The Role of Sociodemographic Factors and Food Choice Motives in Vegetable, Fruit, and Berry Consumption – Does Financial Situation Moderate the Motives' Associations among Private Sector Service Workers?

Master's thesis

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Tiivistelmä – Referat – Abstract

Background: Consumption of vegetables, fruits, and berries (VFB) is connected to better health. However, most Finnish adults fail to consume the recommended 500 grams a day. Service workers share risk factors for poor financial situation and low socioeconomic status (SES). Low SES is often perceived as a barrier to healthy eating and is associated with low intake of VFB. Food choice motives (FCMs) are associated with dietary choices.

Aims: This thesis aimed to investigate, how sociodemographic factors and VFB consumption are associated. Another aim was to research, if service working adults' FCMs of eating "healthy", "locally grown", "environmentally friendly" and "rich in VFB" diet are associated with their VFB consumption and if income level or self-perceived adequacy of income moderate the associations.

Materials and Methods: The data was gathered in 2019 from PAM members (N=6435) with a questionnaire and data provided by Statistical Finland from 2019 connected to the questionnaire answers. VFB consumption frequencies and sociodemographic variables were studied with one-way ANOVAs. VFB consumptions, FCMs, and income levels were analysed with correlations. Linear regression models were built for FCMs and VFB consumptions and adjusted with two sets of sociodemographic factors. The first models of VFB consumption and absolute FCMs were moderated with income level and income adequacy.

Results: Women, married and university-level educated participants, participants considering themselves healthy and reporting adequate income consumed more VFB than their counterparts. FCMs correlated with VFB consumptions and were able to explain 10-20% of their variation. Self-perceived adequacy of income did not moderate the associations. However, the interaction effect of income level was significant with FCM "healthy" $p<0.01$ and with FCM "rich in VFB" $p<0.01$ and berry consumption. Those with higher income levels ate more berries when the FCMs were reported as unimportant, but less when the FCMs were reported as very important, compared to those with lower income levels.

Conclusions: Even though the participants had financial difficulties, the FCMs were associated with the service workers' VFB consumption. The interaction effect of income level was significant with FCMs "healthy" and "rich in VFB" and berry consumption.

Avainsanat – Nyckelord – Keywords
food choice motives; fruit and vegetables; berries; vegetable consumption; working poor; financial difficulties; service working adults

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Ruoanvalintamotiivien ja sosiodemografisten tekijöiden rooli kasvisten, hedelmien ja marjojen kulutuksessa – moderoiko taloudellinen tilanne motiivien ja kasvisten kulutuksen yhteyttä yksityisen palvelualan työntekijöillä?

Ohjaajat — Handledare — Supervisors

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Tiivistelmä – Referat – Abstract

Taustaa: Vihannesten, hedelmien ja marjojen (VHM) kulutus on yhteydessä parempaan terveyteen, mutta silti suurin osa suomalaisista aikuisista syö niitä vähemmän, kun suositellut 500 grammaa päivässä. Toisaalta palvelualan ammattilailla on monesti matala sosioekonominen asema ja matalat tulot, mitkä ovat yhteydessä matalaan VHM kulutukseen. Matalatuloisuuden koetaan usein vaikeuttavan terveellisten elämäntapojen saavuttamista ja VHM syömistä. Toisaalta ruoanvalintamotiivit (RVM) ovat yhteydessä ruokavalintoihin.

Tavoitteet: Tässä tutkielmassa haluttiin tutkia sosiodemografisten muuttujien yhteyttä palvelualan ammattilaisten VHM käyttöön. Lisäksi haluttiin tutkia RVM ”terveellinen” ”runsaskasviksinen”, ”ympäristöystävällinen” ja ”kotimainen” yhteyttä osallistujien VHM syömiseen, sekä tarkastella yhteyksiä, kun niitä moderoidaan itsearvioidulla tulojen riittävyydellä ja tulotasolla.

Materiaalit & metodit: Tutkimusaineisto kerättiin vuonna 2019 palvelualan ammattiliitto PAM jäsenistöltä (N=6435), ja tämä data yhdistettiin Tilastokeskuksen aineistoon vuodelta 2019. Sosiodemografisten muuttujien ja VHM kulutuksen yhteyttä tutkittiin ANOVA-testeillä. VHM kulutusta, ruoankäyttömotiivien ja käytettävissä olevien rahatulojen korrelaatioita tutkittiin. Lineaarinen regressiomalli rakennettiin RVM ja VHM käytön yhteydelle. Malleihin lisättiin moderaatiomuuttujaksi tulotaso, sekä tulojen riittävyys.

Tulokset: Naiset, naimisissa tai avoliitossa elävät, korkeakoulututkinnon suorittaneet, terveeksi itsensä kokevat ja riittävän tulotason raportoivat söivät enemmän VHM vastinpareihinsa verrattuna. RVM korreloivat VHM-kulutuksen kanssa ja pystyivät selittämään 10–20 % niiden vaihtelusta. Tulojen riittävyys ei moderoinut yhteyksiä. Tulotaso moderoi tilastollisesti merkitsevästi RVM:n "terveellinen" $p<0,01$ ja "runsaskasviksinen" $p<0,01$, sekä marjojen käytön yhteyttä. Korkeamman tulotason omaavat söivät enemmän marjoja, kun RVM:t "terveellinen" ja "runsaskasviksinen" eivät olleet heille tärkeitä, mutta pienemmän tulotason omaavat söivät enemmän marjoja, kun nämä motiivit olivat heille tärkeitä.

Päätelmät: Vaikka lähes puolet osallistujista arvioivat tulojensa olevan riittämättömät, RVM ja KHM käytön välillä oli yhteys. Tulotaso moderoi motiivien ”terveellinen” ja ”runsaskasviksinen” yhteyttä marjojen kulutukseen.

Avainsanat – Nyckelord – Keywords

ruoankäyttömotiivit; kasvikset ja hedelmät; marjat; kasvisten käyttö; köyhät töissä käyvät; taloudelliset vaikeudet; palvelualan ammattilaiset

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Acronyms and abbreviations

VFB	Vegetable, fruit, and berry
PAM	Finnish Service Union United
NCD	Non-communicable disease
FCM	Food choice motive
SES	Socio-economic status
T2D	Type II Diabetes

1 Introduction

Vegetables, fruits, and berries (VFBs) are recommended to be eaten in at least five portions or 500 grams a day (1), but most of the Finns fail to reach this goal (2, 3). This is a problem for public health, as VFBs contain necessary vitamins and minerals, beneficial bioactive components, and support good health (4, 5). Furthermore, and low-energy-containing VFBs are an important part of healthy dietary habits, that support body weight management and decrease the risk of disease (5, 6, 7, 8). VFBs have possible protective effects for non-communicable diseases (NCDs), including coronary heart disease (5, 7, 8), cardiovascular diseases (7), strokes (7, 8), cancers (7) and type II diabetes (T2D) (9, 10, 11, 12, 13). Healthy dietary habits and sufficient VFB consumption are also beneficial for metabolic health (9), mental health (14), and diverse gut microbiome (15). Sufficient VFB intake does not only support health but eating more plant-based foods could help reduce CO2 emissions of food, as plant-based foods often produce low greenhouse gas emissions (GHE) (16).

This thesis focuses on the Finnish Service Union United (PAM) members' VFB consumption and food choice motives (FCMs). PAM is a trade union for employees working in private sector service jobs, including retail trade, property services, security services, tourism, restaurant, and leisure services (17). Adult service workers are a heterogeneous group, but many working in this sector suffer from involuntary part-time employment contracts and low salaries (18), which puts the workers at risk of having financial difficulties and food insecurity (19). Moreover, Finnish service workers often share other risk factors for the poor financial situation, including low education, migrant background, and female gender (17, 18). Lower socioeconomic status (SES) including education level, income, and occupation (20), is known to be associated with less beneficial dietary habits (21, 22), and lower consumption of VFB (3, 20, 21, 22, 23). Individuals of low SES are also more often obese (22, 24), have a higher risk of several NCDs (25), smoke more often, and practice less physical activity (7). Other sociodemographic factors associated with VFB consumption include sex, age, ethnicity, marital status, and parental status (2, 20, 26, 27). For example, women eat often more VFBs than men, and fruit and berry intakes tend to increase with age (2, 28, 29). Difficulties in VFB consumption for low-income population include that VFB are often perceived to be expensive (30), access to VFB might be limited and VFB are thought to be inconvenient to store and consume (20, 30, 31). In general, healthy diets are found to be more expensive than those with lower nutritional quality (30), which could explain some of the rising health polarization. However, vegetarian diets could be even cheaper than traditional diets in high-income countries such as Finland (32).

On the other hand, lower VFB intake by low-income groups is not only caused by the VFBs' lower affordability and accessibility, nor their inconvenience, but also by FCMs, beliefs, and attitudes (23). Another explanation for the polarization of health outcomes among SES groups might be different motives leading to food choices, as motives are known to be associated with dietary behavior (33, 34) and SES to be associated with FCMs (26, 33). Research shows that those having lower SES often place importance on familiarity and low cost of food while those having higher SES appreciate more food healthiness (26, 33, 35). One of the most important FCMs are "taste", "pleasure", "healthiness", "price" and "convenience" (26, 36). Furthermore, FCM "environmental concerns" has been linked to healthier food choices (37). In addition to SES, other sociodemographic factors associate with FCMs (33, 36). For example, women tend to appreciate food healthiness more than men, and the appreciation seems to increase with age and higher education (33, 36). On the other hand, for younger people and men "low cost of food" seems to be more important than for women and older people (33, 38).

This thesis was written to understand if several sociodemographic factors are associated with VFB consumption among private sector service workers, and if FCMs "environmentally friendly", "healthy", "locally grown", and "rich in VFB" are associated with their VFB consumption. The aim was also to investigate if the FCMs interact with income level or self-perceived adequacy of income when predicting VFB consumptions, or if the associations of the FCMs and VFB consumptions remain unchanged regardless of income variables.

2 Literature Review

2.1 Literature search

This thesis is focused to study service working adults' sociodemographic factors, FCMs and VFB consumption. PubMed, Scopus, and Helka were used for searching relevant studies for the literature review. Search criteria included VFB consumption with health and disease risks, diet characteristics, and VFB consumption with demographic factors including age, sex, marital status, parental status, SES, education, income and self-perceived income adequacy, employment status, and self-perceived health. The search was also done for VFB pricing and accessibility and VFB consumption with attitudes, motives, and values. Many studies focused on vegetable, fruit, and berry consumption together, but several also studied vegetable, fruit, or berry consumption separately. Some studies included berries in the "fruit" category, and "vegetable" categories included many types of vegetables, such as root vegetables and leafy vegetables. Multiple searches were performed in the databases, and the searches included clinical trials, meta-analyses, reviews, and systematic reviews. Newest research was preferred, but final set of literature included studies from 1995 to 2023. Studies were in both Finnish and English language and studies were excluded that were implemented exclusively for the elderly or teenagers. In addition to scientific articles, electronical articles and documents were used from PAM's database.

