICAL AND CONCEPTUAL FRAMEWORK OF THE STUDY

The key concepts of this dissertation are illustrated in Figure 1.

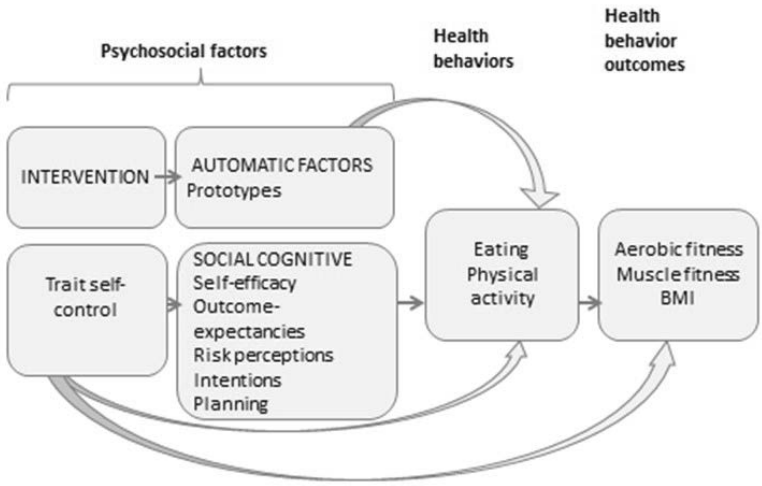


Figure 1 Key concepts in this study.

2.1 EATING HABITS, PHYSICAL ACTIVITY, AND FITNESS AMONG YOUNG MEN

Healthy lifestyle predicts healthier and longer life. In their recent paper, Leenders et al. (2014) pointed out that higher consumption of fruit and vegetables predicts lower risk of death. The mechanism was attributed to lower risk of diseases of the circulatory, respiratory, and digestive system among those who have higher fruit and vegetable intake. Finnish Nutrition recommendations recommend at least 500 g of fruits, berries, and vegetables daily (National Nutrition Council, 2014). Only 8% of young Finnish men report daily fruit or berry consumption and 13% report daily vegetable consumption (Bingham et al., 2010). Also, lowering the intake of saturated fat seems to reduce the risk of cardiovascular disease (Hooper, Martin, Abdelhamid, & Davey Smith, 2015).

Even low levels of physical activity decrease one's risk for chronic disease. Higher levels of physical activity bring additional benefits (e.g. Sattelmair et al., 2011). The benefits of physical activity on cardiovascular risk factors in men can already be detected in young adulthood (Vaara et al., 2014).

Regular physical activity leads to improved physical fitness. Physical fitness is a predictor of not only lower mortality, but better cardiovascular profile and lower abdominal obesity and smoking (Blair et al., 1989; Borodulin et al., 2005; Erikssen et al., 1998). Better muscle fitness is associated with muscular and bone health, whereas better aerobic fitness predicts significantly lower cardiovascular and metabolic morbidity (Kyrolainen, Santtila, Nindl, & Vasankari, 2010). The physical fitness levels of young Finnish men are fairly well documented due to compulsory military service. The statistics indicate that the fitness profile has decreased alarmingly during the last three decades (Santtila et al., 2006).

Lower BMI is associated with better fitness profiles among young men (Kyrolainen et al., 2010). A recent meta-analysis found that weight gain, especially in early adulthood, is an important predictor of the later development of type 2 diabetes (Kodama et al., 2014).

For any behavior to begin, an individual needs to have opportunities and physical capabilities to act as well as psychological capabilities and sufficient motivation (Michie, van Stralen, & West, 2011). Individual-level determinants of healthy eating, physical activity, and fitness were thus studied here. Also investigated were the psychological and psychosocial determinants of eating, physical activity, and fitness.

2.2 PSYCHOSOCIAL DETERMINANTS OF EATING, PHYSICAL ACTIVITY, AND FITNESS

Much of our health behaviors are impacted by our physical environment. The environmental determinants can be the availability of sufficient nutrition and healthy food choices. Also, physical activity patterns may be determined by the proximity of walking or cycling paths or the availability of public transport. Despite fairly similar surroundings, people end up making very different choices in health behaviors. Therefore, psychosocial determinants provide one way of inspecting individual differences in health behaviors.

2.2.1 TRAIT SELF-CONTROL

Personality refers to individual differences in characteristic patterns of thinking, feeling, and behaving. Tangney, Baumeister, and Boone (2004) define self-control as "the ability to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them" (p. 274). In other words, self-regulation is willpower, the capability to resist impulses and control one's own thoughts and actions.

Self-control has mainly been studied from two angles. One of these angles reflects situational "state self-control", which has been compared to a muscle-like strength that depletes with use, e.g. in situational decision-making (e.g.Vohs et al., 2008), or with mood (Tice, Baumeister, Shmueli, & Muraven, 2007). Recent research suggests that what has been attributed to the depletion of a limited resource is actually merely a shift in motivation, goals, and attention (Inzlicht & Schmeichel, 2012). This limited resource appears to involve emotional, cognitive, and physical acts of self-control (Hagger, Wood, Stiff, & Chatzisarantis, 2010). The second angle is "dispositional self-control". Whereas state self-control depletes with use, dispositional self-control refers to a trait that stays relatively stable over time.

Wills and Dishion (2004) argued that self-control develops through transactions between individual characteristics and the family environment. The individual characteristic view has become popular from studies that have shown how childhood self-control predicts future well-being. The most famous study was started by Mischel and colleagues (1972) in the 1970s with a laboratory test of delayed gratification measuring length of a time a preschool aged child could resist the temptation of eating a treat (one marshmallow) with a reward of getting a bigger treat (two marshmallows) for waiting. Decades later, follow-up studies showed that the child's ability to delay gratification predicted several positive outcomes in adulthood like higher sense of self-worth, better ability to cope with stress, higher educational achievement, and less drug use, particularly in individuals vulnerable to psychosocial maladjustment (Ayduk et al., 2000). Lack of positive attachment to one's family may set up a pattern of poor self-control and engagement with deviant peer groups. Development of self-control seems to be a fairly complex process of interactions with temperament, socialization process, and social adaptation (Wills & Dishion, 2004). The present study focuses on this dispositional self-control, which is referred to as "trait self-control" from here onwards.

Extensive evidence supports the benefits of trait self-control (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Tangney et al., 2004). High self-control predicts better adjustment, higher school grades, satisfying relationships, and better interpersonal skills (Tangney et al., 2004). Trait self-control appears to only be associated with positive outcomes (Baumeister & Alquist, 2009; Tangney et al., 2004).

A meta-analysis by De Ridder et al. (2012) concluded that trait self-control has small to medium effect size/ association with both undesirable behaviors (i.e. behaviors one should avoid) and desirable behaviors (i.e. behaviors in which one should engage). De Ridder et al. (2012) also found that the effect of trait self-control on automatic behavior, whether desirable or undesirable, was significantly stronger than the association with reasoned

behavior. The authors suggested that this might be because people with high trait self-control are more skillful in forming good habits and breaking the existing bad habits.

The above-mentioned meta-analysis reported a relatively small effect of self-control on eating self-regulation and weight (de Ridder et al., 2012). The results obtained for adolescents and young adults have been consistent when different aspects of healthy food intake have been assessed. Higher trait self-control is associated with higher fruit and vegetable intake (Crescioni et al., 2011; Gerrits et al., 2010; Junger & van Kampen, 2010; Wills et al., 2007), higher frequency of having breakfast, lower intake of snacks (Junger & van Kampen, 2010), and lower intake of fast foods (Gerrits et al., 2010). Low self-control is associates with a higher saturated fat intake (Wills et al., 2007). Crescioni et al. (2011) found that in a 12-week weight loss intervention participants with higher self-control learned to regulate their caloric intake and consumed fewer calories per meal. Other studies have also pointed out the importance of trait self-control for a dieter. Spoesser et al. (2011) noted the effect of trait self-control on dietary healthiness was stronger than the motivation for body weight control.

Some studies have also found an association between higher trait self-control and more frequent physical activity (Junger & van Kampen, 2010; Wills et al., 2007), lower sedentary behavior (Wills et al., 2007), and lower (self-reported) BMI (Junger & van Kampen, 2010) among adolescents or young adults. Wills et al. (2007) also reported that higher impulsiveness or lower self-control was associated with less vigorous exercise. Thus, evidence for associations of trait self-control with physical activity among young people exists but is not extensive. Few, if any, studies have inspected the association of trait self-control with fitness.

The magnitude of trait self-control seems to be higher among females than among males and to grow with age (de Ridder et al., 2012). However, the differences are not always transformed into behaviors.

2.2.2 COGNITIVE, DELIBERATIVE DETERMINANTS

Most studies on health behaviors have inspected deliberative decision-making. The deliberative or reasoned perspective presumes that decision-making is a planned process that involves anticipated outcomes and deliberation (Gerrard et al., 2008). In other words, behavior is predicted by goal states or intentions that are determined by attitudes or social cognitions towards behavior or behavioral outcomes (e.g. Ajzen, 2002). Most interventions have targeted people's intentions by addressing motivational factors as determinants of intention for behavior change. One such theoretical model that has successfully explained health behaviors and health

behavior change is the Health Action Process Approach (HAPA-model) (Schwarzer, 2008). In this dissertation, the HAPA-model was chosen as the theoretical framework as it acknowledges not only the deliberative processes, but includes social cognitive self-regulation (i.e. situation specific self-efficacy and coping planning). The model also bridges the intention behavior gap, meaning that it explains how strong intentions are more likely to turn into action if the behavior is carefully planned. The HAPA-model is a causal model explaining health behavior change and can also be conceptualized as a stage model (Schwarzer, 2008). However, in this study, the model is investigated as a continuum model.

The key components of the HAPA-model are presented in Figure 3. Like many other cognitive models (Ajzen, 2002; Maddux, 1983), the core idea of the model is that behavior requires a strong intention to commit to the behavior in question. The components of the model have been found to predict intention to commit to various health behaviors (Schwarzer et al., 2007). In the HAPA-model, intention is predicted not only by high risk perception but by one's self-efficacy to conduct the behavior together with good outcome expectancies of the behavior in question (Schwarzer, 2008). In other words, the model acknowledges that one needs to have risk perception (e.g. "If you think of yourself, how likely is it that your weight increases?"). At the same time, however, the model states that being aware of the health risk is not enough to create a strong intention, but one also needs to feel capable of conducting the behavior (e.g. following a healthy diet despite everyday hassles) as well as to think that the behavior will bring benefits (e.g. "if I exercise, I will feel better").

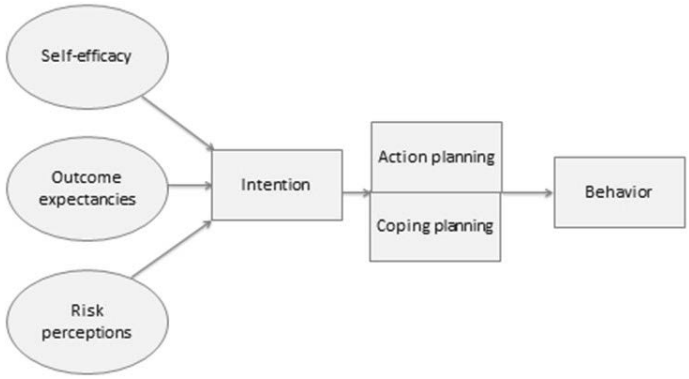


Figure 2 Variables of the HAPA-model used in this study.

A meta-analysis of all meta-analyses on intentions' predictive value for behavior has shown that intentions explain only 28% of the variance in behavior (Sheeran, 2002). According to the HAPA-model, intentions are more likely to turn into action if one makes plans not only for action (when, where, and how to perform the behavior in question) but also for coping ("if x happens, I will do y") (Schwarzer, 2008). Acknowledging the planning component is important as planning future behavior has been found to decrease the intention-behavior gap significantly (Kwasnicka, 2013).

The HAPA-model predicts fruit and vegetable consumption among young men (Hankonen, 2013) and young adults (Lhakhang, 2014). There is less evidence of its association with unhealthy food consumption, especially among young people, but the existing evidence implies that the HAPA-model can explain at least some of the behavior (Hankonen, 2013)

Traditionally, the research on predictive decision-making components of the HAPA-model has focused on health aspects, e.g. on outcome expectancies "if I eat healthy, my blood pressure will stay normal". A recent study has shown that aspects like taste expectations or social pressure are also important predictors of subsequent intention and healthier eating among young men (Hankonen, 2013).

Evidence indicates that the HAPA-model does predict eating behavior (Hankonen, 2013; Wiedemann, 2009). So far, there has been no research on how the HAPA-model relates to self-control, or if it explains the associations between self-control and healthy or unhealthy eating style. The present study investigates whether the effect of the more distal personality trait self-control on eating can be explained by the more proximal, behavior-specific social cognitive factors (as outlined in HAPA-model).

2.2.3 AUTOMATIC AND SOCIAL DETERMINANTS, PROTOTYPES

The social cognitive determinants introduced above emphasize deliberative, reasoned and intentional behavior. During the last decades there has been increasing interest in theoretical decision-making paths that are more automatic (Epstein & Pacini, 1999; Gerrard et al., 2008). These dual process theories assume that experimental or automatic system is intimately associated with affect and encodes information in a holistic, concrete non-verbal form. Despite the limitations of this automatic route, it has the advantage of being far more rapid and efficient for coping with events in everyday life than the rational system (Epstein & Pacini, 1999). The dual process theories suggest that analytic (or deliberative or rational or reasoning) and heuristic decision-making paths work in parallel and are interactive. One of the few theoretical approaches that has combined rational decision-making with non-intentional, automatic decision-making is the

Prototype-willingness model (Gerrard et al., 2008; Gibbons, Gerrard, & Lane, 2003).

The Prototype-willingness model (Gerrard et al., 2008) emphasizes the automaticity of young people's decision-making. Especially adolescents often find themselves in a situation where they, despite their good intentions, end up engaging in risky behaviors (like smoking, drinking alcohol, or having unprotected sex). According to the Prototype-willingness model, the automatic decision-making route relies on prototypes. A prototype is defined as a clear image of a typical peer who engages in certain behavior (e.g. "a typical smoker of my age"). These images describe character rather than physical appearance, although they may also include a visual component (Gerrard et al., 2008). The assumption of the model is that adolescents believe that if they carry out the behavior in question they will acquire the characteristics of the prototype (i.e. "smoking makes me look cool/look like a loser"). This, in turn, translates into a willingness to engage in the respective behavior (Gibbons & Gerrard, 1995).