2.2. Vegetable, fruit, and berry consumption and health

2.2.1. Health benefits of vegetable, fruit, and berry consumption

VFB have a low energy density, are rich in fiber, and include essential vitamins and minerals (4, 39). Moreover, VFB contain bioactive components, some of which are beneficial to human health (4, 5). Increased VFB consumption has been found to improve overall diet quality, by increasing micronutrient, fiber, and carbohydrate intakes, and decreasing fat intake while not significantly changing the diet's energy content (4). Also, individuals having diets close to dietary recommendations have been found to have a more biodiverse gut microbiome than those with lower diet quality (15), which is beneficial for health. Higher intake of VFB is associated with higher levels of Vitamin C, carotenoid (31, 39), and folate (31) biomarkers, which are all beneficial to health. Especially Vitamin C present in many plant products has been found to explain some of the health benefits, and for example, sufficient Vitamin C levels have been found to associate with an 18% lower risk ratio for type II diabetes (39). However, these changes might be dependent on what foods are replaced by VFB, and if those foods are beneficial for health or cause rather unfavorable health effects. Moreover, the health benefits of VFB might be partly caused by good overall diet quality which VFB consumption indices and/or higher micronutrient intake from the overall diet, which includes also VFB (4). High VFB consumption is often associated with other beneficial lifestyle factors, such as a lower prevalence of smoking, higher levels of physical activity, lower alcohol consumption, and altogether a healthier diet, including less consumed red meat (7). These habits could confound some results regarding the health benefits of VFB.

2.2.2. Vegetable, fruit, and berry consumption, and the risk of disease

The association of VFB consumption and health has been widely studied, and high VFB consumption is associated with a lower risk of several diseases (7, 8, 11, 12, 13). Increased VFB consumption has been found to change several nutrient biomarkers more favorable in adults (31). Disease risk prevention of several individual VFB by Aune et. al. (7) and Muraki

et. al. (11) is presented in table 1. Low vegetable intake is a risk factor for coronary heart disease, ischemic strokes, and hemorrhagic strokes (8). Up to 800 g of fruits and vegetables a day has been found to reduce the risk of coronary heart disease, strokes, cardiovascular diseases, and all-cause mortality (7). Vegetable, fruit, and berry consumption have been also found to be associated with disability-free life and longer life expectancy in European adults (40). Coronary heart disease risk is reduced by the consumption of apples, pears, citrus fruits, green leafy vegetables, beta-carotene-rich fruits, and Vitamin C-rich fruits and vegetables (7). Stoke risk was reduced by the consumption of citrus fruit, green leafy vegetables, and Vitamin C-rich plants (7). Furthermore, the consumption of two apples a day has been found to improve cardiovascular health and serum cholesterol (41). Especially higher intake of cruciferous vegetables and green-yellow vegetables were found to reduce total cancer incidence (7). Furthermore, total cancer incidence was found to be reduced when consuming more cruciferous vegetables, and mortality to decrease by higher consumption of berries, apples, pears, green leafy vegetables, cruciferous vegetables, and potatoes (7). Consumption up to 600 g/day of VFB has been found to reduce total cancer risk, in both incidence and dose-response studies (7).

Table 1. Some individual vegetables, fruits, and berries and their disease risk ratios (95% CI) by Aune et. al. (7), and Muraki et. al. (11).

	Type II diabetes [b]	Cardiovascular diseases [a]	Total strokes [a]	Total cancer [a]	All-cause mortality [a]
Berries	0.74^{300g} (blueberries)	1.02^{hl} / 1.13^{100g}	0.98^{hl}/1.07^{100g}	-	0.91^{hl} / 0.95^{100g}
Apples & Pears	0.93^{300g}	0.86^{hl} / 0.92^{100g}	0.88^{hl}/0.94^{100g}	-	$0.80^{hl,\ 100g}$
Bananas	0.95^{300g}	-	-	-	-
Citrus fruits	-	0.78^{hl} / 0.92^{100g}	0.74^{hl} / 0.78^{100g}	0.97^{hl} / 0.99^{100g}	0.90^{hl} / 0.94^{100g}
Green (leafy) vegetables	-	0.84^{hl} / 0.83^{100g}	0.88^{hl} / 0.73^{100g}	0.86^{hl} / 0.91^{100g}	0.92^{hl} / 0.78^{100g}
Beta-carotene rich VFB	-	0.96^{hl} / 0.94^{100g}	-	-	-
Vitamin C rich VFB	-	0.91^{hl} / 0.95^{100g}	0.8^{hl} / 0.92^{100g}*	-	-
Green-yellow vegetables	-	-	-	0.88^{hl}/0.89^{100g}	-
Cruciferous vegetables	-	0.88^{hl} / 0.89^{100g}	0.97^{hl} / 1.04^{100g}	0.84^{hl} / 0.91^{100g}	0.88^{hl} / 0.90^{100g}
Potatoes	-	$1.01^{hl,\ 100g}$	0.94^{hl} / 0.98^{100g}	1.02^{hl} / 0.99^{100g}	0.78^{hl} / 0.91^{100g}
Canned fruits	-	1.23^{hl} / 1.30^{100g}	-	0.90^{hl} / 0.82^{100g}	1.13^{hl} / 1.14^{100g}
Fruit juices	1.08^{300g}	0.67^{hl} / 0.99^{100g}	-	$0.99^{hl,\ 100g}$	0.87^{hl} / 0.88^{100g}

CI= Confidence interval
VFB= Vegetables, fruit, and berries
x^{hl}= high/low comparison, x^{100g} = dose-response (per 100 g / day), x^{300g} = dose-response (per 300 g / day)
*Only ischaemic stroke
[a] Study by Aune et al. (2017), [b] Study by Muraki et. al. (2013)

Berry consumption has been found to prevent type II diabetes (T2D) in Finnish adult men (12). Whole fruit consumption prevented both female and male health professionals from type II diabetes (11) and each additional 100 g of fruit has been found to reduce T2D risk by 2% (13). Fruits have been also found to have a non-linear dose-response association of 10% with increasing fruit consumption to 200-300 g/day (13). On the other hand, one systematic review concluded that only green leafy vegetable consumption was related to reduced T2D risk from fruit and vegetables (10), and another one concluded that there is no probable or convincing evidence for the protective effects of VFB against T2D (8). However, there might be a non-linear dose-response effect with 300 g/day of vegetables increasing a 9% reduction in T2D (13). Muraki et. al. (11) found in their longitudinal study that berries, bananas, grapes, and apples were significantly associated with reduced T2D when consumption of fruit juices increased the risk, which correlates with Aune et. al. (7) findings.

Increased fruit and vegetable consumption has been found to improve metabolic health in overweight or obese individuals (9). In addition, individuals having a diet closer to dietary recommendations, including eating more VFB, have been found to have a more biodiverse gut microbiome than those with lower diet quality (15). Furthermore, higher VFB consumption has been found to be inversely associated with weight gain (6). VFB could also improve mental health. In a systematic review by Dharmayani et al. (14) results of fruit and vegetables associations with depression suggested that higher VFB consumption would be inversely associated with risk of depression (14).

2.3. Factors associated with vegetable, fruit, and berry consumption

Finnish adults do not eat VFB according to recommendations (2). In Finland, the National recommendation for VFB consumption is 5-6 servings daily, which is around 500 grams of fruits, vegetables, root vegetables, berries, legumes, and mushrooms (1), but new Nordic Nutrition Recommendations (28) increase this recommendation to up to 800 grams. The recommended 500 grams of VFB is suggested to include around 250 grams of fruits and berries, and the rest 250 grams consist of vegetables and mushrooms (1). In 2017 in a large National level study, only 22% of Finnish women and 14 % of Finnish men reported eating VFB according to the recommendations (2). High VFB consumption has been found to be associated with better lifestyle in general, including a lower prevalence of smoking, higher levels of physical activity, lower alcohol consumption, and an altogether healthier diet, including less consumed red and processed meat (7).

2.3.1. Sociodemographic factors

Sufficient VFB consumption and healthy dietary patterns are more common among women than men (2, 3, 21, 35, 39, 42), and women have overall better diet quality than men according to dietary indices (21). For example, in recent study, women were found to eat more VFB than men in all Nordic countries (3). Especially berry and fruit consumption varied between countries, but differences were not that consistent or remarkable in vegetable consumption (3). This is consistent with Finravinto 2017 (2) findings that 84% of men and 91% of women ate fresh vegetables during a two-day study period, fresh fruits were eaten by 62% of men and 77% of women, and berries were eaten by only 44% of women and 30% of men (2). All VFB were eaten according to recommendations by only 14% of Finnish adult men and 22% of Finnish adult women. Women have also been found to have higher Vitamin C levels and higher levels of carotenoid biomarkers, which indicate higher VFB consumption (39). In contrast, in China, women consumed more fruit, but men more vegetables (29), which highlights that differences among sexes are most probably caused by culture and other external reasons. On the other hand, VFB intake seems to increase with

age (43), especially fruit and berry intakes (2). Ethnicity and culture affect also dietary habits and FCMs (7, 44), and low SES is not associated in all ethnic groups with lower VFB consumption or poor dietary habits (44). Cultural differences exist also between countries close to one and other, and for example, a study by Nordic dietary recommendations group found differences in VFB consumption ranging from 200 g to 400 g a day in different countries (3). In addition, marital status and having a family are known to be associated with dietary habits (27) and food choices (36). Those who are married eat tend to eat healthier food and women having young children (27). The feeling of self-efficacy and the possibility to affect one's own health are important predictors of VFB eating and healthy eating (45).

2.3.2. Socioeconomic status

SES is used to describe an individual's place in society and is usually defined by financial situation, education level, and occupation (20). Individuals with lower SES have typically lower abilities for living healthy life, through financial and social barriers (46). Moreover, income, education, and occupation are all associated with better diet quality (47). Individuals having lower SES tend to consume less VFB (20, 21, 22). SES factors education and income are both associated with VFB intake (42). SES is also associated with dietary intake (21, 22). Higher SES is associated with lower dietary cholesterol intake, and higher consumption of fiber, fruits, vegetables, and calcium (20, 21). Lower SES has been found to be associated with increased total fat and saturated fat intakes (20, 21), but in the Beydoun (21) study only among white participants, which could be resulted from cultural differences in dietary habits (44). Moreover, lower SES predicts a higher intake of refined grains and added fats (20). On the other hand, obesity is more common among less educated individuals than among more educated in Finland (48). Differences in VFB consumption might be responsible for some of the differences in the weight status of the SES groups (20). Even though diet quality and micronutrient intakes seem to differ between socioeconomic groups and positions, energy intake is not significantly associated with the socioeconomic group or position, (20, 22) and neither are macronutrient intakes (22). Energy-dense food intake and SES might be connected, but this association is not clear (26). It is likely that the higher prevalence of obesity and higher BMI are partly result by non-dietary behavioral differences, such as smoking and physical activity (25). Also, unhealthy behaviors may affect SES, and income, and not just the other way around, as healthier people generally are more able to educate themselves, work more and earn more (46). Health behaviors including physical activity, alcohol consumption, smoking, and diet have been found to explain some of the gradients in mortality and cardiovascular disease occurrences among lower SES, especially among young to middle-aged adults and men, the gradient being most prevalent in the northern USA and Northern Europe (25). This association seems to be stronger, when SES is measured with only occupation (25). Smoking is one of the biggest predictors of inequalities in health between SES groups (25).

Education

Higher education is correlated with better diet quality, including better fat quality and more consumed VFB (2, 21). Furthermore, differences in meal patterns exist, and less educated individuals have been found to be less likely to eat breakfast (25). Education is associated with plasma Vitamin C levels and carotenoid levels, which are biomarkers of VFB consumption (39): The higher the education is, the higher the Vitamin C and carotenoid levels seem to be in the plasma (39). Moreover, VFB consumption has been found to associate with income in all education levels among women and men having high-level education, but not among men with low or intermediate-level education (42). Men consume less VFB in all education levels than women (42), and higher education predict higher fruit

consumption among men than women (35). To add, adult obesity has been found to be more common among less educated individuals than more educated in Finland (48), probably resulting from various lifestyle habits.

Income

Self-perceived adequacy of income also has been found to be associated with dietary behavior (45, 47), and low adequacy of income to be associated with increased risk of food insecurity (19). Household income was not associated with healthy food habits in men in a Finnish study from 2007 (47). However, saturated fat intake has been found to show a deeper gradient with a household income than with individual income (24). Furthermore, individual and household incomes have shown similar gradients of association with food consumption, but when adjusted to other SES factors, the gradient for individual income vanished and for household income halved (24), showing a significant difference between the two. Individuals with lower income have been found to use fewer vegetables than their counterparts (20, 24, 42, 45), and fruit (29). Moreover, food-secure individuals have been found to consume more VFB compared to food-insecure individuals (45), and to consume a larger variety of VFB (20). Low household income has been found to be associated with lower VFB consumption among men working in construction and motor freight occupations (49), among women and highly educated men (42), but not among men having low or intermediate level education (22). Moreover, income has been found to be a more important predictor of fruit consumption for men than women (35), even when other SES factors do not differ (20). Furthermore, VFB consumption is associated with income among women in all education levels compared to men not having this association in low – and middle-level education (42). Even though low VFB consumption is associated with low incomes, research by Dibsdall et. al. (23) shows that low-income participants do not necessarily feel that money prevents them from eating healthily, as most considered themselves to already be eating healthily, even though only 18% reported eating at least five servings of VFB a day. This indicates that in addition to food price, many other FCMs affect food purchases, even if an individual has a low income. In addition to diet, physical activity, and smoking habits have been found to associate with income (24). Higher body mass index (BMI) has been found to be inversely associated with individual income in women, but not with household income (24). However, being overweight does not necessarily associate with household income in men (24), even though the average weight status of SES groups usually differs (20).

Occupation

Working does not necessarily protect from financial insecurity, as in Finland, half of the families that suffer from poverty include at least one working adult (50). In this thesis, the participants are working in private sector service jobs. Those are generally low-paid jobs, and problems with sufficient income are highlighted especially in cleaning services and restaurant jobs (18). Typically, service jobs have irregular work shifts, part-time jobs, and low salaries (18). Compared to other workers, service workers working in restaurants had three times bigger probability to have to compensate low salary with labor market subsidies and adjusted daily allowances for unemployment (18). Dietary habits have been found to be connected to the occupational class, as well as employees' position at work (47). Some research shows that occupational class is not significantly associated with healthy food habits in men (27, 47), and neither working conditions associated with food habits (51). However, employment status has been found to be associated with dietary habits among women (27). Also among women, the effect of education on healthy food habits has been found to be smaller, when adjusting for occupational class, which suggests that the working environment is one of the predictors of healthy food habits (47). This association is also attenuated when the income is considered (47). In addition, a worksite has been found to influence FCMs (36), which are associated with dietary choices. In Finland, most working

adults eat packed food as lunch, but if a staff cafeteria is available at the workplace, most employees tend to eat lunch there (2). So-called blue-collar workers, who work in manual and physically laborious jobs, consume generally less fiber and VFB than other workers (21). One study found that only one-third of study participants, both blue-collar and white-collar employees, found it easy to eat healthy at their job (52). Irregular working shift's associations with health differences have also been studied, and shift working has been found to be associated with food intake (43). It has been also hypothesized that irregular shifts and mealtimes might be one of the causes of stress at work and less beneficial dietary habits (49). Furthermore, passive work has been found to be associated with unhealthier food habits in men (36), and higher occupational physical activity to be associated with higher vegetable consumption (29). Among blue-collar workers, one of the biggest barriers to eating enough VFB has been reported to be a lack of time to eat well (49). Those who were stressed, tired, and feeling forced to eat fast food at work for lack of time, reported eating less VFB (49). Those who believed that they needed to eat right because of their work, ate more VFB than others (49). Men working in night shifts were found to consume less VFB than men working in day shifts (43).

2.3.3. Vegetable, fruit, and berry pricing and accessibility

Access to food is a wide concept, that includes distance to shops, the possibility to move to the shops including the possibility for transportation if that is needed, the quality of shops in the neighborhood (22), and other perceived barriers to access and availability of certain foods. VFB is generally considered to be expensive, especially if their price is compared to the low energy content of VFB (30), but in fact plant-based diets might be cheaper than traditional diets in high–income and upper-middle-income countries such as Finland (32). The high price of VFB and storing difficulties have been pointed out as barriers to VFB eating by low-income adults (20). In the Duthie et al. (2018) intervention, study participants reported their main obstacles for eating VFB after the intervention to be perceived inconvenience and expensiveness of VFB (31). However, giving food insecure families money for food purchases is not likely to increase purchases of VFB, although total purchases increase (53). Increased perceived access and greater availability of VFB have been found to increase the consumption of VFB (22, 54), highlighting the importance of individual's experience of capability.

2.4. Food choice motives association with diet and vegetable, fruit, and berry consumption

2.4.1. Relative and absolute food choice motives

In addition to socioeconomic and demographic factors, FCMs are known to affect dietary behavior (33). Research has shown that studying the prioritization of motives might give more useful results, than single ratings for motives, so called absolute motives (26) Relative FCMs take into consideration individuals' other answers, making the answers easier to compare to one and other (26), when absolute motives are the exact answers without comparison. Moreover, relative FCMs seem to be more strongly associated with food choices compared to absolute motives (26).

2.4.2. Most important food choice motives

"Taste" and "sensory properties" of food are most often considered the most important FCMs (36, 38, 55), followed by "health" (26, 36), "pleasure", "convenience" and "price", in both absolute and relative forms (26, 36). "Price" has been widely considered as an important motive of diet choices (31), which is important in this context, as VFB tend to be considered expensive. FCMs of environmental, ethical, and local food are associated with healthy dietary patterns, especially among women (37). "Health" has been found to be one of the most important FCMs (26, 36). Interestingly, most of low-income participants in the Dibsdall et. al (23) study reported eating already healthily, and enough fruit vegetables, even when only 18% reported eating recommended more than five portions of VFB a day (23). It raises a question, if people consider VFB part of a healthy diet, or if healthiness motivates them to eat some other food products than VFB, for example, due to lack of knowledge of VFB health benefits. Those living alone have reported not eating enough VFB for their health (23), when those cohabiting reported eating them enough more often (23).

The FCM of eating "food rich in VFB" should be logically directly and positively correlated with VFB consumption, but not only FCMs affect food behavior. In one intervention, participants reported not continuing to eat lots of VFB after a VFB eating intervention, because they found consuming VFB inconvenient and expensive (31). However, most did think that they should eat more VFB in both the intervention group and control group, leading to a conclusion that eating the recommended amount of VFB is not caused by lack of knowledge, at least in this intervention (31). The main obstacles to regular VFB eating in this study were pointed to be the cost of fruit, short preservability of VFB, and having to shop more often (31). Moreover, the taste of VFB was reported to be the main reason for picking certain products (31). Those from older age groups have reported enjoying eating VFB and to report eating them enough more often than younger respondents (23). Importantly, jobseekers have reported having more difficulties in buying VFB than those who are working (23), indicating that low income might challenge the ability to eat food rich in VFB.

Environmental concerns have been linked to food choices (34). Both "environmental" and "locally grown" FCMs have been linked to heathier diets among women (37). Moreover, natural concerns, that capture preferences of sustainable eating, such as preferring of organic and fair trade foods, have been found to be more important for older participants (34). "Environmentally friendly" FCM has been found to be most appreciated by those who consume organic foods, and in contrast, "price", "innovation" and "convenience" to be more important than "environmentally friendly" FCMs for those who consume non-organic foods (55). Moreover, FCMs "locally grown" and "environmentally friendly" might sometimes be considered to motivate the same customer groups, but locally grown food could also be valued without any environmental interest (56), such as for supporting local producers. This hypothesis is supported by (37), who found FCM "local and traditional production" to be equally important or even more important than "price" motive among both men and women. Importance of these FCMs is also highlighted in Allés et. al. (37) study, as adults placed more importance on "ethical and environmental concerns" FCM than "convenience" and "innovation".

2.4.3. Sociodemographic differences in food choice motives

Sex, age, BMI, education, parental status, marital status, occupation and workplace, BMI, household income, and smoking are found to associate with FCMs (23, 26, 33, 36). FCMs could explain some SES inequalities in dietary intakes, as individuals having lower SES tend to value familiarity and low cost of food more, than those having higher SES, and value "health" less (26, 35). Moreover, appreciation of food healthiness has been found to increase with age (33, 34, 36) and higher education level (33, 35), and to be appreciated more by women (36). Also, households following vegetarian or gluten-free diets placed more value on food healthiness (33).

Those in different worksites in industry jobs placed different values on different FCMs, indicating that the surrounding work environment shaped their perspectives on food choices (36). Older participants (33), males (36) and cohabiting participants (36) have been found to value "sensory properties" more than their counterparts, but women more "satisfaction" (36). On the other hand, younger participants (33) and women (36) valued "mood control" and "convenience" more than their counterparts, and worksite affected these FCMs (36). Over 45 years old participants value "weight control" in their food choices more than other groups (33), but also women, those having higher BMI and those cohabiting (36). Also, natural and ethical concerns of food were important for older participants (33, 36), women (33, 36), cohabiting participants (36), households following special diets (33) and worksite affected this appreciation (36). "Environmental concerns" were prioritized more by older participants and women (34). Also, organic food has been found to be prioritized more by those living in urban areas (23). "Familiarity" was most important for those with lower incomes, lower education, those following no special diets, and more for men than women (26, 33), and worksite has affected the appreciation of this FCM (36).

Households with higher incomes do not consider the "low cost of food" as important FCMs as households with lower incomes (33). Logically, the importance of the "low cost of food" has been found also to decrease with increasing income and education (33). "Price" has been more valued by women, those having children, and worksite has been found to associate with FCM of food price (36). On the other hand, men and younger participants have been found to appreciate the "low cost of food" more than women and older participants (33, 38), which could be related to the fact that generally young people value low-price and convenience more, and men less healthiness (23). Moreover, only women's education level has been found to be associated with importance of "price" (26). The largest correlations have been found between age and "convenience", income and the "low cost of food", and between age and "mood control" (33). It remains unclear, however, whether lower income limits the importance of FCMs by limiting the access and availability of certain products, such as VFB.

3. Aims and Objectives

This thesis was written to understand if several sociodemographic factors are associated with VFB consumption among adult service workers, and if FCMs “environmentally friendly”, “healthy”, “locally grown”, and “rich in VFB” are associated with VFB consumption among private sector service workers. The aim was also to investigate if the FCMs interact with income level or self-perceived adequacy of income when predicting VFB consumptions, or if the associations of the FCMs and VFB consumptions remain unchanged regardless of income variables. This study group is especially interesting because of private sector service workers’ tendency to have low incomes, low education, and increased risk of financial difficulties (17, 18, 19). Moreover, low income is many times perceived as a barrier to healthy eating and is associated with low intake of VFB (20, 21, 22, 30), which is why the possible moderation effect of income on the associations of VFB consumption and FCM was examined in this study. The FCMs' “environmentally friendly”, “healthy”, “locally grown”, and “food rich in VFB” were chosen as motives, as the results were thought to be interesting and important from a sustainability and public health point of views.