Two recent meta-analyses with 80 and 90 studies, respectively, have shown support for the Prototype-willingness model (Todd, Kothe, Mullan, & Monds, 2014; van Lettow, de Vries, Burdorf, & van Empelen, 2014). Van Lettow et al.'s (2014) meta-analysis also showed that prototypes not only predict intention and willingness, but are directly linked to behavior as well.

Although the Prototype-willingness model was developed to predict adolescents' risk behaviors, such as smoking or drinking, it has been applied to eating as well (Dohnke, Steinhilber, & Fuchs, 2015; Gerrits, de Ridder, de Wit, & Kuijer, 2009). Moreover, another one of the recent meta-analyses mentioned above suggests that the model may also be applied to adults (Todd et al., 2014).

Already before the emergence of the Prototype-willingness model, research had been conducted on social images of healthy and unhealthy eaters as well as their associations with eating (e.g. Barker, Tandy, & Stookey, 1999; Oakes & Slotterback, 2005). These earlier studies as well as the studies that have used the terminology introduced in the Prototype-willingness model (Gerrits et al., 2009; Gerrits et al., 2010) have produced similar results. Both previous and more recent studies show that healthy eaters are generally perceived more positively than unhealthy eaters. Also, if people are asked to describe "typical healthy eaters", the descriptions are mainly positive and highlight characteristics that reflect self-regulation like "active" (Gerrits et al., 2009), "dutiful", and "self-controlled" (Barker et al., 1999). Negative descriptions for healthy eaters are few, generally characteristics that reflect being self-centered or uptight, e.g. "picky" (Fries & Croyle, 1993). Unhealthy eaters, in turn, get negative descriptions that are often related to

their appearance, e.g. “chubby”, but are also perceived positively with such characteristics as “sociable”, “entertaining”, and “masculine” (Fries & Croyle, 1993; Gerrits et al., 2009; Oakes & Slotterback, 2005).

Findings on gender differences in prototype evaluations are mixed. (Gerrits et al., 2009). A recent study discovered that male adolescents tended to rate typical unhealthy eaters more positively and typical healthy eater more negatively than female adolescents (Steinhilber, Fuchs, & Dohnke, 2013).

The distinction for risky behaviors and health-protective behaviors is easily applied to smoking, drinking, and physical activity. I.e. in these risky behaviors, to make a healthy choice one can strictly abstain something (not to smoke or not to drink alcohol). To risk protective behaviors one may choose to be physically active to promote his/her health. Eating, however, differs from these behaviors radically. If healthy and unhealthy eating style is seen as a continuum, both ends include abstaining from something and choosing something as strict healthy eating includes both choosing healthy foods and abstaining from some unhealthy ones. To examine eater prototypes more closely, a useful theoretical perspective is the one introduced by Rivis, Sheeran, and Armitage (2006). They stated that prototypes can be divided into risky (behavior in question undermines health) and healthy (behavior in question promotes or protects health) behaviors. In addition, they pointed out that prototypes can be divided into actor (typical person engaging in a behavior) and abstainer (typical person abstaining from a behavior) prototypes (Rivis et al., 2006). Combining all of these different prototypes yields four prototype dimensions: (1) a risky behavior actor prototype, representing a typical peer who engages in risky behaviors (e.g. eats unhealthy foods), (2) a risky behavior abstainer prototype, representing a typical peer who abstains from risky behavior (e.g. does not eat unhealthy foods), (3) a healthy behavior actor prototype, representing a typical peer who actively engages in healthy behavior (e.g. eats healthy foods), and finally (4) a healthy behavior abstainer prototype, representing a typical peer who abstains from healthy behaviors (e.g. does not eat healthy foods). These four prototypes are presented in Table 1.

Table 1 *Eater prototypes classified according to healthy/risky and actor/abstainer dimensions.*

	Healthy eater prototype	**Risky, i.e. unhealthy, eater prototype**
Actor	Healthy behavior actor = Healthy food chooser	Risky behavior actor = Unhealthy food chooser
Abstainer	Unhealthy behavior abstainer = Unhealthy food abstainer	Risky behavior abstainer = Healthy food abstainer

Van Lettow et al.'s (2014) meta-analysis showed that health risk prototypes generally have stronger associations with outcome variables than health-protective prototypes. In the context of eating behaviors, this is supported by Dohnke, Steinhilber, & Fuchs (2015), who found that whereas unhealthy eater prototypes predicted subsequent unhealthy eating, healthy eater prototypes were not predictive of eating behavior. There have also been other studies unable to show an association between more positive images of healthy eaters and one's own food choices (Gerrits et al., 2009). This has been explained by the fact that healthy eaters tend to get positive ratings not only from other healthy eaters but from unhealthy eaters as well (Barker et al., 1999). Despite these findings, several studies have demonstrated that more positive ratings for healthy eaters are associated with healthier eating style (Barker et al., 1999; Gerrits et al., 2009; Gerrits et al., 2010).

Van Lettow et al.'s (2014) meta-analysis indicated that prototypes are related to behavior directly, not only through willingness. The direct path seems to apply to eating behavior as well; Dohnke et al. (2015) tested the full Prototype-willingness model on eating behavior and found that the association of unhealthy eater prototype and unhealthy eating was not significant only through intention and willingness, as the model predicts, but also directly.

It is possible that as respected and desirable healthy eating is; abstaining from unhealthy foods might not be the best strategy in social situations. In support of this argument is a study by Steinhilber et al. (2013), where male adolescents' prototype perceptions of unhealthy eaters were more positive and those of healthy eaters more negative. Also, the prototypes explained part of the gender differences in eating, especially among older adolescents (Steinhilber et al., 2013). Rivis et al. (2006) raised some interesting questions in terms of the associations of prototypes and eating. Are healthy eaters described positively despite the prototype's actor (choosing fruits and vegetables) or abstainer status (abstaining from fast foods)? Similarly, do unhealthy peer eaters get similar evaluations despite the eater prototype's actor (choosing fast foods) or abstainer (abstaining from fruits and vegetables) status? Is abstaining from foods, whether healthy or unhealthy, socially acceptable? No previous studies have been conducted that have examined the favorability of chooser and abstainer eater prototypes in the context of eating or their associations with the respective eating styles.

2.2.4 CHANGING HEALTH BEHAVIORS THROUGH SOCIAL IMAGES

A multitude of interventions have addressed healthy eating in general and fruit and vegetable consumption in specific settings such as schools. The most common overall strategies have been to target availability of healthy

food or to target individual motivation and decision-making, e.g. by providing information about the benefits of eating fruit and vegetables. However, interventions that target automatic decision-making paths have been investigated less extensively.

To date, few studies have examined manipulation of prototype evaluations. Teunissen et al. (2014) conducted a brief chat room intervention in which adolescents were exposed to the alcohol norms of "peers" (actually, confederates). By manipulating "popular" or "unpopular" peers' willingness to drink, the researchers managed to change the heavy drinker prototype evaluation as well as one's perceived similarity to heavy drinker prototypes. Some effects on willingness to drink were also found. Another study targeted smoker prototypes among 5th and 6th grade children in an internet-based intervention and managed to decrease children's willingness and intention to smoke. The study included multiple components of which social image was included in one among many tasks that required cognitive processing and managed to get a significant change in social image (Andrews, 2011). Another lighter intervention included participants reading a text in which people who have sex without a condom were described as "less responsible and more selfish" or a text in which a person who uses a condom was described as "more responsible and less selfish". The control group read a text in which people who do not vote were described as "less responsible and more selfish". Participants who read the negative description of a person who does not use a condom reported a lower willingness to have unprotected sex than those reading the positive description or control subjects (Blanton et al., 2001).

Eating is not only a means of satisfying hunger, but also includes various social aspects that might turn into expectations. For example, compared with women, men are considered to be less likely to eat fruit (Wardle et al., 2004) and vegetables. Men have also been found to tailor their food habits according to their roles based on their self-perception as peers, fathers, or husbands (Newcombe, McCarthy, Cronin, & McCarthy, 2012). Younger men have also reported sociocultural barriers to eating fruit and vegetables (Dumbrell & Mathai, 2008; Newcombe et al., 2012).

A study of the same population as in the present study shows that young men's risk perceptions "of not eating healthy" are associated with greater intentions of eating more fruit and vegetables (Hankonen, 2013). At the same time, some evidence suggests that the social cognitive route, examined by the HAPA-model, does not predict the behavior of younger adults as well as it does for middle-aged people (Renner, Spivak, Kwon, & Schwarzer, 2007). Men in their late teens or early twenties are not facing immediate health risks if they don't eat vegetables. Thus, targeting the rational decision-making route alone might not be the best option for promoting vegetable consumption.

Previous research on self-stereotypes has demonstrated that people assimilate their behavior to the activated stereotype (Wheeler & Petty, 2001). Thus, the intervention introduced in this study aimed not only to activate a stereotype, but also to promote the image of a peer who chooses vegetables. By promoting a more positive image of a vegetable-choosing peer, the intervention aimed to promote young men's vegetable consumption. This study is the first to evaluate a theoretically based poster campaign that aimed to improve social images of a typical healthy eater in a garrison setting.

3 AIMS

This doctoral dissertation investigates young Finnish men conducting their military service. As military service is compulsory, a large portion of an age cohort can be reached in this setting. The general aim here was to explore the individual-level differences in self-control, social cognitive factors, and automatic social images (prototypes) as determinants of eating, physical activity, and fitness. Study I was, to my knowledge, the first to explore the association of trait self-control and objectively measured fitness. Study II pioneered in studying if the effect of trait self-control on eating can at least partly be explained by social cognitions. Study III was the first to explore abstainer and chooser prototypes in the context of eating for both unhealthy and healthy eating behavior and their associations with eating behavior. Study IV evaluated effectiveness of a public health campaign that targeted healthy eater prototypes among young men. The aims with more specific research questions (RQs) are presented below.

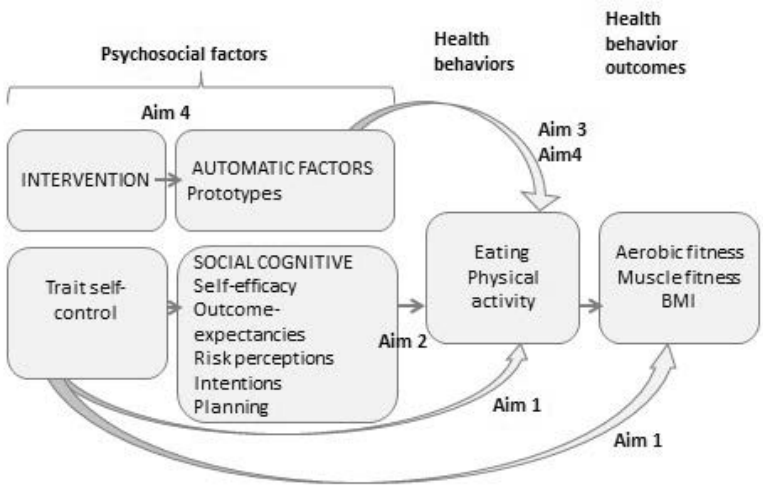


Figure 3 Aims of this dissertation conceptualized with the study concepts.

Aim 1. To examine the association of self-control with health behaviors and risk factors among young men conducting their military service (Studies I & II). More specific research questions were as follows:
RQ1: Is higher self-control associated with healthier eating?
RQ2: Is higher self-control associated with more frequent LTPA?

RQ3: Is higher self-control associated with better aerobic and muscle fitness and lower BMI?
RQ4: Is the association of self-control and fitness explained by higher LTPA and lower BMI?

Aim 2. To examine whether the predictive value of trait self-control is explained by social cognitive factors (HAPA-model) in eating habits (Study II). More specifically, it was examined whether high self-control predicts more positive outcome expectancies of heathy eating, higher self-efficacy of healthy eating and higher risk-perceptions, and whether these in turn lead to stronger intentions to eat plenty of fruit and vegetables or to stronger intentions to avoid fast foods. Finally, whether the association between stronger intentions and actual eating is mediated by more planning was assessed.
RQ1: Does the HAPA-model mediate the effect of self-control on fruit and vegetable consumption?
RQ2: Does the HAPA-model mediate the effect of self-control on fast food consumption?

Aim 3. To investigate the prototype evaluations of typical peers who choose or abstain from vegetables or fast foods (Study III).
RQ1: Are healthy eater prototypes evaluated more positively than unhealthy eater prototypes?
RQ2: Are healthy or unhealthy eaters evaluated positively whether healthy eating is choosing healthy foods or abstaining from unhealthy foods, or whether unhealthy eating is choosing unhealthy foods or abstaining from healthy foods?
RQ3: Are eater prototypes associated with the respective eating styles?

Aim 4. To evaluate an intervention aimed to promote vegetable consumption by targeting the social images (i.e. eater prototypes) (Study IV).
RQ1: Did the intervention influence eater prototypes?
RQ2: Did the intervention influence vegetable consumption?
RQ3: Were changes in intentions to eat fruit and vegetables related to changes in prototypes and changes in vegetable consumption?
RQ4: Did socioeconomic status moderate the intervention effect?

4 METHODS

4.1 STUDY SETTING AND PARTICIPANTS

This study is part of the DefenceNutri intervention study conducted in two garrisons, the Kainuu Brigade (hereafter the Northern Brigade) and the Armoured Brigade (hereafter the Southern Brigade) in Finland between 2007 and 2009 (Bingham et al., 2011; Bingham et al., 2012). In Finland, every man is liable for military service, and nearly 80% of each age cohort completes the military service. About 95% of those who serve in the military enter military service in the year that they turn 19 or 20 years (Defence Command Public Information Division, 2013). During their service conscripts live in garrisons where they are provided three meals plus an optional evening snack. The provided meals are planned to meet the national nutritional recommendations as well as the demands faced by conscripts during service (e.g. during physically demanding camping, the provided meals contain more energy). Fast foods, such as pizzas, kebabs, or burgers, are eaten as snacks from the Soldier's home cafeteria rather than as planned meals. After the first weeks, if not on encampment, conscripts often spend weekends and some other free days at home.

The DefenceNutri study was a 3-year (2007-2009) epidemiological cohort study with two controlled interventions (Supply intervention in 2008, Demand intervention in 2009) to improve eating habits among conscripts. The interventions were conducted in three phases. The data collected in 2007 served as the needs assessment, and control group data came from a Supply intervention carried out in 2008 (Bingham et al., 2012). The final phase, i.e. the Demand intervention, was carried out in 2009. The data used in the present study was mainly collected in 2008 (Studies I-III). The data collected during the Supply intervention at 2008 served also as control data for the Demand intervention in 2009 (Study IV) (Figure 4).