This thesis aimed preliminarily to answer the following three questions:

1. How sociodemographic factors age, sex, self-perceived health, education, working situation, parental status, marital status, and self-perceived adequacy of income are associated with VFB consumption among service workers?

2. Are private sector service workers’ FCMs “environmentally friendly”, “healthy”, “locally grown”, and “rich in VFB” and their VFB consumptions associated?

3. Are the possible associations of service workers’ FCMs and VFB consumptions moderated by income level or self-perceived adequacy of income?

4. Materials and Methods

4.1. Study design and setting

This master's thesis is a cross-sectional epidemiological study and is part of PAMEL (https://blogs.helsinki.fi/pamel-hanke), which is a project of the Finnish Service Union United (PAM), University of Helsinki, and Tampere University. PAMEL project's purpose is to study Finnish private sector service workers' job satisfaction and employment status, and their connection to the workers' well-being. PAM consists of around 210 000 members, of whom 75% are women (17). The members work in the service industry, mostly in retail, property, and cleaning services, and security, restaurant, tourism, and leisure fields. Altogether, 32% of PAM members are younger than 30 years old, and 21% are aged between 31-40 years old (57). Moreover, 33% are aged 41-60 and the rest 14% are aged more than 61 years old (57). This study was conducted only to PAM's Finnish-speaking members, excluding student members.

4.2. Data collection

The data for this thesis was collected from the PAM's members through a questionnaire in April and May 2019. The questionnaire is found in appendix 1. All PAM members, that were Finnish speaking and had a working email address, received an online questionnaire in 2019. The questionnaire was sent to 111 850 PAM members excluding student members. The questionnaire was sent separately from PAM's annual member questionnaire. All participants were asked for permission to connect their answers to register data by Statistics Finland from the past five years (2014-2019). Statistics Finland provided data on age, sex, and income level from year 2019 for this thesis.

4.3. Participants

The study survey included a total of 6573 participants. Those who did not give their consent for using the registered data for research purposes were excluded, incorrect ID numbers were corrected, and those deleted, who did not have a national identification number in the background data. The total of the participants was after these corrections 6435, from which two had to be excluded in the regression models for missing information on sex and age, leaving a total of 6433 (98%) for final analyses.

4.4. Data characteristics and modifications

4.4.1. Vegetable, fruit, and berry consumption data

VFB consumption data was collected with a food frequency questionnaire (FFQ) from a previous month, reported on seven categories. The categories of VFB consumption were "not at all", "less than once a month", "1-3 times in a month", "1-2 times a week", "3-5 times a week", "daily or almost daily" and "several times a day", from which participants were asked to choose one. Consumption frequencies of fresh, cooked, and canned vegetables, fresh fruit, and fresh and frozen berries were included into this study, excluding canned and frozen fruit. Answers of cooked, canned, and fresh vegetables were added together, and the consumption of frozen and fresh berries were asked with a single question.

Vegetable, fruit, and berry consumption were used as dependent variables and studied separately in the analyses. VFB consumptions were transformed into weekly consumption frequencies, which allowed to use analyses for continuous variables. A syntax is found in appendix 2. Categories were transformed to frequencies: 0 = “not at all”, 0.12= “less than once a month”, 0.47= “1-3 times in a month”, 1.5=1-2 times a week, 4= “3-5 times a week”, 6= “daily or almost daily” and 8= “several times a day”. Fruit and eating frequencies could get values from 0-8 times a week, but as cooked and fresh vegetables were added together, vegetable consumption frequencies could get values between 0-16 times a week. For the regression, correlation, and ANOVAs, berries were transformed into in a Napierian logarithm form (ln) to correct the distribution closer to normal.

4.4.2. Sociodemographic factors and self-perceived health data

Study participants’ marital status, education level, employment status, parental status, self-perceived adequacy of income, and self-perceived health were asked in the study questionnaire and included in this thesis for their relevance. Participants were asked if they are married or in a registered partnership, cohabiting, divorced or separated, widowed or single, and the answers are referred to as a marital status in this thesis. Furthermore, the highest education level was asked to be reported to be either comprehensive education, secondary education, bachelor’s degree, master’s degree, or something else. Participants were also asked to choose, which describes their current employment status best: if they are in work-life, part-time retired, laid off, unemployed, studying, home with kids, on long-term sick leave, retired, not working for some other reason, or something else. The answers to this question are referred to as an employment status in this thesis. To add, self-perceived health was reported in four categories to be either good, somewhat good, average, somewhat bad, or bad. Participants were also asked how many of their family members are younger than seven years old, 7-17 years old, 18-24 years old, 25-64 years old, or older than 65 years old, from which parental status could be calculated. On the other hand, self-perceived adequacy of income was studied by asking the participants, if in the participant’s household, when considering the total income of the household, the usual expenses are covered with big difficulties, difficulties, small difficulties, some difficulties, easily or very easily. Sex, age, and income level data were connected to the PAM data from Statistics Finland data from 2019. Income level data was reported as available gross incomes by person, without income transfers. Sex was presented in binary form and age as a birth year, from which the age could be calculated.

Sociodemographic factors were recoded as binary for regression analyses, based on the data analyses with ANOVA. The syntaxes are presented in appendix 2. Married and cohabiting participants were compared to other groups, and those having bachelor’s or master’s level university degrees were compared to other education groups. Participants in work-life were compared to other groups outside the work-life. Families with children were compared to families without children. Household’s all children aged 0-17 years old were added together, and this resulted into a number of children between 0-9. Next, all participants having children were compared to those having zero children in the households, resulting into the binary parental status used in this thesis. The self-perceived adequacy of income was transformed into binary form by comparing those who had difficulties in covering their daily expenses to those who reported having no difficulties. Age was transformed into ages from the reported birth year of each participant. Both income level and age were included as continuous variables in regression and moderation models. However, age was also used as a categorical variable, when presenting frequencies and ANOVAs to describe the participant characteristics. There it was categorized into groups of 17-29 years old, 30-44 years old, 45-64 years old, and older than 65 years old.

4.4.3. Food choice motives

Participants were asked to rate on a scale of one to four, how important they thought that certain FCMs were by asking statements that measure FCMs. The final absolute FCMs are called as "rich in VFB", "healthy", "locally grown" and "environmentally friendly" in this thesis. Rich in VFB FCM was formed from a statement: "for me, it is important that to eat a lot of vegetables, fruit, and berries". The statement: "for me, it is important that that the food I eat is good for my health" was used to form the "healthy" FCM and the "locally grown" motive was formed from a statement: "for me, it is important that the food I eat is locally grown". Lastly, the statement: "for me, it is important that that the food I eat causes environment as little harm as possible" was used to form "environmentally friendly" FCM. Answering options were 1= "not at all important", 2= "not that important", 3=somewhat important, and 4= "very important". These were transferred into three categories by combining groups 1= "not at all important" and 2= "not that important", as ANOVA test showed only a little or not at all difference between groups. Absolute FCMs were also transferred into relative FCMs by subtracting the mean value of all FCMs from each of the FCMs.

4.5. Statistical analyses

The data were analysed with statistical methods using IBM SPSS Statistics 27.

4.5.1. Frequencies and One-way ANOVA tests

The frequencies of VFB consumption in groups of background variables age, sex, marital status, education level, employment status, parental status, self-perceived adequacy of income, and self-perceived health were studied, and frequencies were analysed with One-way ANOVA, to compare the effect of each background variable on the VFB consumption.

4.5.2. Correlations

Absolute FCMs' "healthy", "environmentally friendly", "locally grown" and "rich in VFB" correlation with each other and with VFB consumption was analysed. Spearman's correlations were used to analyse absolute FCMs' correlations with VFB consumption, as absolute motives were categorical variables. Pearson's correlation was used to analyse relative motives correlation between one another and VFB consumption.

4.5.3. Multiple linear regression models

Multiple linear regression was performed for FCMs and VFB consumptions by adjusting for different sets of confounders. Models were built to test absolute FCMs' ability to predict VFB consumptions when moderating the multiple regression with either income level or self-perceived adequacy of income. Three sets of multiple regression models were created. First regression models (MI) were performed by using each of the FCMs as explanatory variables and separately vegetable, fruit, and berry consumptions as dependent variables, adjusted with binary sex and continuous age. The second set of multiple regression models (MII) was then performed with a larger number of confounders, including participant continuous age, binary sex, binary parental status, binary self-perceived health, binary education, binary self-perceived adequacy of income, and binary employment status. Finally, the models adjusted to gender and age where moderated with either income level

(MIII) by a person or self-perceived adequacy of income (MIV) to see if these income variables interacted with the FCMs, when models were predicting VFB consumptions. All analyses were performed to absolute motives but the correlations, regression models MI and MII were also created to relative motives. Berry consumption was in a Napierian logarithm form in all regression analyses, and therefore regression coefficients for berry consumption were transferred into percentages by exponentiating the coefficients, subtracting one from the results, and multiplying the numbers by 100.

4.6. Ethical considerations

This study was implemented according to the guidelines of the Declaration of Helsinki. All procedures, in which study participants were involved, were approved by the University of Helsinki Ethical Review Board in the Humanities and Social and Behavioral Sciences (Statement 11/2019). The participants were asked a written consent of participating to this study. Participation was completely voluntary, and participants were informed of this. Participant data was handled carefully to take care of data privacy and the data was coded with unrecognizable identity numbers. Moreover, all data was stored in password-protected folders, and access was provided only to those who were part of the PAMEL study group. All possible data, which could include information that could be connected to individuals, is to be deleted from personal computers after the research project.

5. Results

5.1. Study Participants and their vegetable, fruit, and berry consumptions

5.1.1. Participant characteristics

This study had 6435 participants when at the end of 2019, PAM had 207 334 members (3%) (58). Both age and sex had six missing values, but by using the PAM questionnaire's data, it was possible to find the data for four of the participants, ending up with data including sex and age from 6433 study participants. Frequencies of participant characteristics are presented in table 2. This study included more women (80%) than men, and the largest age group was those aged 45-64 years old (45%), most were married or cohabiting (67%), and most had studied 2-3 years after comprehensive school, such as in higher secondary school or vocational school. Most of the participants had lower than university degree education (83%). Furthermore, most of the participants were at work-life (70%) at the time of the questionnaire. Among non-working participants, the biggest group was unemployed, inn which belonged almost 10% of all participants. Even though full-time students were excluded from the study, some students remained in the data, which is most likely a result of some students not registered to PAM as student members. Moreover, 68% of the households consisted of only adults.

Table 2. Characteristics of the study participants*, N=6435.*

	N	Percentage (%)
Gender		
Men	1306	20
Women	5127	80
Missing	2	<1%
Age, years		
17-29	1146	18
30-44	2197	34
45-64	2914	45
65–94	171	2.7
Missing	2	<1%
Marital status		
Married or cohabiting	4308	67
Other	2127	33
Education		
Secondary level or lower	5357	83
University level	1068	17
Working situation		
Working	4529	70
Other*	1906	30
Parental status		
Family without children	4394	68
Family with children	2012	31
Missing	29	<1%
Self-perceived health		
Good or very good	4409	69
Average or lower	2026	32
Self-perceived adequacy of income		
Not adequate	3008	47
Adequate	3427	53
Income level		
N	6428	100
Missing	7	<1%

* Other= Part-time retired, laid off, unemployed, studying, home with kids, on long-term sick leave, retired, not working for some other reason, or something else

Most of the participants reported their health to be good or very good (69%). Almost half of the study participants (47%) reported facing difficulties in covering their living expenses with income. Mean yearly income level was 21312€, and the yearly incomes varied between 300€ and 83400€.

5.1.2. Participant vegetable, fruit, and berry consumptions with sociodemographic variables

The total VFB consumptions of participants grouped by several sociodemographic variables are presented in figure 1. In this study, vegetables were consumed six times or more weekly by 71% of the participants, fresh fruits by 42% of the participants, and berries by 19% of the participants. Sex, age, marital status, education, self-perceived health, and self-perceived adequacy of income were associated with VFB consumptions. Average and median VFB consumptions are presented in table 3 together with ANOVA results. Women reported eating more vegetables, fruit, and berries compared to men. Moreover, there was a difference between VFB consumptions and age groups, and the trend seemed to be that older participants ate more VFB than younger participants. Those aged 65-94 years reported the highest consumption frequency of VFB and those aged 45-64 consumed VFB the second most. 30–44-year-old participants were eating more vegetables than the youngest age group, but the youngest group was eating slightly more fruit and berries. The married and cohabiting group ate more VFB weekly compared to those having other marital status. Furthermore, higher-educated participants ate more VFB than those less educated. Moreover, there was a difference between those who were working and those who did not work in fruit and berry consumption, but not in vegetable consumption. Families consisting of only adults ate more fruits and berries compared to those having children. Furthermore, those who reported having better health were eating more VFB. Those who reported having adequate income reported eating more VFB weekly, compared to those reporting not having adequate income.

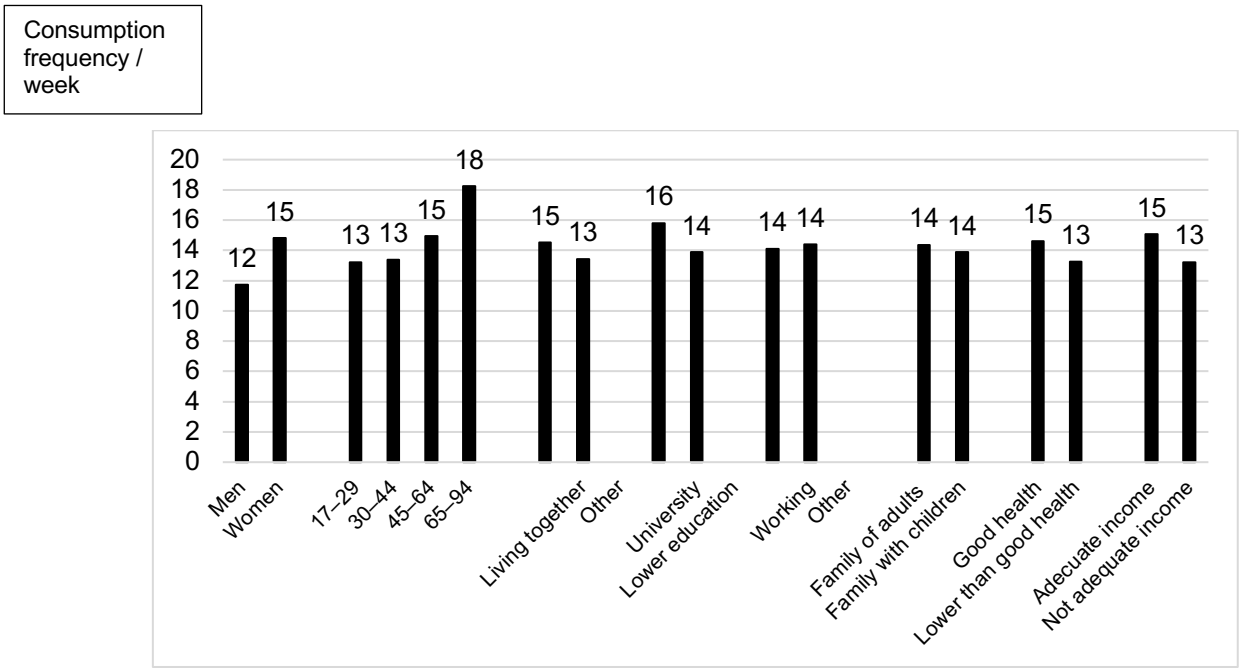

Figure 1. Vegetable, fruit, and berry consumption frequencies in a week by demographic groups of participants. Vegetables, fruits, and berries are added together.

Table 3. ANOVA-Tests with weekly vegetable, fruit, and berry consumption frequencies and sociodemographic factors in groups of sex, age, marital status, education, employment status, parental status, self-perceived health, and self-perceived adequacy of income.

	Vegetable consumption[1]			**Fruit consumption[2]**			**Berry consumption[2]**		
	Mean (SE)	**Median**	***p***	**Mean (SE)**	**Median**	***p***	**Mean (SE)**	**Median**	***p***
Sex									
Men	7.0 (0.1)	7.5	<0.01	3.2 (0.1)	4	<0.01	1.5 (0.1)	0.5	<0.01
Women	8.5 (0.1)	8		4.1 (0.0)	4		2.3 (0.0)	1.5	
Age									
17–29	7.7 (0.1)	7.5	<0.01	3.5 (0.1)	4	<0.01	2.0 (0.1)	0.5	<0.01
30–44	8.1 (0.1)	8		3.5 (0.1)	4		1.8 (0.1)	0.5	
45–64	8.4 (0.1)	8		4.3 (0.1)	4		2.3 (0.0)	1.5	
65–94	9.3 (0.3)	10		5,4 (0.2)	6		3.5 (0.2)	4.0	
Marital status									
Married or cohabiting	8.4 (0.1)	8	<0.01	4.0	4	<0.01	2.2 (0.0)	1.5	<0.01
*Other	7.7 (0.9)	7.5		3.7	4		2.0 (0.1)	0.5	
Education									
Secondary level or lower	8.0 (0.1)	7.5	<0.01	3.8 (0.0)	4	<0.01	2.1 (0.0)	0.5	<0.01
University level	9.2 (0.1)	10		4.3 (0.1)	4		2.4 (0.1)	1.5	
Employment status									
Working	8.2 (0.1)	8	0.22	3.9 (0.0)	4	0.04	2.0 (0.0)	0.5	<0.01
Other	8.1 (0.1)	8		4.0 (0.1)	4		2.3 (0.1)	1.5	
Parental status									
Family of adults	8.2 (0.1)	8	0.97	4.0 (0.0)	4	0.01	2.2 (0.0)	1.5	<0.01
Family with children	8.2 (0.1)	8		3.8 (0.6)	4		1.9 (0.1)	0.5	
Health									
Good or very good	8.4 (0.1)	8	<0.01	4.0 (0.0)	4	<0.01	2.2 (0.0)	1.5	<0.01
Average or lower	7.6 (0.1)	7.5		3.7 (0.1)	4		1.9 (0.1)	0.5	
Income adequacy									
Not adequate	7.7 (0.1)	7.5	<0.01	3.6	4	<0.01	1.9 (0.0)	0.5	<0.01
Adequate	8.6 (0.7)	8		4.2	4		2.3 (0.0)	1.5	

Sociodemographic statistics presented for vegetable, fruit, and berry weekly consumption frequencies. The data was analysed with one-way ANOVA to compare the effect of each sociodemographic variable on the vegetable, fruit, and berry consumption.

[1] Weekly consumption of vegetables from 0 to 16 or more portions a week, including both cooked and fresh vegetables.

[2] Weekly consumption of fruit and berries from 0 to 8 or more portions a week, including fresh fruit, and fresh and frozen berries.
SE = Standard Error
*Other marital status includes divorced, separated, widowed or single participants.

5.2. Food choice motives and vegetable, fruit, and berry consumption

5.2.1. Correlations

The results are presented in table 4. All FCMs correlated with each other positively and the correlations were statistically significant ($p < 0.01$). The "healthy" correlated strongly ($r \geq 0.40$) with the "rich in VFB", but also with the "environmentally friendly" FCM. The "environmentally friendly" FCM correlated strongly with the "rich in VFB". All FCMs correlated positively with VFB consumption, but only the correlation of "rich in VFB" was strong ($r \geq 0.40$) with vegetable and fruit consumption. Furthermore, VFB consumptions correlated positively and strongly with each other. Income level correlated weakly and negatively with "healthy" and "environmentally friendly" FCMs and weakly but positively with vegetable consumption, other correlations remained not significant.

Table 4. Correlations between "healthy", "environmentally friendly", "locally grown", and "rich in VFB" food choice motives, vegetable, fruit, and berry consumptions, and income level.

		1.	2.	3.	4.	5.	6.	7.	8.
1.	Healthy	1.0	-	-	-	-	-	-	-
2.	Environmentally friendly	**0.42****	-	-	-	-	-	-	-
3.	Locally grown	0.31**	0.35**	-	-	-	-	-	-
4.	Rich in VFB	**0.53****	**0.39****	0.29**	-	-	-	-	-
5.	Vegetable	0.28**	0.22**	0.13**	**0.41****	-	-	-	-
6.	Fruit	0.24**	0.18**	0.12**	**0.41****	**0.43****	-	-	-
7.	Berry	0.26**	0.18**	0.16**	0.39**	**0.45****	**0.46****	-	-
8.	Income level	-0.03*	-0.06**	-0.02	-0.02	0.06**	0.01	0.01	-

* p-value < 0.05, ** p -value < 0.01
Rich in VFB= Rich in vegetables, fruit, and berries
Numbers 1-4. represent food choice motives "healthy", "environmentally friendly", "locally grown", and "rich in VFB."
Numbers 5.-7. represent vegetable, fruit, and berry consumptions.
Number 8. represents income level as a continuous variable.

Relative food choice motives
The results for relative FCMs are presented in appendix 3. All FCMs correlated with each other significantly ($p < 0.01$) and negatively due to relative adjusting. The "healthy" FCM correlated strongly ($r \geq 0.40$) with the "locally grown" FCM. Moreover, the "environmentally friendly" FCM correlated strongly with the "rich in VFB" FCM. Also, the "locally grown" FCM correlated strongly with the "rich in VFB" FCM. On the other hand, VFB consumption correlated with "rich in VFB" and "locally grown" FCMs, and fruit and berry consumption also with "environmentally friendly" FCM. Vegetable, fruit, and berry consumption were again strongly and positively correlated with one another.

5.2.2. Multiple linear regression models for food choice motives and vegetable, fruit, and berry consumptions

Results of multiple regressions for absolute FCMs are presented in table 5. All four FCMs were positively associated with VFB consumptions ($p < 0.01$). Participants that found the FCMs important, ate more VFB compared to those that did not. Adjusted R^2 increased in all

models when in addition to age and sex (MI), other confounders were included into the models (MII). The number of participants was 6435, because of missing sex and age data.

Vegetables

"Rich in VFB" FCM seemed to be the most important predictor of vegetable consumption of all four FCMs. Those who reported that "rich in VFB" was not an important FCM for them ate slightly less than five times (MII) fewer vegetables a week, compared to those who found this FCM important. When all confounders were in the model, the adjusted R^2 increased from 0.19 to 0.21. Those reporting "environmentally friendly" FCM as not being important to them ate more than two times (MII) fewer vegetables weekly, compared to those considering this FCM important. When all confounders were in the model, the adjusted R^2 increased from 0.10 to 0.12. Those who reported "healthy" FCM being not important to them ate more than three times (MII) less frequently vegetables. When all confounders were in the model, the adjusted R^2 increased from 0.07 to 0.10. Those reporting "locally grown" FCM not being important to them consumed more than one time (MII) fewer vegetables weekly compared to those who valued locally grown food most. When all confounders were in the model, the adjusted R^2 increased from 0.04 to 0.07.