Figure 4 Timeline of the DefenceNutri study

In 2008 and 2009, two service units from both garrisons, each containing from 80 to 150 men, participated in this study. The target *N* reported was based on the names listed for the study units. At the beginning of military service, the name lists change daily, even by dozens, as conscripts may for example be transferred to another unit within the garrison or they may have received determent due to their study schedule. Thus, the target *N*s reported here are suggestive only. Altogether, data from 1824 men have been analyzed for the present study. The *N*s for the substudies can be seen in Figure 5. Participation in the study took place during service time, but was voluntary. Informed signed consent was obtained from those willing to participate. The study protocol was approved by the Ethics Committee of the Hospital District of Helsinki and Uusimaa.

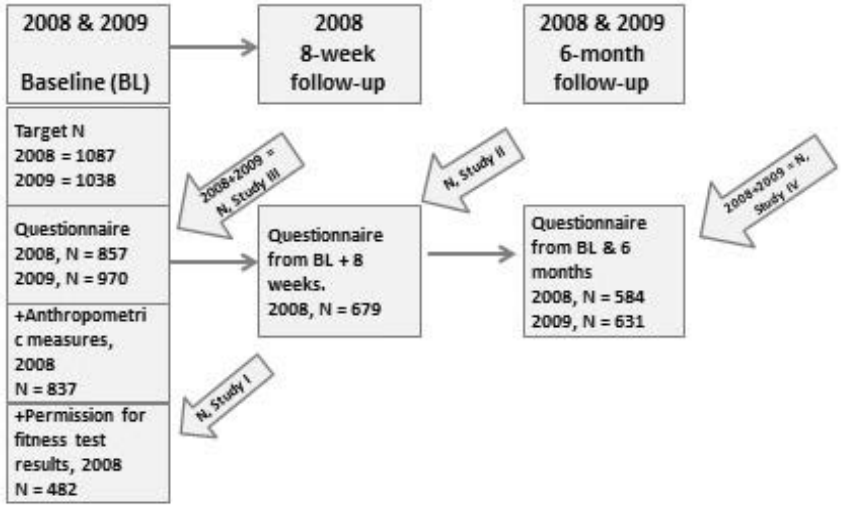


Figure 5 Number of participants in different substudies.

4.2 MEASURES

The data used for the present study from the DefenceNutri data included questionnaire data, anthropometric measures, and fitness test results. The baseline anthropometric and questionnaire data were collected during the first week of military service, and the fitness tests were conducted during the

first three weeks of service. The follow-up questionnaires were collected 8 weeks after entering service and 6 months after baseline.

4.2.1 PSYCHOSOCIAL MEASURES

Self-control was measured with a 20-item scale adapted from the original 36-item Self-Control Scale developed and validated by Tangney et al. (2004). (e.g. "I am good at resisting temptation," "People would describe me as impulsive" (reversed), "I'm able to work effectively toward long-term goals"). Items that were irrelevant in the target group's life situation were dropped from the original scale. Also, one item was added ("I sometimes lose my control with intoxicants"). The scale showed good internal consistency (Cronbach's α = .85).The composite score variable ranged from 1.85 to 4.60. The items of the scale can be found in the Appendix.

Outcome expectancies of eating healthy food were measured from four areas. Bad taste outcomes were measured with two items (r = .47), e.g. "the food tastes better". Inconvenience outcomes also contained two items (r = .38), e.g. "I will have to make an effort in buying the right products". Physical well-being outcomes were measured with four items (Cronbach's α = .76), e.g. "I will be in better physical condition". Social punishment outcomes contained two items (r = .50), e.g." I will meet my mates more often". Items are presented in more detail in the Appendix. Possible responses ranged from 1 (not at all true) to 4 (completely true).

The *Self-efficacy* measure assessed how sure one was of overcoming the given obstacles. Two areas of self-efficacy were included: emotional barriers self-efficacy (five items, Cronbach's α = .88) (e.g. perceived certainty of being able to carry out healthy eating intentions even when having problems and worries/feeling tense) and social self-efficacy (two items, r = .69) (e.g. "have to behave in a different way than my friends"). For a more detailed version of the items, see the Appendix. The scale varied from 1 ("I'm sure I couldn't") to 4 ("I'm sure I could").

Risk perceptions included two subtypes of risk perception (see also Appendix): weight gain (two items, r = .43) and perceived risk of health problems (e.g. cholesterol level/blood pressure, three items, Cronbach's α = .77). The answering scale ranged from 1 ("Not at all true") to 4 ("Absolutely true").

Intentions were measured with two items that answered for a question "What kind of intentions do you have for the coming weeks and months?" "I intend to eat a lot of fruit and vegetables" and "I intend to avoid fatty foods".

The response scales ranged from 1 ("I definitely do not intend to") to 7 ("I definitely intend to").

Action Planning was measured with five items *(*Cronbach's α = .86) (e.g. "I tend to plan where to eat/what eat"). Coping planning was measured with four items (Cronbach's α = .85) (e.g. "I tend to plan how to stick to my healthy eating habit even in difficult situations"). The response options for planning items ranged from 1 (Not at all true) to 4 (Absolutely true). Planning scale items can be found in the Appendix.

Prototype measure. Participants were randomly assigned to two groups to evaluate either 1) a typical "Fat chooser" and a typical "Fat abstainer" or 2) a typical "Vegetable chooser" and a typical "Vegetable abstainer". The stem for the question was "We will ask you to evaluate a typical conscript, who behaves in a way described below". The stem was followed by the definitions of an abstainer and an actor:

- Abstainer: "A typical conscript who tries to avoid fast foods and snacks" (Fat condition) / "vegetables and fruits" (Vegetable condition).
- Actor: "A typical conscript who strives to choose fast foods and snacks (Fat condition) / fruits and vegetables (Vegetable condition) at every meal.

The answering scales consisted of 17 antonyms. The adjectives were based on earlier studies (Barker et al., 1999; Fries & Croyle, 1993) and on a qualitative pilot study among male conscripts conducted by our research group. The adjective pairs were asked to be answered on a five-point scale with the antonym adjectives at the extremes. Participants were asked to "choose an option from the scale that most accurately represents your opinion". The antonyms were the following: easygoing—uptight, popular—unpopular, unreliable—reliable, convincing—unconvincing, physically fit—physically unfit, childish—grown-up, fat—skinny, self-indulgent—austere, masculine—feminine, careless—meticulous, responsible—irresponsible, insecure—confident, muscular—lanky, fashionable—unfashionable, dumb—intelligent, attractive—unattractive, good company—dull. Appropriate reversions were done for higher scores to reflect more positive evaluations.

To explore the factor structure of the four prototypes (Vegetable chooser, Vegetable abstainer, Fat chooser, Fat abstainer), exploratory factor analyses with Maximum likelihood extraction and Varimax rotation were conducted. Two items were dropped (convincing and austere) due to cross-loadings and field researchers' feedback from the comments from conscripts concerning the meaning of the items. The resulting factor solution was explored with confirmatory factor analysis. The first analyses yielded a three-factor solution for Fat chooser and Vegetable abstainer and a four-factor solution for Fat abstainer and Vegetable chooser. For the three-factor solution, the criteria were eigenvalues ≥ 1, and scree plots confirmed the results. For the four-

factor solution, eigenvalues were ≥1, but the scree plots were less clear. The three-factor explanatory factor solutions explained from 46.3% to 52% of the variance. The rationale in these analyses was that finding similar structures (i.e. factors) enables comparing these structures and that it would give more reliable information on positive and negative evaluations than using just sum scores for four prototypes, the original 17 items, or selected items.

The factor structure was examined with confirmatory factor analysis, with Full Information Maximum Likelihood (FIML) for estimating missing data. As an indication of acceptable model fit, Comparative Fit Index (CFI) ranged from 0.82 to 0.87, the Tucker-Lewis Index (TLI) from 0.78 to 0.84, and the Root Mean Square Error of Approximation (RMSEA) from 0.07 to 0.08. The relevant prototype items were summed into composite scores for the subsequent analyses (composite scores referred to as "factors" from here onwards). The Cronbach's alphas were satisfactory at the 0.60 level (range for *α*s: 0.60-0.74). Fat and vegetable prototypes were measured in different groups, and the statistical comparisons were made within the group (i.e. fat prototypes in one group and vegetable prototypes in another). The content of the factors are described in the Results section.

4.2.2 HEALTH BEHAVIOR MEASURES

LTPA was measured by the frequency measure similar to that used by Mäkinen, Borodulin, Laatikainen, Fogelholm, and Prättälä (2009). The stem: "During a regular week before the military service how often did you exercise for at least 30 minutes so that you perspired and were out of breath?" was followed by seven options on a response scale that was collapsed into four categories: Not at all to once a month = 1, 2–4 times/month = 2, 2–3 times/week = 3, 4–7 times/week = 4.

Eating was measured by a 36-item food frequency questionnaire asking "On how many days during the past week in civilian life (baseline)/ "during the past week" (after 8 weeks and after 6 months of military service) did you consume the following food items? The answering scale ranged from 0 to 7. The questionnaire was based on several corresponding questionnaires for Finns (e.g. Paalanen et al., 2006) and adjusted for conscripts on the basis of a previous food diary study among Finnish conscripts (Bingham et al., 2009). Two eating indices were created: the Fruit and Vegetable Index to describe the consumption of fruits or berries and fresh vegetables (mean of the two items), and the Fast Food Index to measure fast food consumption (mean of five items: French fries, potato chips, pizza and kebab, hamburgers and hot dogs, meat pies and savory pastries). The Fast Food Index was based on earlier studies of eating behavior among men in military service (Bingham et al., 2011; Jallinoja et al., 2011). In Study III, the Fast Food Index was referred to as the "Fatty Food Index". Possible values on both indices, the Fruit and Vegetable Index and the Fast Food Index varied between 0.00 and 7.00.

4.2.3 FITNESS MEASURES

Every conscript completes compulsory fitness tests within the first two weeks of service. Aerobic fitness was measured as physical endurance by the Cooper 12-Minute Running Test which has been validated as a good measure of maximum oxygen uptake at the population level (Grant, Corbett, Amjad, Wilson, & Aitchison, 1995). The test is mainly performed outdoors, but in the winter it is recommended that tests are conducted indoors. Test timing and circumstances were standardized according to an expert supervisor of the Defense Forces. Conscripts were instructed to perform the 12-minute run "with a maximal effort" and they had the option of stopping voluntarily. The accuracy of the measurements was +10 meters, and the result of the running test (meters run) was used as a continuous variable in the analysis.

Muscle fitness tests comprising pull-ups, push-ups, sit-ups, standing long jump, and a back-muscle test are described in more detail in Santtila et al. (2006). Duration of the muscle fitness tests for each exercise was one minute, apart from the standing long jump and the pull-ups. The recovery time between each test was at least five minutes. Before testing, the supervisor demonstrated and explained the correct way to perform each test. To calculate the muscle fitness result, the points from individual muscle fitness test results were added together and categorized as follows: excellent (13–15 points) = 4; good (9–12 points) = 3; satisfactory (5–8 points) = 2; and poor (0–4 points) = 1.

4.2.4 ANTHROPOMETRIC MEASURES

Body Mass Index (BMI) was calculated as the weight in kilograms divided by the square of the height in meters. Body height (accuracy of 0.1 cm) and mass (accuracy of 100 g) were measured by the study researchers. Waist circumference was measured between the highest point of the iliac bone andthe lowest rib at the end of expiration. The results were recorded to the nearest 0.5 cm. Waist circumferences ranged from 60 cm to 132 cm (M = 83.9 cm, SD = 10.06). As the waist circumference yielded similar results to BMI in the analyses, only BMI results are reported.

4.2.5 SOCIOECONOMIC BACKGROUND

Socioeconomic background was measured with one question on education "What is the highest education that you have completed?" Completion of upper secondary school was reported by 49% of participants. More specifically, college level or higher degree was reported by 1%, vocational training by 40%, and secondary school by 10%. These were combined into a dichotomous measure (1 = secondary or vocational school and 2 = upper-secondary or college level/higher education).

4.3 INTERVENTION

In 2008, the personnel in the Northern and Southern Brigade garrison canteens and Soldiers' homes were targeted in the Supply intervention. The main objective of the Supply intervention was to change environments and increase the supply of healthy foods, i.e. to develop and promote availability of healthy food choices in garrison canteens and soldiers' homes. This Supply intervention is described and evaluated in more detail in Bingham et al. (2012). The Demand Intervention evaluated in this dissertation took place in 2009. The intervention description follows the TiDier checklist (Hoffmann et al., 2014). The Demand intervention contained 1) the changes made for 2008 in food selection in Soldiers' homes and garrison canteens (i.e. the Supply intervention) and 2) a campaign targeted to conscripts to promote a positive, socially acceptable, masculine image of vegetable eaters (i.e. prototypes) in order to increase the "demand" of healthy food among participants. The general objective of the Demand intervention was to increase individuals' willingness to consume healthy foods. The campaign included two different posters that were hung on the walls of service units, canteens, and Soldier's homes, three different table triangle comic adverts in Soldier's homes and in canteens, and a "counting days to get home" postcard. There were also comic strip competitions in which the conscripts could fill in the text themselves. Materials included texts with a play on words (e.g. "Kasvisota" can be translated either as "Vegetable War" or "Take Vegetables"). In comics, there was also a prompt "Your body has a war every day. To beat the enemy, choose the heavy weapons and load half a kilo of vegetables on your plate each day". The intervention materials are provided in the Appendix. These materials were on view twice between the measurements, for a two-week period each time. The participants for the Supply intervention (year 2008) served as the control group, and participants for the Demand intervention (year 2009) served as the intervention group.

Both Supply and Demand interventions were supported by management in the garrisons as well as by military staff in study units. Also, military staff in study units was provided with an opportunity to take part in the physical measurements of the study. Although the staff eats the same food as conscripts, the meals are provided in different canteens. The conscript leaders were not especially targeted, but they eat their meals with conscripts.

4.4 STATISTICAL ANALYSES

All statistical analyses for Studies I, III, & IV were originally performed using SPSS Statistics software, starting from PASW, version 18 and confirmed later with SPSS version 22. The analysis included t-tests (Studies III & IV), Pearson correlation, multiple regression (Studies I & III), and repeated measures ANOVAs (Study IV).

For Study I, two online software packages were also used: for effect size measure, Cohen's *f*2 (Soper, 2011) and for mediation analyses a Sobel test, which is superior to the Baron-Kenny method of testing for mediation (Preacher, 2010). For Study III, Cohen's *d* effect sizes for t-test were computed by Social Science Statistic online calculator (Social science statistics, 2016) and confirmed by another online calculator (Becker,1999).

The confirmatory factor analyses for Study III and structural equation models for Study II were run by Mplus program (version 6.11). For both studies, the model fits were evaluated using the Comparative Fit Index (CFI), the Tucker–Lewis index (TLI), and the Root Mean Square Error of approximation (RMSEA) (Kline, 2005). Missing data were handled by Full Information Maximum Likelihood estimation (FIML), considered the least biased method to date (Graham JW, 2009). For Study II, Mplus was used to explore the correlations and structural path models. Self-control was specified as an exogenous variable (i.e. a variable not predicted by any prior variable), and a following regression path was specified on outcome expectations (inconvenience, physical well-being, social punishment, taste), self-efficacy (social, emotional barriers), and perceived risk (health, weight gain), on which, in turn, intention was regressed (as outlined by the HAPA-model). The model also included paths from intention to action and coping planning, and then from these on food consumption.

Coefficients from all analyses are reported as standardized, if not otherwise mentioned.

5 RESULTS

The results for Studies I-IV are presented according to the aims of this dissertation. More detailed analyses can be found in the original articles.

5.1 ASSOCIATION OF SELF-CONTROL, HEALTH BEHAVIORS, FITNESS, AND BMI AMONG YOUNG MEN (STUDIES I & II)

Descriptive statistics for self-control, health behaviors, physical fitness, and BMI can be seen in Table 2. Descriptive statistics and correlations include all available data from participants who had given their consent. All other variables were measured during the first week of military service, but items measuring eating were collected 8 weeks after stepping into military service.

As there were many missing consents to combine the fitness test results from the Defense forces' database, a series of t-tests were run. The results indicated that participants who had given their consent did not differ in education, LTPA, self-control levels, or BMI (all *p*s ≥ .099). The correlations as well as the number of participants (*n*) in each correlation are presented in Table 3. Self-control predicted higher fruit and vegetable consumption and lower fast food consumption after 8 weeks with a small effect size (RQ1). The associations of self-control and LTPA were examined in a cross-sectional setting and a significant small effect size association was found (RQ2).

Table 2. *Descriptive statistics for self-control, LTPA, fitness tests, HAPA-components and eating variables after 8weeks (variables from Studies I and II).*

	n	*Min.*	*Max.*	*M*	*SD*
Self-control	854	1.68	4.85	3.34	0.51
LTPA	852	1	4	2.91	0.93
Muscle Fitness score	609	0	15	7.47	3.70
12-min running (Aerobic fitness)	618	1200	3310	2499	326
BMI	823	14.4	40.6	23.98	4.03
8-week FV	705	0	7	2.78	1.60
8-week FF	705	0	4	0.55	0.58
OCE social punishment	850	1	4	1.42	0.57
OCE physical well-being	852	1	4	2.93	0.64
OCE bad taste	850	1	4	2.41	0.71
OCE inconvenience	851	1	4	2.52	0.78
Self-efficacy social	851	1	4	3.06	0.63
Self-efficacy emotional barriers	852	1	4	2.51	0.61
Risk perception weight gain	853	1	5	3.31	0.97
Risk perception health problem	853	1	5	3.96	0.73
FV intention	853	1	7	4.32	1.48
FF intent	853	1	7	3.71	1.60
Action planning	853	1	4	2.30	0.67
Coping planning	852	1	3.75	2.01	0.64

NOTE. The results have slight differences to those published in Study I as *N*s for Studies I and II differed. Study I included only those participants who had completed all relevant measures and had given their consent to combine their fitness test results from the Defense Forces database.
BMI = Body Mass Index
OCE = Outcome expectancies
8-week FV = Fruit and vegetable consumption after 8 weeks
8- week FF = Fast food consumption after 8 weeks

Table 3. *Number of participants and correlations between self-control, LTPA, fitness tests, BMI, and eating variables after 8 weeks.*

	1.	2.	3.	4.	5.	6.	7.
1. Self-control	-						
2. LTPA	.19** *n* = 850	-					
3. Muscle fitness	.14** *n* = 510	.34** *n*= 508	-				
4. Aerobic fitness	.20** *n*= 519	.29** *n* = 517	.60** *n*= 599	-			
5. BMI	-.13** *n*= 804	-.06 *n* = 803	-.33** *n* = 499	-.47** *n*= 509	-		
6. 8-week FV consumption	.21** *n*= 678	.22** *n* = 675	.18** *n* = 449	.19** *n* = 459	-.16** *n* = 661	-	
7. 8wk FF consumption	-.19** *n* = 678	.00 *n*= 675	.10* *n*= 449	.02 *n* = 459	-.05 *n* =705		-

NOTE. *p < .05 **p < .001
8wk FV = Fruit and vegetable consumption after 8 weeks.
8wk FF = Fast food consumption after 8 weeks.

Higher self-control had significant small-sized correlations with better muscle fitness, better aerobic fitness, and lower BMI (RQ3). In the multiple regression analysis, the small-sized association of self-control and aerobic fitness remained significant after controlling for the effects of LTPA and BMI (see Table 4).

The significant small-sized association of self-control and muscle fitness faded after controlling for the effects of BMI and LTPA (see Table 5). The mediation tests showed that LTPA did not mediate between self-control and aerobic fitness (Sobel test = 0.003, SE = 8.35, p = .99) or between self-control and the muscle fitness test result (Sobel test = 0.878, SE = 0.03, p = .380) (RQ4).

Table 4. *Regression models with total variance explained (R^2_{adj}), confidence intervals, and unstandardized (B) and standardized (β) coefficients for variables predicting aerobic fitness (i.e.12-minute running test result) (n = 482).*

		95% CI					
	B	LL	UL	SE B	*β*	R^2_{adj}	f^2
Model 1						**.043**	**.05**
Self-control	128.60	75.51	181.69	27.02	.21***		
Model 2						**.21**	**.26**
Self-control	92.04	43.20	140.88	24.20	.15***		
BMI[a]	-33.77	-40.38	-27.16	3.36	-.41***		
Model 3						**.28**	**.30**
Self-control	60.42	12.88	107.96	24.20	.10*		
BMI[a]	-35.12	-41.45	-28.79	3.22	-.43***		
LTPA[b]	90.70	64.61	116.79	13.28	.27***		

NOTE. [a]BMI = Body mass index; [b]LTPA = Leisure-time physical activity. f^2=Cohen's f^2 effect size

*p <.05, ***p <. 001

Table 5. *Regression models with total variance explained (R^2_{adj}), confidence intervals, and unstandardized (B) and standardized (β) coefficients predicting muscle fitness test result (n = 482).*

		95% CI					
	B	LL	UL	SE B	*β*	R^2_{adj}	f^2
Model 1						**.02**	**.03**
Self-control	1.16	.53	1.80	.32	.16***		
Model 2						**.21**	**.26**
Self-control	.84	.23	1.45	.31	.19**		
BMI[a]	-.30	-.38	-.021	.04	-.31***		
Model 3						**.23**	**.31**
Self-control	.36	-.22	.94	.30	.05		
BMI[a]	-.32	-.39	-.24	.04	-.33***		
LTPA[b]	1.38	1.06	1.70	.16	.35***		

NOTE [a]BMI = Body mass index; [b]LTPA = Leisure-time physical activity. f^2=Cohen's effect size, **p < .01, ***p < .001.

5.2 MEDIATION OF SOCIAL COGNITIVE FACTORS (HAPA-MODEL) BETWEEN SELF-CONTROL AND EATING (STUDY II)

Descriptive statistics for the social cognitive factors (i.e. components of the HAPA-model) are presented in Table 2.
The correlations between self-control and the components of the HAPA-model were statistically significant (except for perceived risk of weight gain), and the effect sizes were small (to moderate). The correlations can be seen in Table 6. The strongest associations between self-control and the HAPA-components were with the emotional barriers to self-efficacy, action planning, and social self-efficacy.

The t-tests showed that participants who dropped out from the questionnaire at 8 weeks (i.e. when the eating variables were measured) scored lower on trait self-control (ΔM = .12, $t(849)$ = 2.82, p = .005, d = 0.23), reported more inconvenience in healthy eating (ΔM = .19, 852) = 2.69, p = .008, d = 0.24), more bad taste expectations of healthy food (ΔM = .12, $t(848)$ = 2.00, p = .047, d = 0.17), and lower risk perceptions about not eating healthy foods (ΔM = .19, $t(851)$ = 2.83, p = .005, d = 0.25).

Table 6. *Correlations between self-control, social cognitive factors (components of HAPA-model), and FV and FF consumption.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Self-control	1													
2. Self-efficacy social	.29***	1												
3. Self-efficacy emotional barriers	.41***	.42***	1											
4. OCE inconvenience	-.15***	-.12***	-.23***	1										
5. OCE physical well-being	.09*	.19***	.11***	.15***	1									
6. OCE social punishment	-.17***	-.24***	-.16***	.32***	-.06	1								
7. OCE bad taste	-.19***	-.17***	-.24***	.42***	-.25***	.31***	1							
8. Risk perception weight gain	-.02	.02	.04	.08*	.15***	-.02	-.01	1						
9. Risk perception health prob	.25***	.24***	.18***	-.08*	.15***	-.11**	-.12***	.02	1					
10. Action planning	.34***	.14***	.25***	-.15***	.15***	-.02	-.24***	.08*	.11 **	1				
11. Coping planning	.20***	.09**	.21***	-.10*	.18***	.00	-.21***	.13***	.02	.53***	1			
12. FV intention	.26***	.25***	.24***	-.11***	.29***	-.13***	-.34***	.00	.19***	.27***	.28***	1		
13. FF intention	.20***	.15***	.21***	-.09**	.37***	-.06	-.34***	.24***	.11**	.30***	.35***	.41***	1	
14. 8 wk FV	.21***	.15***	.18***	-.14***	.13**	-.09*	-.23***	-.08*	.12**	.27***	.20***	.39***	.16***	1
15. 8 wk FF	-.19***	-.09*	-.08*	.01	-.07	.08*	.11**	-.06	.00	-.13**	-.09*	-.11**	-.14***	-.05

Note. **p* < .05, ***p* < .01, ****p* < .001

OCE = Outcome expectancies

8wk FV = Fruit and vegetable consumption after 8 weeks

8wk FF= Fast food consumption after 8 weeks

RQ1 of this aim investigated whether the HAPA-model mediates the significant association between higher self-control and higher fruit and vegetable consumption. The structural equation model (Figure 6) fit the data well ($\chi 2$ = 13.82, df = 8, p = .09, CFI = 1.00, TLI = .97, RMSEA = .029). There was a significant small-sized total effect of self-control on fruit and vegetable consumption (β = .21, p < .001), which was fully mediated by the HAPA-model, as the direct effect of self-control on fruit and vegetable consumption did not remain significant (β =.07, p =.07). The significant indirect effects can be found in Study II.

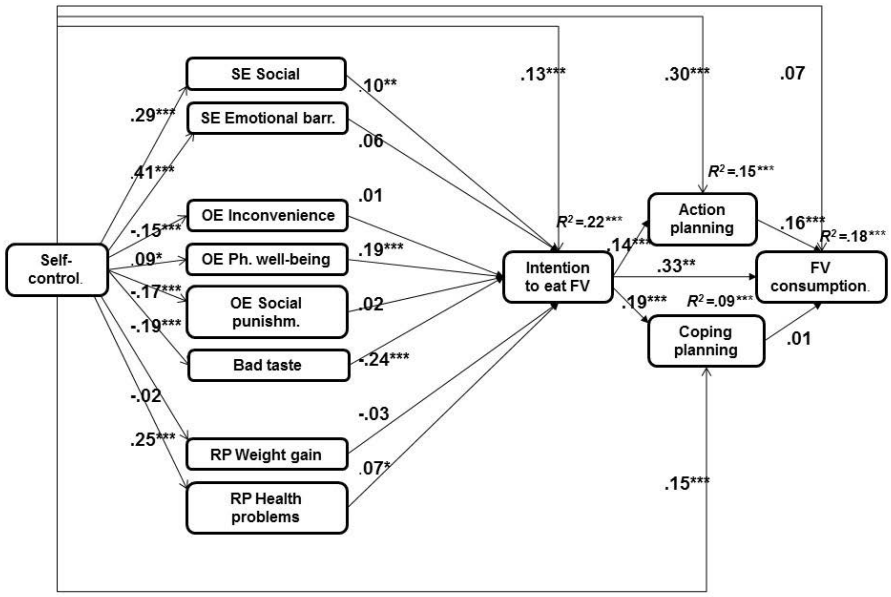


Figure 6 Components of the HAPA-model that predicted fruit and vegetable consumption after 8 weeks. SE = self-efficacy, OE = outcome expectancies, RP = risk perceptions, FV = fruit and vegetables.

RQ2 of this aim was to investigate whether the HAPA-model also mediates the association between self-control and fast food consumption. The analysis showed that the model (Figure 7) fit the data well ($\chi 2$ = 8.48, df = 8, p = .39, CFI = 1.00, TLI = .98, RMSEA = .008). There was a small-sized total effect of self-control on fast food consumption (β =−.19, p <.001), and the total indirect effect of self-control on fast food consumption (sum of 29 indirect effects) was also significant (β =−.03, p =.02). However, the direct effect of self-control remained marginally significant (β =−.15, p <.001). The HAPA-model thus mediated the association between self-control and fast food

consumption only partially. There was only one significant indirect effect from self-control on fast food consumption; self-control → bad taste expectations → intentions → fast food consumption (β =−.004, p =.040). The other indirect effects were non-significant.

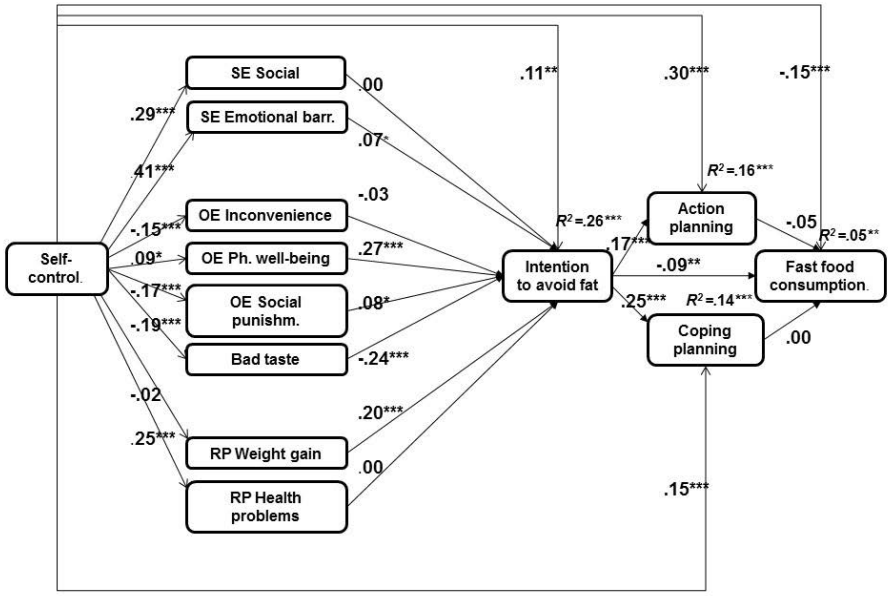


Figure 7 Components of the HAPA-model that predicted fast food consumption after 8 weeks. SE = self-efficacy, OE = outcome expectancies, RP = risk perceptions.