Fruit

"Rich in VFB" FCM seemed to be the most important predictor of all four motives with also fruit consumption. Those who reported that eating "rich in VFB" food was not important for them ate more than three times (MII) less frequently fruit, compared to those who found it important. When all confounders were in the model, the adjusted R^2 increased from 0.20 to 0.21. Those who reported "environmentally friendly" FCM not being important to them consumed more than one time (MII) less fruit weekly, when comparing to those who considered this important. When all confounders were in the model, the adjusted R^2 increased from 0.10 to 0.11. Moreover, those who reported "healthy" food being not important to them ate less than two times (MII) less frequently fruit. When all confounders were in the model, the adjusted R^2 increased from 0.07 to 0.09. Those who reported "locally grown" FCM being not important to them, ate less than one time (MII) less fruit weekly compared to those valuing this FCM. When all confounders were in the model, the adjusted R^2 increased from 0.06 to 0.08.

Berries

The regression coefficients of berry consumption were transformed into percentages for logarithmic transformation. Those who did not value "rich in VFB" FCM ate 85% (MII) less frequently berries than those who valued it most. When all confounders were in the model, the adjusted R^2 increased from 0.16 to 0.17. Those who did not place importance on "environmentally friendly" FCM consumed 52% (MII) less frequently berries than those who valued the FCM most. When all confounders were in the model, the adjusted R^2 increased from 0.08 to 0.10. Moreover, those who did not find "healthy" FCM important ate 71% (MII) less frequently berries than those who valued it most. The adjusted R^2 changed from 0.05 to 0.07, when all predictors were in the model. Those who did not find "locally grown" FCM important consumed 49% (MII) less frequently berries than those who valued it most. When all confounders were included in the model, the adjusted R^2 increased from 0.05 to 0.07.

Differences of vegetable, fruit, and berry consumption with food choice motives

Figures describing the VFB consumption with different FCMs are presented in appendix 4. The largest differences in VFB consumption predictions were between those who thought "food rich in VFB" is important and those who did not. The next biggest differences were between VFB consumptions of those placing importance on "healthy" FCM and those who

did not, even though the motives healthy, “environmentally friendly”, and “locally grown” had the same value of goodness-of-fit. The third biggest difference between groups was with the “environmentally friendly” motive, as those not valuing environmentally friendly reported eating less VFB compared to those valuing it. The lowest difference seemed to be between those placing importance on “locally grown” FCM and those who did not. However, berry consumption had a bit different trend among relative importance of motives, as “locally grown” FCM had almost as big differences between those placing importance on it and those who did not.

Relative food choice motives

Regression analysis results for relative FCMs are presented in appendix 5. Only “locally grown” and “rich in VFB” FCMs were significantly predicting vegetable consumption. In addition to these two motives, the “environmentally friendly” motive was significantly associated with fruit and berry consumption, but not FCM “healthy”. Adjusted R^2 was highest for rich in VFB motive and vegetable, fruit, and berry consumption compared to other motives, explaining about 10% of the variation in the VFB consumptions.

Table 5. Multiple linear regression models for absolute food choice motives' associations with vegetable, fruit and berry consumption

MI, N=6433												
	Vegetables				Fruit				Berries			
		CI				CI				CI		
	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2
Rich in VFB				0.19				0.20				0.16
Very important (ref.)												
Somewhat important	-2.33	-2.52	-2.14		-1.53	-1.65	-1.40		-0.86	-0.94	-0.78	
Not important	-5.13	-5.43	-4.84		-3.14	-3.33	-2.95		-1.96	-2.09	-1.83	
Locally grown				0.04				0.06				0.05
Very important (ref.)												
Somewhat	-0.56	-0.78	-0.34		-0.35	-0.49	-0.21		-0.29	-0.39	-0.20	
Not important	-1.44	-1.74	-1.15		-0.77	-0.96	-0.58		-0.75	-0.87	-0.62	
Healthy				0.07				0.07				0.08
Very important (ref.)												
Somewhat	-1.65	-1.85	-1.45		-0.83	-0.96	-0.71		-0.53	-0.62	-0.45	
Not important	-3.41	-3.75	-3.06		-1.92	-2.14	-1.70		-1.30	-1.45	-1.15	
Environmentally friendly				0.10				0.10				0.05
Very important (ref.)												
Somewhat	-1.11	-0.47	-2.11		-0.60	-0.78	-0.42		-0.39	-0.51	-0.27	
Not important	-2.32	-0.47	-2.14		-1.19	-1.38	-1.01		-0.76	-0.88	-0.63	

(continued)

Table 5. (continued)

MII, N=6404	Vegetables				Fruit				Berries			
		CI				CI				CI		
	B	LI	UI	Adj R2	B	LI	UI	Adj R2	B	LI	UI	Adj R2
Rich in VFB				0.21				0.21				0.17
Very important (ref.)												
Somewhat important	-2.28	-2.47	-2.09		-1.50	-1.62	-1.38		-0.85	-0.93	-0.77	
Not important	-4.98	-5.28	-4.68		-3.08	-3.27	-2.89		-1.91	-2.04	-1.78	
Locally grown				0.07				0.08				0.07
Very important (ref.)												
Somewhat	-0.54	-0.76	-0.32		-0.33	-0.47	-0.19		-0.28	-0.37	-0.19	
Not important	-1.29	-1.58	-0.99		-0.69	-0.88	-0.51		-0.68	-0.81	-0.56	
Healthy				0.12				0.11				0.10
Very important (ref.)												
Somewhat	-1.63	-1.83	-1.44		-0.81	-0.94	-0.68		-0.52	-0.61	-0.44	
Not important	-3.20	-3.54	-2.86		-1.81	-2.03	-1.59		-1.22	-1.37	-1.08	
Environmentally				0.10				0.09				0.07
Very important (ref.)												
Somewhat	-1.18	-1.46	-0.91		-0.61	-0.79	-0.44		-0.41	-0.53	-0.29	
Not important	-2.29	-2.58	-2.00		-1.16	-1.35	-0.98		-0.74	-0.86	-0.62	

MI adjusted with age and sex.
MII adjusted with age, sex, self-perceived health, education, employment status, parental status, self-perceived adequacy of income and marital status.
CI= Confidence Interval, LI= Lower interval, UI=Upper interval, Adj R^2= Adjusted R^2, ref.=reference group
Reference group = those who found the food choice motive to be very important
Vegetable consumption frequencies are presented on a scale of 0-16 times a week
Fruit consumption frequencies are presented on a scale of 0-8 times a week.
Berry consumption frequencies are in Napierian logarithm (ln) form, from a variable presented on a scale of 0-8 times a week.

5.2.3. Multiple linear regression models with the moderation of self-perceived adequacy of income or income level

Models MIII and MIV were testing absolute motives' ability to predict VFB consumption when adjusted to gender and age when moderating the regression with either income level (MIII) by a person or self-perceived adequacy of income (MIV). The number of participants was 6404 because of the missing parental status data.

Self-perceived adequacy of income

Interactions between self-perceived adequacy of income and any of the four FCMs were not significant when examining VFB consumptions. Regarding vegetable consumption, the significance of the interaction of self-perceived adequacy of income with FCM "healthy" and was p=0.13, for FCM "locally grown" p=0.80, for FCM "rich in VFB" p=0.10, and for FCM "environmentally friendly" p=0.60. For fruit consumption, significance was for FCM "healthy" p=0.35, for FCM "locally grown" p=0.80, for FCM "rich in VFB" p=0.76 and for FCM "environmentally friendly" p=0.55. Significance of the interactions for berries were for FCM "healthy" p=0.52, for FCM "locally grown" p=0.90, for FCM "rich in VFB" p=0.29 and for FCM "environmentally friendly" p=0.84.

Income level

Interactions were not significant with any FCMs and fruit or vegetable consumption, and neither were the interactions of berry consumption and FCMs "environmentally friendly" and "locally grown". Regarding vegetable consumption, the significance of the interaction of financial situation with FCM "healthy" and was p=0.39, for FCM "locally grown" p=0.10, for FCM "rich in VFB" p=0.43, and for FCM "environmentally friendly" p=0.77. For fruit consumption, significance was for FCM "healthy" p=0.74, for FCM "locally grown" p=0.99, for FCM "rich in VFB" p=0.73, and for FCM "environmentally friendly" p=0.94. Significance of the interactions for berries were for FCM "locally grown" p=0.73, and for FCM "environmentally friendly" p=0.34. However, the interaction effect of income level was significant with FCMs "healthy" $p<0.01$ and with FCM "rich in VFB" $p<0.01$.

The adjusted R square of the model of "healthy" FCM and berries is 0.08, and the interaction is demonstrated in figure 2. Those who had a better income level ate more berries than those having lower income level, when food healthiness was not considered important. On the other hand, if food healthiness was considered very important, those who had lower income level ate more berries than those with higher income level. If food healthiness was considered somewhat important, income did not cause differences between groups.

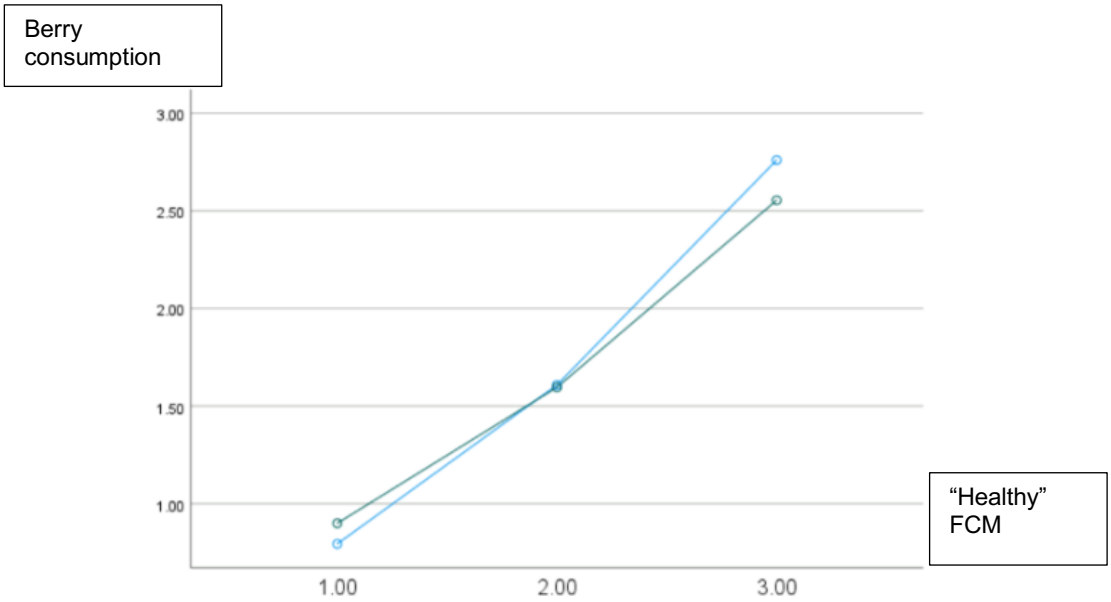

Figure 2. Associations between 'healthy' food choice motive and berry consumption frequencies moderated with income.
Blue line=lower income level
Green line = higher income level
"Healthy" FCM = "healthy" food choice motive
1= not important, 2= somewhat important, 3= very important

Furthermore, the adjusted R square of the model "rich in VFB" is 0.16, and this interaction is demonstrated in figure 3. Those who had a higher income level ate more berries than those having lower income level, when the "rich in VFB" was not considered important. On the other hand, if "rich in VFB" was considered very important, those who had lower income level consumed more berries than those with higher income level. If richness of VFB was considered somewhat important, income did not cause differences between groups.