5.3 THE EVALUATIONS OF EATER PROTOTYPES AND THEIR ASSOCIATIONS WITH EATING (STUDY III)

The three prototype factors were Self-regulation (including the items of reliable, grown-up, meticulous, responsible, and intelligent), Social standing in peer group (including easygoing, popular, masculine, and good company), and Appearance (including muscular, fashionable, attractive, skinny, and physically fit). Prototype items were subsequently summed into composite scores for the analyses (referred to as factors in the text). Cronbach's alphas ranged from 0.59 to 0.74. To clarify the concepts of the present study, the 12 factors are also presented in Table 7. Means and confidence intervals for the different Vegetable chooser and abstainer prototype factors are illustrated in Figure 8 and for Fat chooser and abstainer factors in Figure 9. Correlations between the prototype factors are presented in Table 8. The effect sizes of the

correlations between the factors varied from non-significant to large. More positive perceptions of Vegetable chooser prototype factors were related with more negative ratings of Vegetable abstainer factors. Similarly, more positive ratings of Fat abstainer were related to more negative ratings of Fat chooser prototype.

Table 7 *Different abstainer and chooser prototype factors in this study.*

Healthy eater prototypes	**Vegetable chooser** Self-regulation Social status Appearance	**Fat abstainer** Self-regulation Social status Appearance
Unhealthy eater prototypes	**Vegetable abstainer** Self-regulation Social status Appearance	**Fat chooser** Self-regulation Social status Appearance

RQ1: was to inspect whether healthy eater prototypes are evaluated more positively than unhealthy eater prototypes. Healthy eater prototypes (Vegetable chooser and Fat abstainer) were mostly rated more positively than the respective unhealthy eater prototypes (Vegetable abstainer and Fat chooser). Two-tailed t-tests showed that the typical Vegetable chooser was rated significantly higher with a large effect size than Vegetable abstainer on Appearance (ΔM = 0.60, $t(912)$ = 21.02, p < .001, d = 1.16) and Self-regulation (ΔM = 0.70, $t(909)$ = 22.94, p < .001, d = 1.27) factors. Vegetable chooser on Social standing in a peer group was rated higher than Vegetable abstainer with a small effect size (ΔM = 0.72, $t(910)$ = 2.91, p = .004, d = 0.15). Single item t-tests revealed similar results, except that typical Vegetable chooser was rated as less "masculine" (ΔM = o.11, $t(904)$ = 3.22, p = .001, d =0.16).

Of the fat prototypes, the healthy eater prototype, i.e. Fat abstainer, was rated significantly higher with a large effect size than Fat chooser on Self-regulation (ΔM = 0.72, $t(892)$ = 25.35, p < .001, d = 1.39) and Appearance (ΔM = 0.76, $t(892)$ = 25.88, p < .001, d = 1.44) factors. Again, single-item t-tests revealed that healthy eater (Fat abstainer) was rated as less "masculine" (ΔM = -0.23, $t(888)$ = -6.62, p < .001, d = 0.33). Thus, for RQ2 it can be concluded that healthy eater was rated more positively on Self-regulation and Appearance.

RQ2 was to investigate whether chooser prototype shows some benefit over abstainer prototype. The results revealed that not only Vegetable chooser, but also Fat chooser was rated higher on Social standing than Fat abstainer with a small effect size (ΔM = -0.19, $t(892)$ = -8.78, p < .001, d = 0.39) (see Figure 8).

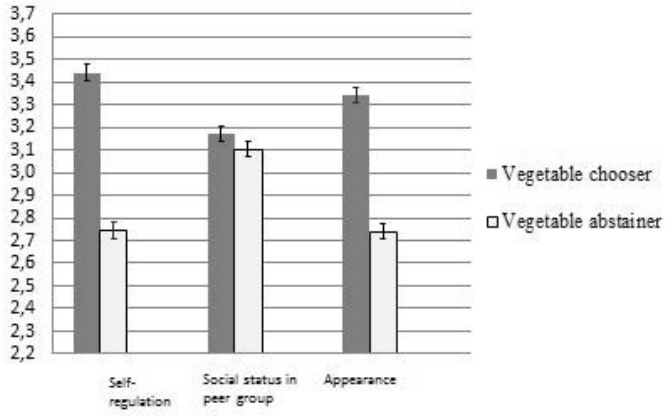


Figure 8 Means and confidence intervals for Vegetable chooser (Healthy eater) and Vegetable abstainer (Unhealthy eater) prototype factors.

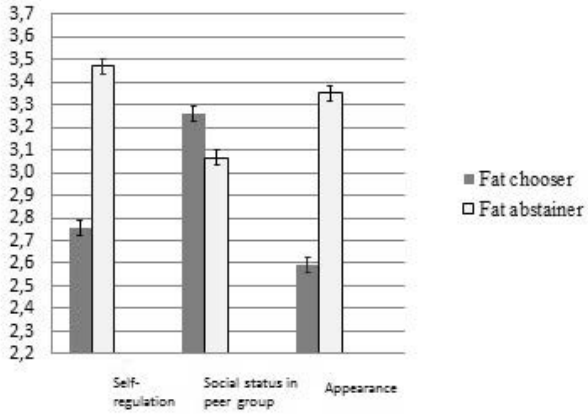


Figure 9 Means and confidence intervals for Fat chooser (Unhealthy eater) and Fat abstainer (Healthy eater) prototype factors.

Table 8 *Correlations between Vegetable chooser and Vegetable abstainer factors and between Fat chooser and Fat abstainer factors.*

	Vegetable chooser			***Vegetable abstainer***	
	Self-reg.	Soc.standing	Appearance	Self-reg.	Soc.standing
Vegetable chooser:					
Self-reg.	1				
Soc.standing	.35**	1			
Appearance	.53**	.46**	1		
Vegetable abstainer:					
Self-reg.	-.39**	-.11*	-.25**	1	
Soc.standing	-.06	-.20**	-.05	.23**	1
Appearance	-.38**	-.20**	-.39**	.52**	.32**
	Fat Abstainer			***Fat chooser***	
	Self-reg.	Soc.standing	Appearance	Self-reg.	Soc.standing
Fat Abstainer:					
Self-reg.	1				
Soc.standing	.26**	1			
Appearance	.42**	.34**	1		
Fat chooser:					
Self-reg.	-.35**	-.04	-.22**	1	
Soc.standing	.15*	-.11**	.07	.17**	1
Appearance	-.37**	-.12*	-.40**	.55**	.12**

Note. *$p < .05$ **$p < .001$

Soc.standing = Social standing

RQ3 studied the associations between eater prototypes and eating behavior. Fruit and vegetable consumption correlated significantly with all Vegetable chooser prototype factors, meaning that more positive ratings of a vegetable-choosing peer were related to higher fruit and vegetable consumption (Table 9). Also, all Vegetable abstainer factors had negative correlations with actual fruit and vegetable consumption, i.e. those with higher fruit and vegetable consumption rated typical vegetable-abstaining peers more negatively.

Of Fat abstainer prototypes, more positive ratings on Self-regulation and Appearance factors had significant very small-sized associations with lower fast food consumption, meaning that participants who reported higher fast food consumption tended to rate these Fat abstainer factors more negatively. More positive ratings of all Fat chooser prototype factors had significant very small to small-sized associations with higher fast food consumption.

The associations between fat and vegetable prototypes and eating were analyzed in separate multiple regression models for fruit and vegetable consumption and fast food consumption (see Table 9).

In the first model, fruit and vegetable consumption was explained (R^2 = .08, $R^2_{adj.}$= .07, $F(6, 897) = 12.15$, p <.001). When all six Vegetable chooser and Vegetable abstainer factors were entered simultaneously into the model, Self-regulation in Vegetable chooser and abstainer prototypes as well as Appearance in the Vegetable abstainer prototype remained significant small-sized predictors of fruit and vegetable consumption.

When all six Fat chooser and Fat abstainer factors were inspected in the multivariate model, none remained significant predictors of the consumption of fast food items (R^2 = .03, $R^2_{adj.}$ = .02. $F(6, 880) = 4.59$, $p < .001$).

Table 9 *Bivariate correlations, unstandardized and standardized regression coefficients from multivariate linear regression models for A) fruit and vegetable consumption and B) fast food consumption.*

	***r* with fruit and vegetable consumption**	*B*	*SE B*	ß
Vegetable chooser:				
Self-regulation	.19***	.35	.14	.10*
Social standing	.10***	.11	.14	.03
Appearance	.12***	-.03	.16	-.01
Vegetable abstainer:				
Self-regulation	-.22***	-.42	.13	-.13**
Social standing	-.13***	-.21	.14	-.05
Appearance	-.21***	-.28	.14	-.08*
	***r* with fast food consumption**			
Fat abstainer:				
Self-regulation	-.10**	-0.07	0.06	-0.05
Social standing	-.05	-0.01	0.06	-0.01
Appearance	-.09*	-0.05	0.06	-0.04
Fat chooser:				
Self-regulation	.14***	0.12	0.07	0.08
Social standing	.07*	0.09	0.05	0.06
Appearance	.13***	0.08	0.06	0.05

Note. *p < .05, **p < .01, ***p < .001.

5.4 INTERVENTION TO PROMOTE EATER PROTOTYPES AND VEGETABLE CONSUMPTION (STUDY IV)

RQ1 investigated whether the intervention managed to affect eater prototypes. Prototypes were measured at baseline and after six months. The means for the prototypes at baseline and follow-up are presented in Figures 10 and 11.

Intervention effectiveness in changing Vegetable chooser prototype. The only significant changes found in the Vegetable chooser prototype were changes in the Self-regulation factor. The within-subject analysis showed that the ratings for Self-regulation decreased during the six months in military service $F(1, 441) = 15.85$, $p < .001$. The within-subject analysis also yielded a significant interaction term between the Self-regulation factor and the intervention arm $F(1, 441) = 5.70$, $p = .017$, meaning that the negative change occurred in the control group only. There were no significant changes during the six months nor were there significant interactions in the Social standing and Appearance factors of the Vegetable chooser prototype (see Figure 10).

Intervention effectiveness in changing Vegetable abstainer prototype. The within-subject analysis indicated that ratings for Self-regulation factor increased also in the Vegetable abstainer during the six months in military service $F(1, 441) = 12.58$, $p < .001$. Again, the within-subject analysis showed a significant interaction term between the study arms $F(1, 441) = 8.56$, $p = .004$, suggesting that the negative development occurred mainly in the control group. A similar change occurred also in the Appearance factor: the within-subject analysis showed that it was rated higher after six months in military service $F(1, 441) = 8.16$, $p = .004$, but the within-subject analysis interaction term indicated that the negative change took place in the control group only $F(1, 441) = 4.26$, $p = .04$. There was no significant change in the Social standing factor during the military service, and no significant interaction effects were found (Figure 11).

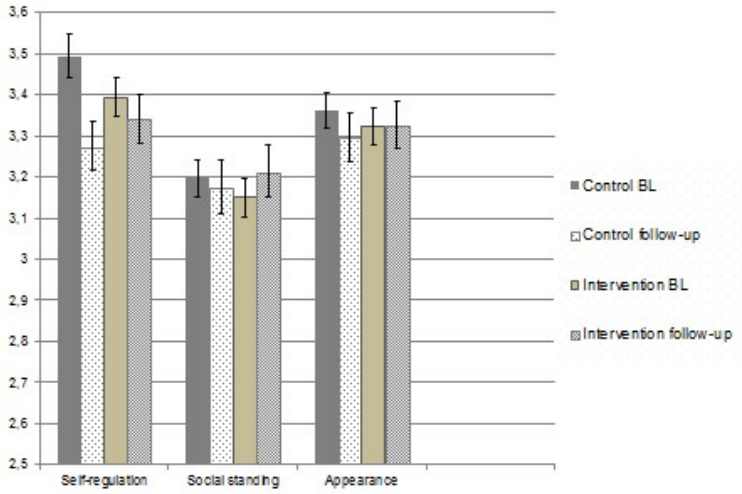


Figure 10 Means and confidence intervals of **Vegetable chooser** prototypes for control and intervention groups at baseline and after 6 months.

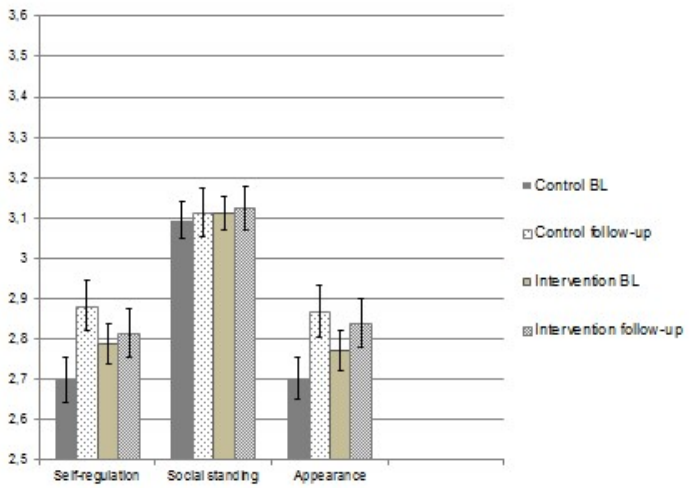


Figure 11 Means and confidence intervals of **Vegetable abstainer** prototypes for control and intervention groups at baseline and after 6 months.

RQ2 investigated whether the intervention had an effect on vegetable consumption. The means for vegetable consumption from all participants who had reported their vegetable consumption are presented in Table 10. The control group reported higher vegetable consumption with a small effect size (ΔM = 0.29, t(1,1806) = 2.003, p = .045, d = 0.13). Also, as the intervention targeted all men in the research units (but only half of the participants answered on questions on Vegetable chooser and abstainer prototypes), the vegetable consumption of all available participants was analyzed. The within-subject analysis indicated that military service had a negative effect on vegetable consumption F(1, 906) = 17.75, p < .001. However, the negative development took mainly place in the control group (within-subject interaction between the study arms F(1, 906) = 4.76, p = .029).

Table 10 *Means and standard deviations of vegetable consumption at baseline and at the 6-month follow-up in control and intervention groups.'*

Group	Baseline		6-month-follow-up	
	M	*SD*	*M*	*SD*
Control (*n =424)*	3.33	2.15	2.88	1.95
Intervention (*n* =484)	3.04	2.17	2.90	2.00

RQ3 investigated whether changes in intentions to eat fruit and vegetables are related to changes in prototypes and changes in vegetable consumption. The intentions to eat fruit and vegetables were significantly higher in the control group at baseline (ΔM=0,24, t(1800) =3.46 p < .001, d =*0.16)*. The change score analyses indicated that the intention to eat fruit and vegetables declined during the six months in military service F(1, 900) = 31.69, p < .001 and that the intervention did not influence intention; within-subject intention * study arm interaction F(1, 900) = 3.23, p < .073. The descriptive statistics for the change scores (6-month follow-up and baseline) in intention, prototype variables that responded to the intervention, and vegetable consumption are presented in Table 11.

Table 11. *Means and standard deviations for the change scores (follow-up – baseline) of change in intention to eat fruit and vegetables, change in vegetable consumption and prototype changes in control and intervention groups.*

Change score variables	Veg. chooser Self-regulation	Veg. abstainer Self-regulation	Veg. abstainer Appearance	Intention to eat FV	Veg. consumption
Control *M(SD)*	-0.18 (0.60)	0.19 (0.66)	0.15 (0.65)	-0.39 (1.66)	-0.45 (2.07)
Intervention *M(SD)*	-0.04 (0.58)	0.13 (0.59)	0.03 (0.65)	-0.21 (1.49)	-0.14 (2.20)

Correlations between the change score variables (6 months – baseline) in intention to eat fruit and vegetables, fruit and vegetable consumption, and the three prototype factors that reacted to the intervention were evaluated. The only significant correlations between the change scores were found in the intervention group, where increased intention to eat fruit and vegetables predicted increased fruit and vegetable consumption with a small- sized correlation (r = .11, p = .017) and a more positive change in Vegetable chooser Self-regulation factor predicted more positive changes in intentions to eat fruits and vegetables with a small-sized correlation (r = .20, p = .002).

RQ4 investigated whether education moderated the intervention effect. Education was associated with some prototype evaluations. The participants in the control group were more likely to have higher education (38.5% control vs. 32.4% intervention; t(1790) = 3,08, p = .002, d = 0.93). Education did not predict drop-out status at follow-up (ΔM = 0.00, t(1790) = -0.11, p = .911).

Vegetable chooser prototype. At baseline, participants with higher education reported more positive Vegetable chooser prototypes on Self-regulation F(1, 431) = 10.32, p < .001 and Social standing factor F(1, 431) = 3.92, p = .048]. There were no significant interactions between time * intervention arm * education, meaning that the intervention did not affect any Vegetable chooser prototype factor (i.e. Self-regulation, Social status, or Appearance) differently in educational groups.

Vegetable abstainer prototype. Participants with higher education evaluated Vegetable abstainer prototypes as lower on Self-regulation F(1, 431) = 14.10, p < .001 and Appearance factors F(1, 428) = 5.83, p < .001 at baseline, meaning that participants with lower education evaluated these unhealthy prototypes more positively There were significant interaction terms in within-subject analysis; study arm * time interaction * education interaction on Self-regulation F(1, 428) = 5.70, p = .017 (see Figure 12) and

Appearance factors $F(1, 428) = 4.98$, $p = .026$ (see Figure 13), indicating that in the intervention group the negative development occurred mainly among the participants with lower education.

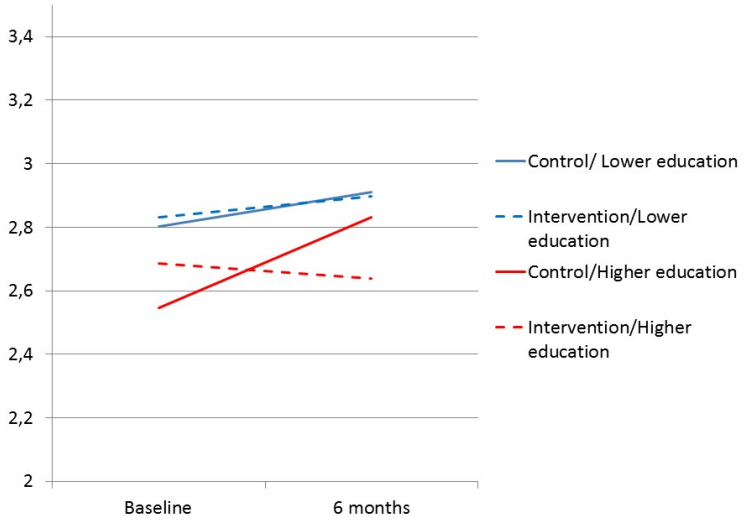


Figure 12 Means of Vegetable abstainer Self-regulation factor in control and intervention groups at baseline and after 6 months in different educational groups.

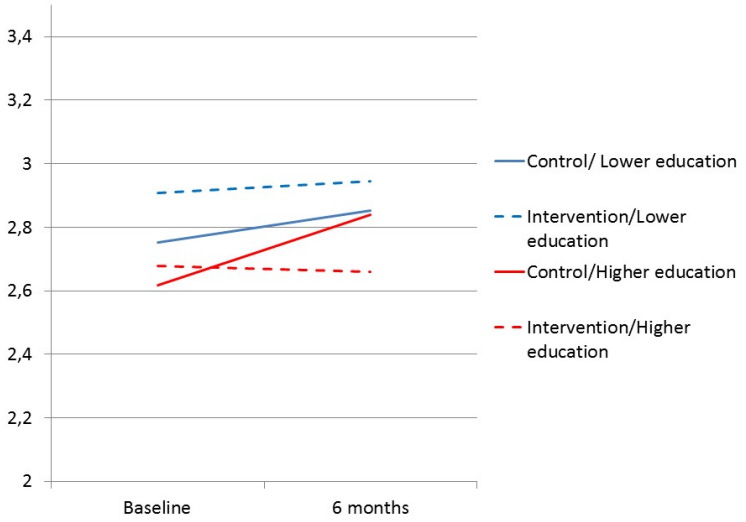


Figure 13 Means of Vegetable abstainer Appearance in control and intervention groups at baseline and after 6 months in different educational groups.

RQ4 investigated the role of education in vegetable consumption. There was a significant difference between the educational groups at baseline $F(1, 1780) = 157.31$, $p < .001$. No significant interaction emerged for vegetable consumption * intervention arm * education in within-subject analysis, meaning that the change of vegetable consumption during 6 months was similar in both educational groups in the intervention $F(1, 887) = 0.381$, $p = .537$ (see Figure 14).

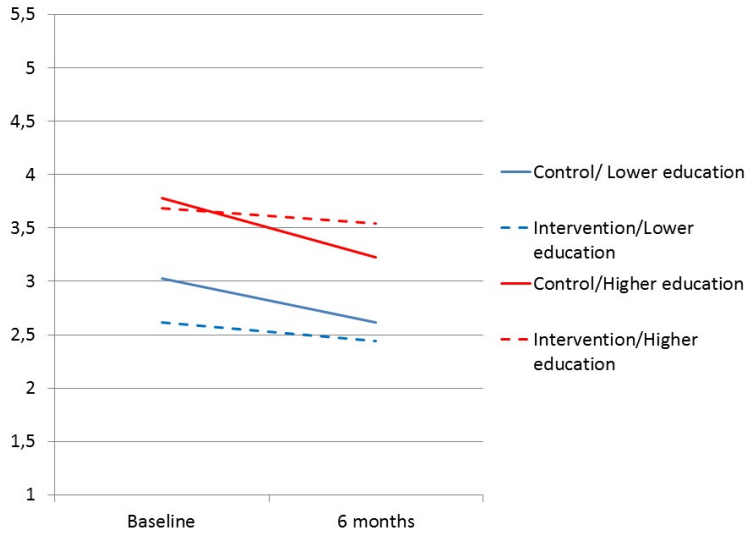


Figure 14 Means of vegetable consumption in control and intervention groups at baseline and after 6 months in different educational groups (*Min*.= 0, *Max*. = 7).

6 DISCUSSION

6.1 OVERVIEW OF THE MAIN RESULTS

The first aim of this dissertation was to examine the associations of personality self-control with healthier eating, more frequent LTPA, better aerobic and muscle fitness, and lower BMI. It was examined whether the association between self-control and fitness is explained by higher LTPA and lower fitness. The second main aim was to evaluate whether the predictive value of self-control for eating, more specifically for higher fruit and vegetable consumption and lower fast food consumption, is explained by the HAPA-model. Other aims included investigating whether automatic social images of peer eaters (prototypes) are more positive for healthy eaters than for unhealthy eaters, and whether choosing or abstaining from healthy or unhealthy foods is more positively rated and whether choosing or abstaining from healthy or unhealthy foods are similarly related to eating of unhealthy or healthy foods. The final aim of this study was to evaluate whether a poster campaign intervention would influence conscripts' vegetable prototype and vegetable consumption.

The main results and contributions of the individual studies are summarized in Table 12. Next, the methods, data, and results will be evaluated and discussed in light of the theoretical perspectives as well as the implications for research and practice.

Table 12 *Summary of the main results of Studies I-IV*.

Study	What was already known	What was asked	What the study found
I	Higher self-control is associated with more positive outcomes (academic, interpersonal, less binge eating, lower alcohol consumption)	Is self-control associated with a) Higher levels of LTPA? b) Objectively measured aerobic fitness? c) Objectively measured muscle fitness? d) Lower BMI?	• Self-control was associated with a higher level of LTPA (*r* =*.19)*, better aerobic fitness (*r* = *.20)*, better muscle fitness (*r* =.14), and lower BMI (*r* = -.13). • Self-control was associated with better muscle (*β* = .19) and aerobic fitness (*β* = .15) regardless of BMI. • A small association remained between self-control and higher aerobic fitness (*β* = .10), but not muscle fitness (*β* = .05), after controlling for LTPA and BMI.
II	HAPA-model predicts young men's eating behaviors	Does HAPA-model mediate the association of self-control and eating?	• HAPA-model fully mediated the association between self-control and FV consumption (total effect *β* = .21, direct effect *β* = .07). • HAPA-model partially mediated the association between self-control and FF consumption (total effect *β* = -.19, direct effect *β* = -.15).
III	• A typical healthy eater prototype is evaluated with mainly positive characteristics • A typical unhealthy eater is evaluated more negatively, but as "more fun to be with"	• Do young men evaluate healthy eater prototypes more positively whether they are active (choosing healthy/ unhealthy foods) or abstaining (abstaining from unhealthy/ healthy foods)? • How are active or abstaining eater prototypes associated with eating behavior?	• Healthy eater prototype was evaluated as more self-regulative (*d*s = 1.27 & 1.39) and better looking (*d*s = 1.16 & 1.44), whether abstaining or active, except fat chooser was rated higher on social standing than fat abstainer prototype (*d* = 0.39). • Associations between eater prototypes and FV consumption (*r*s ranging from -.22 to.19) were stronger than in FF consumption (*r*s ranging from -.10 to .14). • Self-regulation factors on Vegetable abstainer (*β* = -.13) and chooser (*β* = .10) prototypes remained significant predictors of FV consumption when all vegetable factors were included. Higher ratings on self-regulative vegetable chooser were associated with higher FV consumption.
IV	• FV consumption too low	• Can a visual campaign in garrison area promote more positive image of a vegetable eater? • Can it promote FV consumption?	• The prototypes and FV consumption tended to change unfavorably during the six months in military service. • The campaign had some success in hindering the unfavorable development. .

6.2 IS SELF-CONTROL ASSOCIATED WITH EATING, PHYSICAL ACTIVITY AND FITNESS?

Despite the variance in magnitude of the previously found associations between self-control and health behaviors, self-control has been referred to as one of the most beneficial traits in personality (de Ridder et al., 2012). It was examined how self-control is associated with different health behaviors and behavioral outcomes. This study confirmed earlier findings on the association between self-control and self-reported LTPA (Crescioni et al., 2011; Junger & van Kampen, 2010; Wills et al., 2007) as well as lower BMI (Crescioni et al., 2011; Junger & van Kampen, 2010). These results also suggest that young men with higher self-control are more often physically active and lean than those with lower self-control. Better muscle fitness was explained by more frequent physical activity and lower BMI, but self-control independently explained young men's objectively measured aerobic fitness, albeit with a weak association, despite more frequent physical activity and lower BMI.

Despite the many advantages offered by self-control, it is illogical to assume that self-control itself will produce better aerobic fitness in high self-control people. One explanation for the obtained association might arise from the measure for LTPA in Study I ("During a regular week before the military service, how often do you exercise at least 30 minutes so that you sweat and get out of breath?"). This question focuses mainly on frequency. Duration and intensity are included, but very roughly so. It is therefore possible that a more precise measure of intensity and duration might have explained the association between self-control and aerobic fitness. Also, inclusion of a sedentary behavior measure might have been beneficial. Another explanation could be that high self-control improves results in the test situation by increasing perseverance and resistance to the temptation to lessen one's effort or to quit.

This study is not the first to report self-control's predictive power on outcome over and above measured behavior. Crescioni et al. (2011) ran a six-week weight-loss intervention that included group meetings and various self-regulation techniques. They found that participants with higher self-control lost more weight, but neither participants' caloric intake nor their engagement in exercise predicted weight loss after controlling for self-control. The authors suggested that this might be due to the high self-control participants' better attendance at meetings, and more marginally to more calories burned through exercise (Crescioni et al., 2011). Obviously, whereas Crescioni et al.'s (2011) findings come from a longitudinal intervention setting, the cross-sectional design of Study I does not allow any causal

conclusions to be drawn. It is thus possible that the more frequent physical activity and better fitness increase self-control. In line with this causal order, there is evidence showing that self-control (state) is a muscle-like strength that can be built (Hagger et al., 2010), and that regular physical activity improves a range of self-regulatory behaviors (Oaten & Cheng, 2006). However, this evidence provided by Oaten and Cheng (2006) is limited to task-specific self-regulatory behaviors, not to trait self-control, which was assessed here. So far, no evidence has shown that general self-regulation capacity could be increased by regular physical activity. Instead, general capacity of self-regulation has been shown to be a relatively stable trait (Mischel, Shoda, & Peake, 1988; Mischel et al., 2011).

Another study found similar results regarding the association between personality and physical fitness in an aging population (Tolea et al 2011); participants with low conscientiousness, a personality trait closely related to self-control, had lower muscle strength, but only if they also had high neuroticism. Conscientiousness by definition includes, among other things, impulse control, self-discipline, task and goal orientation, ability to delay gratification, and good planning skills (Bogg & Roberts, 2004). Findings from a meta-analysis on the association between conscientiousness and physical activity are mixed; only a weak association was reported by Bogg and Roberts (2004), while a consistent positive association was seen by Rhodes and Smith (2006). Especially, one of the five subfacets of conscientiousness, self-discipline (i.e. corresponding to self-control), seems to explain a large part of the association between conscientiousness and physical activity (Hagger-Johnson & Whiteman, 2007; Weiss & Costa, 2005).