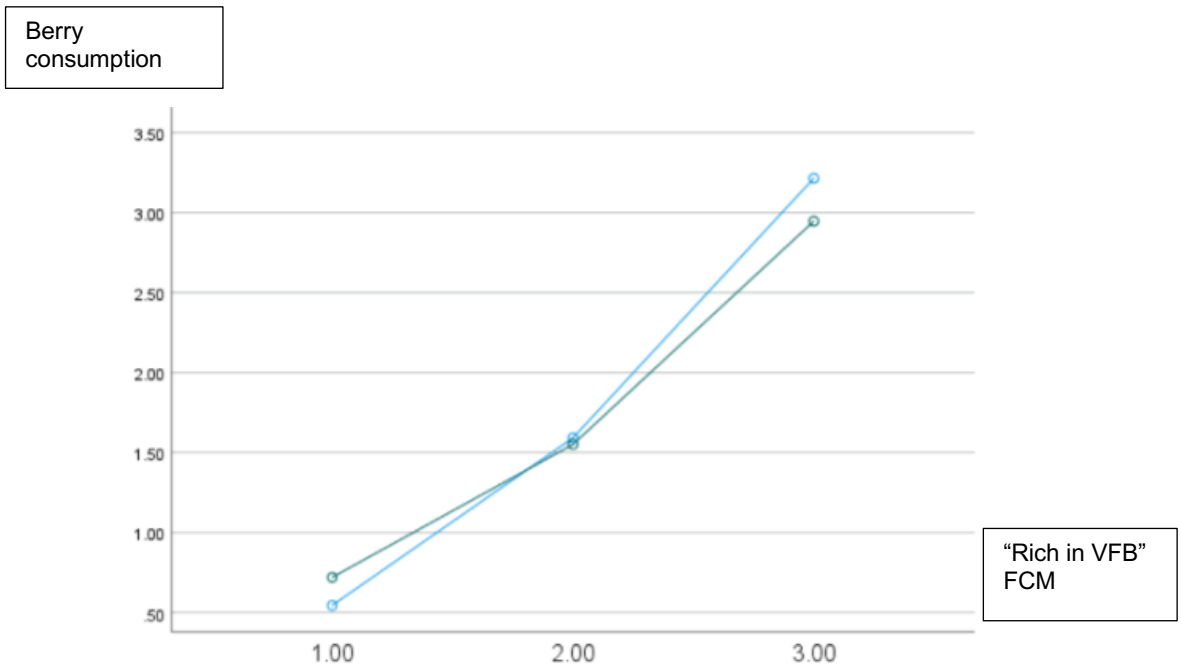

Figure 3. Associations between 'rich in vegetables, fruit, and berries' food choice motive and berry consumption frequencies moderated with two levels of income level.
Blue line =lower income level
Green line = higher income level
"Rich in VFB" FCM = "rich in VFB" food choice motive
1= not important, 2= somewhat important, 3= very important

6. Discussion

This thesis was written to understand how several sociodemographic factors are associated with private sector service workers' VFB consumption and if FCMs "environmentally friendly", "healthy", "locally grown", and "rich in VFB" are associated with their VFB consumption. The aim was also to investigate if the FCMs interact with income level or self-perceived adequacy of income when predicting VFB consumptions, or if the associations of the FCMs and VFB consumptions remain unchanged regardless of income. This study revealed that women, married or cohabiting participants, university-level educated participants, those considering themselves healthy, and those who reported having adequate income, ate more VFB than their counterparts. Employed adults ate less fruit and berries than those outside work-life and those having children ate less fruit and berries than those not having children. Furthermore, all four FCMs were positively associated with VFB consumption. No interactions existed between income level, nor self-perceived adequacy of income and FCMs when predicting vegetable and fruit consumptions. However, those having higher income level ate more berries when the FCMs "healthy" and "rich in VFB" were not important to them, while those having lower income level ate more berries when the two motives were reported to be very important to them.

6.1. Vegetable, fruit, and berry consumption among sociodemographic groups

In this study, women ate VFB on average 15 times a week VFB compared to men eating VFB on average 12 times a week, when the Finnish recommendation (1) is to consume 500 grams of around 5-6 portions of VFB a day. Therefore, although women consumed on average more VFB than men, all adults in this study had difficulties in reaching the recommendations (1). This result is not surprising, as low VFB consumption of adults is a common dietary challenge in modern societies (2, 47). The recommendation will be even harder to reach in the future, as new Nordic recommendation is to consume VFB up to 800 grams a day (28). When our findings are compared to a Finnish national-level study from 2017 (2), both service-working men and women ate on average less VFB than the rest of the population. In the national study (2), Finnish adult men consumed vegetables on average twelve times a week, and together fruit and berries nine times a week, while in our study men reported eating only seven times a week vegetables, slightly more than three times fruit and less than two times berries. In contrast, women consumed in this study vegetables less than nine times a week, fruit slightly more than four times, and berries over two times, compared to the national study (2) finding women consuming vegetables thirteen times a week, and thirteen times a week fruit and berries together. Women consuming more VFB compared to men was a predictable result, as women have previously been found to eat more VFB (2, 3, 35), and to have higher levels of biomarkers indicating higher VFB consumption (39). One reason explaining this difference by gender could be FCMs, and in fact, natural concerns, weight control, and ethical concerns have been found to be valued more by women and mediate the differences in food choices between genders (59).

On the other hand, older adults ate more VFB in this study. The greatest differences in VFB consumptions existed between those older than 65 and those younger than 44 years old. This result is supported by previous findings, as young adults have previously been found to consume less VFB than older adults (29, 43), which could indicate that older adults are more health conscious when making food choices (33, 34, 36), financially more secure and experience less food insecurity (19, 60, 61) or have more time to focus on healthy eating. However, a previous National study in Finland (2) did not find an association between vegetable consumption and age, while in this study both mean and median vegetable

consumptions increased with increasing age. It could be hypothesized that service sector workers have less time, resources, or motivation to eat VFB when still in work life, compared to other working-aged Finnish population, but have more time to focus on that when retired, which could explain some of this association between VFB consumption and age. This hypothesis is supported by the fact that motivation to eat healthily increases commonly with age (33, 34, 36), and that those feeling stressed at work or lacking time to eat well consume less VFB(49).

Furthermore, those reporting having adequate income ate VFB more a week compared to those reporting their income not being adequate. This result is supported by previous findings, as those having not adequate incomes tend to have less healthy dietary habits and eat less VFB (21, 22, 24, 45). Moreover, those having lower incomes have been found to have less self-efficacy for healthy eating and planning meals with VFB, which could explain some of the polarization among income groups (45). Married and cohabiting participants ate more VFB compared to those with other marital statuses, which is in line with the previous finding of married people eating more often according to dietary guidelines (27). To add, in this study, higher educated participants were found to eat more VFB, which was predictable, as higher educated adults eat more often healthily, including consuming more VFB (2, 20, 21, 39). Moreover, it was expected that parental status would have an impact on VFB eating so that those with children would eat more VFB, as the diet has been found to be closer to recommendations among women having children (27), but surprisingly they ate slightly less fruit and berries. This may be in relation to the financial situation, as those with children might have more difficulties in covering their expenses or are more at risk of suffering from financial difficulties (50).

On the other hand, working adults ate, quite surprisingly, less fruit and berries than those outside work-life, but slightly more vegetables. One explanation could be that employed adults might eat more balanced meals in staff cafeterias and therefore eat more vegetables (2), but it is noticeable that not all employees have access to them. However, although this was a statistically significant result, in practice the differences were small, consumption frequency differed less than one time a week for all VFB. Furthermore, those who considered themselves healthy ate on average two times more VFB a week, which highlights the role of feeling healthy in food choices as that might increase self-efficacy and motivation to eat healthier, and on the other hand, those who eat healthier might feel healthier. In fact, individuals being food insecure have been found to have lower self-efficacy to cook from VFB and cook healthily (45), which could explain some of the difference in VFB consumption.

6.2. Food choice motives associations with vegetable, fruit, and berry consumption

Associations between diet, VFB consumption, and FCMs have previously been found to exist in several studies (26, 34, 59). Especially “healthy” FCM included also in this thesis has been studied before, and many times found to have one of the strongest associations between FCMs and VFB consumption (26, 59), and it was an important predictor of VFB consumption also in this study. All absolute FCMs were successful in predicting VFB consumption, which is supported by previous findings by Konttinen et. al. (26, 33), Renner et. al. (34) and Pollard et. al. (59). Around 10% of the variation in vegetable, fruit, and berry consumption could be explained by the FCMs of “healthy”, “locally grown”, and “environmentally friendly”, and around 20% of the variation by FCM of “food rich in VFB”.

As expected, the "rich in VFB" FCMs was the most important motive for VFB consumption. Moreover, "healthy" FCM has many times been found to be one of the most important predictors of food behavior (26), so it was no surprise to find it explaining differences in the VFB consumption. However, the healthiness of food could be even more important now after the COVID-19 pandemic, as its' relative importance was found to increase during the pandemic (62). In this study, "environmentally friendly" FCM was associated with VFB consumption as expected, as natural, ethical and environmental concerns have been reported to be considerable important FCMs on the population level (34, 37, 55, 62), and those motivated by environmental concerns are more likely to have a diet closer to recommendations (37). The result also correlates also well with a finding from 2020, that 91% of PAM members younger than 40 years old reported to consider climate change as a serious problem (63), which indicates that environmental choices are important for young PAM members. It is good to point out that "environmentally friendly" FCM could stand out even more with food groups such as meat products, or the overall diet. FCMs of local food are not that widely studied, but we found it predicting VFB consumption, which is supported by Allés et. al. (37). "Locally grown" FCM seemed to be most important with berry consumption, understandably, as Finns consume berries on average 5-12 kg/year/person (2). Furthermore, "environmentally friendly" and "locally grown" FCMs could be appreciated by the same people (56), which could have been interesting to study with a larger set of relative motives. On the other hand, increasing environmental concerns could lead individuals to eat more plant-based diet, which probably increases VFB consumption. Previously it has been found that those following plant-based diets placed more importance on the ethicality and healthiness of the food (33), which could be a favorable change.

6.3. Income, food choice motives, and vegetable, fruit, and berry consumption

Income level was weakly and negatively associated with "healthy" and "environmentally friendly" FCMs and positively with vegetable consumption. These results are supported by Konttinen et. al. (26) findings, although FCM "healthy" and income had no correlation in their study. However, income was negatively associated in their study with "ethical" FCM, indicating that those with higher income valued ethicality less than those with lower income, although the gradient vanished with relative FCMs, leaving only the appreciation of FCMs "price" and "familiarity" to decrease with increasing income (26). Similarly, those with higher income were found to appreciate "environmentally friendly" food less in our study. Konttinen et. al. (26) have also results of appreciation of relative health motive increasing with increasing income, controversial to our finding with absolute motive. When known that higher income predicts healthier dietary habits (20, 24, 42, 45), the result of Konttinen et. al. (26) that income increases health appreciation seems more logical compared to our finding, that "health" is not that significant FCM for those having higher income level. However, the negative correlation between the two motives and income level was very low, indicating maybe a low practical importance of this result. Also, this finding might only be valid in this low-income population group, and not applicable to other populations. On the other hand, the positive association between income level and VFB consumption eating could be somewhat explained by salary increasing with increased age among working-aged adults at least until the age of 50 years (60) and older adults reporting more often adequate income (61), and higher VFB consumption (2). Other possible factors explaining this correlation could be higher income indicating higher education and more interest generally in the long-term effects of certain behaviors (33, 34).