The impact of self-discipline on one's life goes beyond what is discussed above; scoring high on self-discipline even predicts lower mortality (Weiss & Costa, 2005). Weiss et al. (2005) suggested that the positive effects of the subfacet of self-discipline may be explained by findings that people with higher self-discipline engage in a variety of health-promoting behaviors and tend to avoid or minimize health-damaging behaviors. The above findings might be relevant to the present study; a closer look at the measure of self-discipline reveals many similarities with the self-control measure that we used (see Appendix) (e.g. "Get chores done right away", "Start tasks right away", "Carry out my plans").

All in all, there is more evidence in the literature to support a causal order where high self-control leads to healthy behaviors, rather than the other way around. The next study investigated the process in this sequence more closely. In that study, self-control was not only associated with eating more healthy foods but also eating less unhealthy foods. This finding is in line with earlier literature (Gerrits et al., 2010; Sproesser et al., 2011; Wills et al., 2007). Also, the variance of eating explained purely by self-control is equal to

that reported in previous literature (de Ridder et al., 2012). One possible mechanism will be discussed next.

6.3 IS THE EFFECT OF SELF-CONTROL ON EATING MEDIATED VIA SOCIAL COGNITIONS?

Does having low self-control mean that one is forever doomed to unhealthy behaviors? As self-control is a relatively stable trait (Mischel et al., 2011), intervening on it might not be reasonable. At the very least, helping people with low self-control to change their eating requires an understanding of the mechanism underlying the healthier lifestyle maintained by people with high self-control. The results of this dissertation suggest there are more proximal social cognitions that explain the effect of self-control, and they might be more feasible targets for interventions.

Higher fruit and vegetable consumption among young men with higher self-control was explained by more positive social cognitions in the HAPA-model. More specifically, the young men with higher self-control who participated in this study had higher self-efficacy and exhibited more confidence in keeping up their healthy diet even under social pressure or strain. They also had more favorable outcome expectations; they did not believe they would face social pressure if they ate healthy foods and they thought healthy foods tasted better. They also did not consider healthy eating as burdensome and had slightly better expectations of the physical well-being that eating healthy foods might bring. Men with higher self-control also had higher risk perceptions, and they recognized that unhealthy eating has negative consequences on one's health. Higher self-control did not, however, predict risk perceptions on weight gain from eating unhealthy foods. Higher intentions to eat fruit and vegetables were partly explained by self-control and partly by the above-mentioned social cognitive components. Men with higher self-control also engaged in more careful planning of their healthy eating and made more coping plans to overcome barriers to eating healthy foods. In explaining the eating of fruit and vegetables, self-control was most strongly related to the emotional barrier to self-efficacy and action planning.

Self-control regarding fast food consumption was also explained by social cognitions, similarly to fruit and vegetable consumption, but with a lower magnitude and only partially. Wills et al. (2007) found no association between good self-control and saturated fat intake, but the association between poor self-control and saturated fat intake was significant, and was slightly stronger among males than females. The finding that the HAPA-model explained only partial mediation of the effect of self-control on fast food consumption can be understood in light of the results from the meta-

analysis by De Ridder and colleagues (2012). They found that the effects of self-control on undesirable behaviors were slightly less consistent than the effects of self-control on desirable behavior, although there was no difference in the effect sizes (de Ridder et al., 2012). The authors suggested undesirable behaviors might be more amenable than others to self-control. Many of the desirable behaviors are unambiguously desirable (such as getting good grades, happiness, or psychological adjustment). Similarly, many of the undesirable behaviors are unambiguously undesired (like violent crime), but many "undesirable behaviors" may include desirable aspects as well. For example, one might enjoy the immediate consequences of smoking or the taste of fast foods. Also, undesirable behaviors might be associated with pleasant social situations. If they are not perceived as something that should be avoided, the behavior does not require self-control.

In the garrison, conscripts are provided with four meals that should satisfy their physical needs. Buying fast foods happens often in social situations where peers are involved and unspoken peer pressure for "masculine" unhealthy food choices is present (Hoikkala et al., 2009). The sample of the present study consists of men only and the magnitude of the association is similar to that found by Wills et al. (2007). In the study here, intention predicted fruit and vegetable consumption with a medium magnitude, but had only a small role as a predictor of fast food consumption. Planning had none or only a small predictive power on fast food consumption. It is possible this might be due to operationalization of the planning questions that assessed eating in general, but not plans to eat fruit and vegetables or fast foods. It is also possible that choosing fast foods is a more heuristic process and relies on environmental cues (like physical and social environment) that actually might require more impulse control. Ability for self-control includes cognitive components, but it also involves automatic processes. Considering that the HAPA-model measures rational, cognitive components, it is not surprising that it does not fully explain the association between self-control and fast food consumption, at least in this population. It also very likely that there are other factors, like hunger, present in a situation where fast foods are easily available (as in Soldiers' home cafeterias), explaining behavior over and above social cognitive factors (Dohnke et al., 2015). It might also be that the obtained results would be different in different age groups and in different social environments.

Also, explanations can be sought from mediational paths; the effect of self-control on fruit and vegetable consumption was largely explained by stronger self-efficacy to resist peer pressure and taste outcome expectation that led to behavior through stronger intention. The mediation also occurred via intention directly and through action planning. For fast food consumption, only one indirect path was significant; participants with lower self-control expected healthier foods to taste bad. This led to a lower

intention to avoid fatty foods and snacks, which in turn predicted higher fast food consumption. Although it makes sense that people make more impulsive choices with unhealthy foods if they think that healthy foods taste bad, it is very unlikely that higher self-control itself would make healthy foods taste better. More likely, people with high self-control have already followed healthier diets, and hence, are more used to the taste of healthy foods. A very recent study pointed out that eating intentions should be investigated on a within-subject level (Inauen, Shrout, Bolger, Stadler, & Scholz, 2016) because intentions were found to be far more predictive when they are stable (Inauen et al., 2016). For the reasons mentioned above, intentions to avoid fast foods among young people may not be as stable and are thus not as predictive of eating as the intention to eat fruit and vegetables.

6.4 EATER PROTOTYPES AND THEIR ASSOCIATIONS WITH EATING

In this study, 12 prototype factors were found (Self-regulation, Social status, and Appearance in Vegetable chooser, Vegetable abstainer, Fat abstainer, and Fat chooser)). Supporting previous studies (Gerrits et al., 2009; Gerrits et al., 2010), healthy eater prototypes in this study were evaluated more positively than the respective unhealthy eater prototypes, i.e. a vegetable-choosing peer was rated more positively than a peer abstaining from vegetables, and a fat-abstaining peer was rated over a peer choosing fatty foods. Of special interest here was whether the abstaining or choosing nature of the behavior impacts on prototype evaluations. It should be noted that Prototype-willingness model was developed to predict adolescents' risk behavior such as drinking alcohol, smoking, or using drugs (Gerrard et al., 2008; Gibbons & Gerrard, 1995). In such risky behaviors as smoking, abstaining equals healthiness and choosing equals unhealthiness. But in terms of eating, one can either choose or abstain from both healthy foods and unhealthy foods.

In Study III, the healthy eater prototypes were seen as more self-regulative and better looking (positive) irrespective of whether they abstained from unhealthy foods (i.e. fast foods) or chose healthy foods (e.g. vegetables) compared with the respective unhealthy eaters. However, in the Social standing factor the unhealthy Fat chooser prototype was rated over the healthy Fat abstainer prototype. This finding might either reflect the context (in a closed environment with peers) of the participants (discussed next), or it might reflect the positive ratings given to unhealthy eaters that are related to sociable factors (Fries & Croyle, 1993; Gerrits et al., 2009). Perhaps a peer making an explicit effort to abstain from an unhealthy choice is not considered good company. The magnitudes of the correlations between chooser and abstainer prototypes suggested that abstaining and choosing are

indeed related, but are also separate concepts, not just the different ends of a continuum.

Two findings were especially relevant when thinking about health promotion in this specific setting: First, healthy eaters – both choosers and abstainers – were seen as less masculine than unhealthy eaters. This is in line with previous studies linking masculinity to unhealthy behaviors (Courtenay, 2000). Second, the fast food chooser was perceived more positively than the fast food abstainer. Considering that the participants' environment is a garrison containing over 1000 peers (and 98% of them males), with a strong emphasis on masculinity and communion in the military culture (Hoikkala et al., 2009), peer pressure is probably constantly present.

The magnitudes of the associations obtained with eating in this study were similar irrespective of chooser or abstainer status. Rather than choosing or abstaining, the associations were slightly but consistently stronger with healthy foods than with unhealthy foods. This actually contradicts the results of a meta-analysis suggesting that prototypes have shown a stronger association with behavior for health risk prototypes than for health protective prototypes (van Lettow et al., 2014). Although there is at least one study with similar findings in the context of eating (Gerrits et al., 2009), there are other studies demonstrating associations between both unhealthy and healthy prototypes and eating (Steinhilber et al., 2013). Also, the present study is not the first to find that the prototypes related to healthy foods had stronger associations with behaviors than those related to unhealthy foods; a similar finding was presented earlier by Dohnke et al. (2015). The present study found that associations with fast food consumption were lower than associations with fruit and vegetable consumption. In Study II, intentions predicted fruit and vegetable consumption, but not fatty food consumption. Dohnke et al.'s (2015) paper combines these results. They found that both prototypes and intention predicted general eating, but not snack consumption. Snack consumption was instead predicted by willingness and hunger. That finding might explain the smaller magnitudes of the associations obtained with fat prototypes and fast food consumption in this study.

6.5 CAN INTERVENTION WITH SOCIAL IMAGES (PROTOTYPES) CHANGE EATING BEHAVIOR?

Apparently, the present study was the first scientific study that evaluated a theory-based intervention that targets prototypes and health behaviors by poster campaign. The aim was to promote images of a vegetable-eating peer

to increase vegetable consumption. The results indicated that military service has a negative effect on some prototypes; evaluation of Vegetable chooser Self-regulation decreased, and evaluations of Vegetable abstainer Self-regulation and Appearance increased during military service, but the intervention managed to slow down the negative development. In the intervention group, the negative development of Vegetable abstainer Self-regulation and Appearance was not as steep as in the control group. Also, it was shown that although the Vegetable chooser prototype factors were not affected by the intervention among all participants, the Vegetable chooser Self-regulation prototype intervention's positive effect took place mostly among the more educated participants.

There were educational differences not only in participants' vegetable consumption levels, but also in their prototype perceptions (those with higher education favoring health). This may reflect identity-based motivation, i.e. the process by which content of social identities influences beliefs about in-group goals and strategies (Oyserman, Fryberg, & Yoder, 2007; Oyserman, Smith, & Elmore, 2014). The prototypes assessed perceptions of "a typical conscript". It is interesting that the educational differences were seen at the prototype level despite the military environment striving to create social uniformity (among persons of the same rank).

Previous studies that have managed to impact peer evaluations have included some tasks or cognitive effort (Andrews, 2011; Blanton et al., 2001; Teunissen et al., 2014). In the present study, the changes in intentions were only associated with changes in fruit and vegetable consumption in the intervention group. Also, the change in the Vegetable chooser prototype was associated with a more positive change in intentions, suggesting that some cognitive processing occurred. Some materials did include stories containing persuasive messages, but the participants were not given any tasks other than filling in questionnaires and they were unaware of the association between the intervention materials and the study that they attended.

Military service had a negative impact on vegetable consumption that declined during the six months in service. The intervention was able to slow the negative development. The changes were similar irrespective of participants' education. The effects obtained with the intervention were minor. It is reasonable to raise the question that would the effects have been greater had the intervention been more intensive (e.g. larger dose of a variety of prototype-targeting images), using different graphics (e.g. not comic books, but photos), or additionally targeting the cognitive-reflective route (e.g. information and self-regulation techniques that have been used successfully by, for instance, Stadler, Oettingen, & Gollwitzer (2010)), or perhaps targeted to a more limited group (e.g. those with the worst eating habits)? However, in these particular circumstances, the research group

needed to build an intervention that could be applied to the environment without burdening the resources of the Defense Forces. Drawing a sample of a high-risk population (e.g. from those reporting no/rare vegetable consumption) would have taken hours from the conscripts' service. It was also known that conscripts eat vegetables on an average of 2.5 days/week (SD = 2.0) (Absetz et al., 2010). Compared with nutrition recommendations (National Nutrition Council, 2005), the whole population was in need of an intervention. The poster campaign was a cost-effective means of reaching the target group.

6.6 STRENGTHS AND LIMITATIONS OF THE STUDY

The sample consisted of young males only in a fairly unusual environment. Although the military environment may have an impact on some of the results, the results can, with some caution, be generalized to the healthy age group, as at the time that the data were collected over 80% of each age group entered military service, and nearly 80% completed it. The rest either apply for non-military service for ethical or religious reasons or are exempted (Defence Command Public Information Division, 2013). No previous studies in Finland have inspected psychosocial factors in such a large sample of healthy men from various socioeconomic backgrounds in this age group.

Many of the variables investigated were collected by self-reported questionnaires. Given the resources, using self-report measures in a large sample was necessary. Other studies have shown adequate validity of the questionnaire-based measures used in this study. For instance, validity of the original self-control scale has been demonstrated (Tangney et al., 2004). Also, the food frequency measure was carefully planned to cover the Finnish diet consumed by young men in garrisons and in civilian life (Bingham et al., 2011). As the measure ("on how many days did you consume…") distinguishes between those who eat either many or large portions per day, we calculated control analyses where the last portion size was taken into account and found that the results remained similar. Another strength of the present study was to be able to use objective measures for adiposity and fitness in such a large sample of participants.

The missing value analyses showed that participants who dropped out within the first eight weeks scored lower on trait self-control, reported more inconvenience in healthy eating, were more likely to think healthy foods taste bad, and had lower health risk perceptions of unhealthy eating. This bias was not taken into account in the analyses. Thus, it is possible that including the missing status into the model might have affected the results.

The cross-sectional design of Studies I and III limits the causal interpretation of the results. There has been less discussion of the mechanisms of self-control. One possible mechanism is discussed in the present study, but there might be more dynamic processes related to self-control; it is not the only possible interpretation of the results that scoring high on self-control is a resource for more frequent physical activity and better fitness. It may also be that being more active and fit bring more energy, thus facilitating the life of those with high self-control. Also, young people are responsive to cultural norms, but it is also plausible to assume one's own eating habits shape the prototype perceptions, i.e. people give more positive evaluations to those who are similar to themselves.

The eigenvalues of the explanatory factor analysis were not exactly alike for all four prototypes (a three factor solution for, Vegetable abstainer and Fat chooser; and a four factor solution for Vegetable chooser and Fat abstainer) and thus, a composite score factors were used. Also, not all Cronbach's alphas were ideal. However, the results of the Confirmatory factor analysis were satisfactory and the structure enables comparing unhealthy and healthy prototypes more accurately than using one composite score for all items.

Another limitation concerns the measurement of the prototypes. Some power was lost as each participant answered either on Vegetable chooser and abstainer prototypes or on Fat chooser and abstainer prototypes. This means that the analyses for vegetable and fat prototypes were run on separate samples, and thus, they have not been compared with each other. It might have been useful to run analysis for all 12 factors in the same model. However, previous literature suggests prototypes predict the respective eating style only, i.e. unhealthy eater prototype predicts unhealthy eating and healthy prototype healthy eating (Gerrits et al., 2009). The decision to limit prototype measurements to either vegetable or fat made the questionnaire more respondent-friendly.

Socioeconomic status was assessed by enquiring about participants' highest education to date. The use of a dichotomous variable (1. Lower education = secondary school/ vocational training, 2. Higher education = Upper secondary or higher) may underestimate the possible effects of education. However, as only approximately 10% of the participants had completed secondary school alone, a dichotomous variable was computed. Mother's highest education was measured, but since preliminary analyses yielded similar results as for a participant's own education, it was left out.

Some limitations concern intervention materials. The social status factor was not affected by the intervention. Slight effects were seen on Appearance and Self-regulation factors. To ensure material content, a pilot test with

target group commenting (thinking aloud) on the materials might have improved their content. However, the obtained changes followed theoretical expectations, i.e. managed to halt the unhealthy effect.

Previous studies measuring eater prototypes (e.g. Gerrits et al., 2009; Gerrits et al., 2010) have used a 7-point scale. The present study used a five-point scale, hence decreasing the potential variance. Both of these factors have probably contributed to the magnitudes of the associations between prototypes and eating being only moderate at best. Again, however, the directions found are in line with the theoretical expectations.

The final limitation is that the whole Prototype-willingness model was not covered in this study. Especially, the roles of willingness (Todd et al., 2014) and prototype favorability (van Lettow et al., 2014) might have added to knowledge about fast food consumption. Moreover, fast food consumption is likely to be mostly affected by hunger (Dohnke et al., 2015) and other situation-specific cues, which were not investigated in this study.

6.7 IMPLICATIONS FOR RESEARCH

The present study has raised some further questions, and several suggestions for future research questions can be made. The existing association between self-control and aerobic fitness after controlling for LTPA and BMI left open questions. Future research should address the mechanism more thoroughly; is LTPA of people with high self-control more focused on aerobic exercise than LTPA of people with low self-control? Do they carry out the reported LTPA at a higher intensity than those with lower self-control, as reported by Crescioni et al. (2011), or do they behave differently in the test situation in terms of effort and perseverance? Another potential explanation is differences in sedentary behaviors. Wills et al. (2007) found that adolescents with high self-control reported less screen time, while low self-control was associated with more screen time. The present study did not assess sedentary behaviors. It is plausible that inclusion of sedentary behaviors in the model would have diminished the effect of self-control. Understanding the mechanisms of self-control on health behaviors as well as health behavior outcomes would provide tools for health promotion.

Recently, there has been theoretical discussion on the multiple pathways from self-control to health behaviors (Hagger, 2014; Hagger, 2013). Hagger suggested a moderating effect of self-control in addition to mediation of self-control by other factors (Hagger, 2014). This model assumes that self-control moderates the effect of intention on behavior (i.e. intention-behavior gap is lower in people high in self-control). While this pathway makes common sense, it should be tested empirically as well. This would yield information for intervention planning, as it might provide an opportunity to target people

whose strong intentions have not translated into action (Hagger, 2014). Thus, future studies should verify first that the suggested moderative pathway exists, and then test whether the moderating effect of self-control on the intention-behavior gap can be buffered by post-intentional tools (Hagger, 2014) such as action planning.

Self-control contains elements that are assumed to influence both automatic and deliberative decision-making. To depict both pathways, the self-control scale contains an impulsiveness/impulse control factor and factors that reflect contemplation and reflective decision-making. In the present study, the reasoned decision-making path (HAPA-model) and automatic social images path (prototypes) were not combined. The results of this dissertation encourage combining prototypes with HAPA when predicting fruit and vegetable consumption. Fat chooser and Fat abstainer prototypes' small or non-existent associations with fast food consumption imply that combining both routes in this population might not bring any additional knowledge. This reasoning is supported by Dohnke et al. (2015), with the whole Prototype-willingness model predicting general eating, but not snack consumption. As discussed above, it seems that fast food consumption among young men includes either a cognitive component that our measures did not reach or is determined by self-control failure or more automatic factors (like contextual or environmental cues). The results for prototypes do not encourage combining prototypes with fast consumption.

The results of Gerrits et al. (2010) suggest that only healthy eater prototypes, are associated with self-control. The model suggested by Hagger (2013) might also provide future information on the association between prototypes and eating. The model suggests five pathways between self-control and health behaviors. The first pathway is a direct one, the second is mediated by intentions, and the third is mediated by implicit motives. The fourth pathway was explained above; it assumes that self-control moderates the intention-behavior gap. The fifth pathway suggests that self-control would also moderate the association between implicit motives and health behaviors (Hagger, 2013). In the context of prototypes this would mean that individuals with low self-control were more susceptible to prototypes. It is already known that prototypes have both indirect and direct pathways to eating behavior (Dohnke et al., 2015), but this suggested pathway should be tested as well.

Many health campaigns are built around risk messages: if you do not adopt healthy behaviors, you are at an increased risk for adverse health outcomes. In a population-level intervention for conditions where risks for most people are neither immediate nor very high, this approach might not be very effective. How to motivate people whose risks will only increase decades later and who do not necessarily perceive a need for change? And how to reach those with lower education and unhealthier social images and habits?

One suggestion follows Oyserman, Smith, and Elmore's (2014) views that identities are created by changing structural factors; providing equal assets or at least personal control by increasing heath behaviors and reducing beliefs that healthy behaviors are for the middle class only. This requires actions and research beyond the individual level. On a smaller scale for changing behaviors through social images of healthy or unhealthy actors (or abstainers), research needs to learn from marketing and advertising strategies. They are often built on prototypes; the implicit message is that by using a certain product one gains characteristics that are desirable. Based on the obvious evidence of successful marketing, it may be worthwhile targeting prototypes.

In this study, all social cognition measures were related to eating. There were no assessments of self-efficacy, outcome expectancies, risk perceptions, intentions, or planning related to physical activity. It remains a question for future studies to investigate whether the HAPA-model mediates the association between self-control and physical activity.

7 PRACTICAL IMPLICATIONS AND CONCLUDING REMARKS

The current environment of young people, not only those in military service, makes unhealthy food choices easy. This ease combined with increased sedentary behaviors have led to increased BMI among young men (Santtila et al., 2006). Societal and community-level health promotion actions are therefore vital. Providing an environment that supports less sedentary behaviors, more physical activity, less cues to unhealthy eating, and more healthy food choices is the key factor for effective health promotion. The DefenceNutri Supply intervention (Bingham et al., 2012) changed the food supply in garrisons. These changes included not only providing healthier foods but also "nudging" the conscripts towards healthier choices by better displaying the healthy foods and changing the content of the foods (e.g. adding flours containing more fibers). However, understanding individual determinants of health behaviors and health outcomes enables interventions for different target groups and individual-level support.

The findings of the present study confirm the advantages that high self-control brings to the individual. Previous studies have focused on proving the association between self-control and health behaviors. Focusing on the impact of self-regulation capacity can be more of a hindrance than a promoter from the in health perspective, as the implicit message is that people with low self-control are doomed. Study II showed that a higher level of fruit and vegetable consumption was actually explained by social cognitive factors that we know can be promoted (Wiedemann, 2009). The results from Study II are encouraging for those working in individual-level health promotion.

Study III provided new information on eater prototypes; healthy eaters are perceived more positively, but abstaining from foods, even unhealthy foods, may cause social pressure among young men. Combining this finding with findings of Study II then suggests that when intervening on young men's health behaviors, social pressure from peers should be taken into account. For example, many campaigns visible to young people as well as health information provided concentrates merely on facts, i.e. the importance of eating healthy foods and being physically active. Study IV made an attempt to meet this challenge by promoting vegetables relying merely on the automatic decision-making path rather than on providing information. This dissertation shows that our health behaviors arise from the interplay between our personalities, rational decision-making, and more automatic decision-making.

8 APPENDICES

8.1 PSYCHOSOCIAL MEASURES

Appendix 1. Self-Control: Please answer the following items as they apply to you.

	Not at all true	Barely true	I don't know	Mostly true	Always true
1) I have a hard time breaking bad habits.	❑1	❑2	❑3	❑4	❑5
2) I say inappropriate things.	❑1	❑2	❑3	❑4	❑5
3) I never allow myself to lose control.	❑1	❑2	❑3	❑4	❑5
4) I have trouble saying no.	❑1	❑2	❑3	❑4	❑5
5) I change my mind fairly often.	❑1	❑2	❑3	❑4	❑5
6) I blurt out whatever is on my mind.	❑1	❑2	❑3	❑4	❑5
7) People would describe me as impulsive.	❑1	❑2	❑3	❑4	❑5
8) I refuse things that are bad for me.	❑1	❑2	❑3	❑4	❑5
9) I am good at resisting temptation.	❑1	❑2	❑3	❑4	❑5
10) I get carried away by my feelings.	❑1	❑2	❑3	❑4	❑5
11) I do many things on the spur of the moment.	❑1	❑2	❑3	❑4	❑5
12) People would say that I have iron self-discipline.	❑1	❑2	❑3	❑4	❑5
13) I'm not easily discouraged.	❑1	❑2	❑3	❑4	❑5
14) I have trouble concentrating.	❑1	❑2	❑3	❑4	❑5
15) I'm able to work effectively towards long-term goals.	❑1	❑2	❑3	❑4	❑5
16) Sometimes I can't stop myself from doing something, even if I know it's wrong.	❑1	❑2	❑3	❑4	❑5
17) I often act without considering all of the alternatives.	❑1	❑2	❑3	❑4	❑5
18) I lose my temper easily.	❑1	❑2	❑3	❑4	❑5
19) I often interrupt people.	❑1	❑2	❑3	❑4	❑5
20) I sometimes lose self-control with intoxicants.	❑1	❑2	❑3	❑4	❑5

Self-efficacy:

Most people try to avoid or reduce some foods because they consider them unhealthy or fattening. Sometimes such temptations are difficult to resist due to different barriers. How certain are you that you can overcome the difficulties below?
« I would stick to my intentions even when I. . . »

Emotional barriers to self-efficacy:
« …have problems and worries »
« …am depressed and blue »
« …feel tense »
« …am tired »
« …am busy »

Social self-efficacy:
« …have to behave in a different way than my friends »
« …even when my friends make remarks on my diet »

Outcome expectancies:

« If I eat healthy food — low-fat, low-salt, lots of vegetables — the consequences are… »

Physical well-being:
« …my looks will improve »
«…I won't suffer from weight problems »
« …I will have more energy »
« …I will be in better physical shape »

Inconvenience:
«… I will have to go through a lot of trouble in considering what to eat »
« …buying the right products will be inconvenient »

Social:
« …my friends will think that I am feminine/womanish"
« …my friends will mock me »

Bad taste:
« …food will not taste good »
« …food will taste better »

Risk perceptions:

« If you think of yourself and your military service, how likely is it that… »

Weight gain:
«… your weight will increase »
« …your weight will decrease »

Health problems:
« …your cholesterol level will increase »
« …you will have a heart attack »
« …your blood pressure will increase »

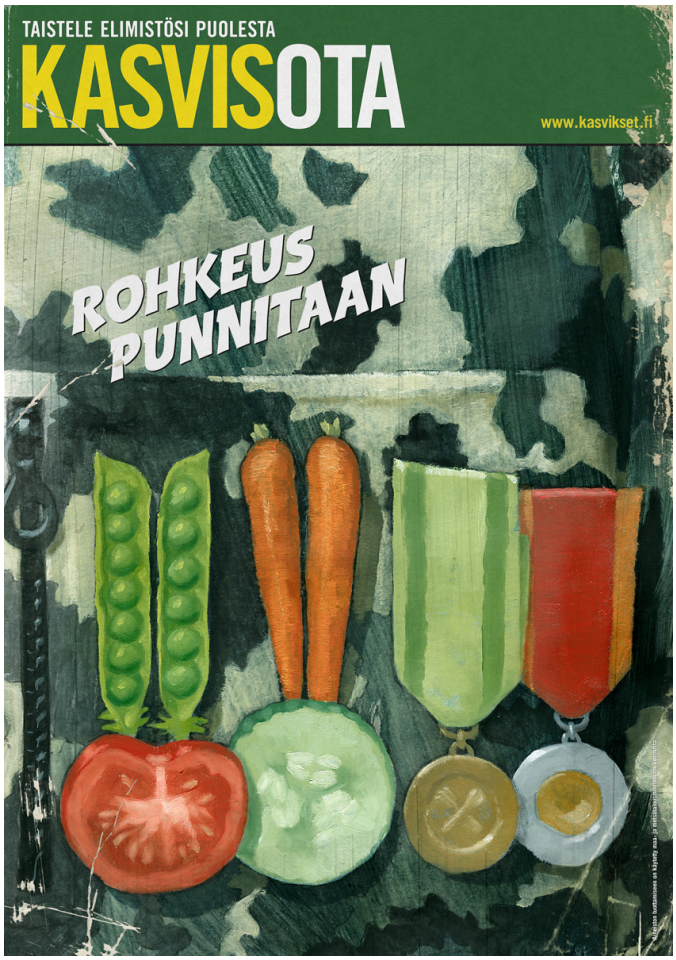
Planning:

« The following questions relate to how you plan your eating. I usually plan beforehand.. »

Action planning:
« …what time I eat »
« …where I eat »
« …what I eat »
« …how much I eat »
« …how often I eat »

Coping planning:
« …what to do when something interferes with my plans »
« …how to cope with setbacks »
« …how to hold onto healthy eating habits »
« …when to be especially alert to avoid relapse »

8.2 INTERVENTION MATERIALS



Picture 1 Intervention materials, poster 1.

Picture 2 Intervention materials, poster 2.

Picture 3 Intervention materials, comic strip 1.

Picture 4 Intervention materials, comic strip 2.

Picture 5 Intervention materials,comic strip 3

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