The hypothesis was that both income level and self-perceived adequacy of income would moderate some of the associations between FCMs and consumption of VFB. However, most of the interactions of income variables and FCMs when analysing VFB consumption

remained insignificant, suggesting that the motives predicted VFB consumption regardless of income level or difficulties with income adequacy. However, two significant interactions were found between the income levels and two motives, "healthy food" and "food rich in VFB", when the outcome was berry consumption. Income has previously been found to have a direct effect on VFB consumption, and an indirect effect through absolute motives of ethicality and familiarity (26). Interestingly, the income level had only significant interactions with "healthy" and "rich in VFB" FCMs and berry consumption, but not with "locally grown" and "environmentally friendly" FCMs. Income has previously been found to be associated with motives, so that those having less income did consider health less often important (33), in contrary to our findings. Considerable is that the FCMs "healthy" and "rich in VFB" only interacted with income when predicting berry consumption, but not with vegetable and fruit consumption. This may be explained by price differences between vegetables, fruits, and berries. Berries are relatively expensive, although the prices vary a lot with the country of origin, season, and whether purchased from a freezer or fresh. For example, on 31.1.2023 in the S-groups online store (www.s-kaupat.fi), the biggest supermarket chain in Finland, the cheapest frozen blueberries were priced at 8.95€ per kilo, lingonberries at 4.45€ per kilo, blackcurrants 6.95€ per kilo and strawberries 3.90€ per kilo. When compared to apples costing 0.99€ per kilo, bananas 1.55€ per kilo, and mandarins being 2.99€ per kilo, fruits tend to be cheaper. Again, when comparing cheap vegetables, such as cabbage being 0.99€ per kilo, tomato at 2.69€ per kilo, and broccoli at 3.30€ per kilo, it is clear why income shows an especially big role in berry purchases. However, berries grow wild in Finnish forests, and according to Ruokatieto Yhdistys ry (64), at least 100 kg of berries per Finnish capita sprout every year, from which less than half are picked. This could maybe explain why those valuing healthy food and food rich in VFB consumed a lot of berries, and even more when lower income level. Berry picking from forests and storing them by freezing is traditional in Finland, but nowadays older Finnish people may pick more berries than younger people, as in theory, those retired could have lower income level, but have more time and interest to pick up berries from forests. Older generations could also be more used to traditionally gathering food from nature compared to younger generations.

6.4. Strengths and weaknesses of this study

This study was conducted on a large group of adults, which is a strength of this study. The demographic data of this study describes PAM members well. Furthermore, this study was equally accessible to all PAM members who had a working email address, were Finnish-speaking and were not student members. Women were slightly overrepresented in this study (80%) compared to PAM's own membership data (75%) (65). Furthermore, those older than 30 years old were slightly overrepresented and those younger than 30 years old underrepresented compared to PAM's annual report from 2020 (57). Our finding that 17% of the participants had university-level education is supported by a finding from 2020 (66), that 17% of younger than 40 years old adult service workers have university-level education. However, in 2019, 45% of those working in retail sales, wholesales, restaurant, hospitality, security, and landscaping services had higher education than secondary school, but in other sectors than wholesales less than 25% were higher educated employees (17). Therefore, education level varies between sectors, as 49% of the adults working in wholesale have a higher education, compared to only 12% having higher level education in property maintenance and landscape services (17). On the other hand, service sector workers are often forced to work part-time, caused by a lack of full-time contracts (17), especially in restaurant, retail, and cleaning services (18). For example, in 2020, 56% of private service sector workers younger than 40 years old did not have a full-time permanent job contract (66). This might be one of the reasons leading to our finding that almost half (47%) of

participants reported insufficient adequacy of income. Moreover, salaries are generally low in the service industry, which is likely to contribute to inadequate incomes (17).

Food frequency questionnaires (FFQs) always include some errors. FFQ is a widely used tool for measuring dietary intake but includes the possibility of an error caused by over- or underreporting (67). Participants are also asked to report food products retrospectively, which requires participants to remember their consumption frequency from the previous month and requires an ability to describe their food consumption. To add, foods considered healthy tend to be overestimated (67), which is why overestimating might be possible when studying VFB, which are generally considered healthy.

The data was studied with a wide set of carefully planned analyses, and regression analyses included many confounders, which can be seen as a strength of this study. Additional ANOVA tests and correlations were performed to understand the study group better and to get a better understanding of their VFB consumption. However, the fact that the motives were in absolute form might weaken the findings of this study, as relative motives have been found to predict VFB consumption better (26). In this study, relative motives were analysed in addition to absolute motives, as they are commonly used in motive studies. As the eating food rich in VFB motive was associated very strongly with VFB consumption compared to the other chosen three motives, it affected much of the statistical power of the other three motives. Therefore, the relative motive method was not that favorable in the study setting, with only four FCMs, but it might have been more useful with a wider set of motives. To conclude, relative motives would have given a better understanding of participants' FCMs related to one another, if there was a different study setting. On the other hand, motives are always subjective. In this study, each motive was asked with a single 4-point category -question, and more accurate answers could have been received with a larger pattern of questions that imply the same motive. Especially the risk of misunderstanding the questions could be reduced with a question pattern rather than a single question (68). Also, the inclusion of a price -motive could have been interesting in this study when the interest lies in the sufficiency of finances.

Moreover, it was a strength of this study to be able to use Statistics Finland's income level data in this thesis and to have the possibility to use it parallel with the adequacy of income. One explanation for the different effect of the income variables could be that the income level's inability to consider individual life expenses. Sufficient income level might be individually very different due preferences, other life expenses and family size, while those reporting income adequacy consider their household's typical living costs. For example, the household's income level might be good when compared to other population, but the lifestyle expensive, which is why the respondent might still report the income is not adequate. In the end, income adequacy is a very subjective matter and might mean different levels of income for different individuals. The inclusion of adequacy of income and income level makes this study differ from other VFB consumption and FCM studies and gives new knowledge on the field of motive and dietary behavior studies.

6.5. New research ideas and practical implications

The problem of the adult population not eating enough VFB is common across modern countries, and actions are needed so that adults would have an interest in eating VFB. The problem will even increase, when the recommendation for VFB increases to 500-800 grams (28). In this study, the four motives, "healthy", "locally grown", "environmentally friendly" and "rich in VFB", included in this study were positively associated with VFB consumption. This knowledge could be further used to investigate how to get PAM members and adults,

in general, motivated to eat healthy, VFB-rich food, local and environmentally friendly food, as this could lead to an increase in VFB eating. This study indicates that the more importance an individual placed on the FCMs, the more they consumed VFB, which is an important goal for public health (1). The increase of interest on the healthier, richer in VFB, local and more environmentally friendly food could therefore result in higher VFB consumption, even if the financial situation does not improve.

This study also raises the issue of berries being free to pick by anyone in the forests, but still, Finns consume berries significantly less than fruit. Therefore, berry picking could be promoted more, especially to the younger generations. Moreover, berry consumption of families with children and those without could be further studied, as families with children ate fewer berries a week. Especially important would be to understand if this difference is in relation to financial difficulties when we know that the financial situation moderates the association of some FCMs and berry consumption. Obviously, price discounts, especially on berries, but also on vegetables and fruit could be beneficial, although one of the main results in this study is that FCMs are, at most, able to explain 10-20% of the consumption of VFB even when financial difficulties are present. If this thesis was planned again, it would also be interesting to include meat or processed meat consumption in the models, as these are associated with VFB consumption and health (7), and could be an interesting comparison approach in a FCM study. It would be interesting to study again these four FCMs, but additionally include other food products, such as meat, milk, and legumes, to see how these motives are associated with the consumptions when income level and adequacy of income are moderating the associations. Furthermore, smoking could have been added as a confounder, as it is known to have an association with VFB consumption and health (7), and may associate with FCMs. Moreover, including BMI in the regression models and ANOVAs could have been useful, as the weight status indicates certain dietary habits.

Also, it would be worth considering either using a larger set of motives and performing factor analyses for relative motives or using motives to be ranked according to their relative importance. If motives had been asked to be ranked or put into an order according to their importance, we could have received motives in participants' personal, relative order, and this would have been useful when comparing the motives to one another. This method could have also been used with only these four motives and shown what the participants valued most and what least. Finally, it is good to discuss whether the chosen motives are relevant when considering VFB consumption. FCMs are subjective, and these motives might include individual variation. For example, many VFB sold in stores are not locally grown, especially in Northern countries such as Finland. To add, all VFB are generally environmentally friendly when compared to meat, but if you compare foreign fruit to some other local food products, such as grain products, the products might not seem that environmentally friendly. Also, valuing food rich in VFB is a subjective motive, as the individual decides what is the amount of VFB considered "rich" for them. Moreover, VFB are well known to be beneficial to health, but individuals might have different viewpoints on that. Maybe with larger question patterns or qualitive research methods such as interviews with adults these viewpoints could be discussed and researched further.

7. Conclusions

Private sector service workers in Finland do not meet the recommendations of VFB consumption according to this study, the trend also found across the adult population in Finland and Nordic countries (2, 3, 28). Sufficient VFB intake does not only support good health but could also help to compose more environmentally friendly diet (4, 5, 7, 16). On the other hand, adult service workers suffer from involuntary part-time employment contracts and low salaries (18) and share other risk factors for the poor financial situation, including low education, migrant background, and female gender (17, 18), which puts the workers at risk of having financial difficulties and food insecurity (19). VFB are perceived expensive (30), and consumed less by low-income populations (3, 20, 21, 23, 30), which is why this study setting was implemented. This thesis was written to understand sociodemographic factors' associations with VFB consumption among private sector service workers. In this study, married or cohabiting participants, university-level educated participants, those considering themselves healthy, and those who reported having adequate income, ate more VFB than their counterparts. Employed adults ate less fruit and berries than those outside work-life and those having children ate less fruit and berries than those not having children. Another aim of this study was to investigate if FCMs "environmentally friendly", "healthy", "locally grown", and "rich in VFB" are associated with VFB consumption among private sector service workers, and to investigate, if these associations remain unchanged regardless of the level of income level or self-perceived adequacy of income. We found that FCMs "environmentally friendly", "healthy", "locally grown", and "rich in VFB" were all positively associated with VFB consumption. Interactions were not found between income level or self-perceived adequacy of income and FCMs in models predicting vegetable and fruit consumptions. However, those having higher income level ate more berries when the FCMs "healthy" and "rich in VFB" were not important to them, but those having lower income level ate more berries when the two motives were reported to be very important to them. This study gives an insight to understanding the employees' eating behaviors and highlights the importance of the motivation in the VFB consumption. Also, this study points out that almost half of the members of PAM feel that their income is not adequate to cover their daily expenses, which could explain why their VFB consumption was lower than the VFB consumption of other Finnish population (2). However, in this study, FCMs were able to predict VFB consumption regardless of financial difficulties, highlighting the importance of motives in food choices.

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Appendix

Appendix 1. Original PAMEL questionnaire, questions used in this thesis

1) * Annan luvan käyttää tämän kyselyn vastauksia tutkimustarkoituksiin ja luvan yhdistää kyselyvastaukseni PAM:in jäsenkyselyyn ja Tilastokeskuksen rekisteritietoihin.
○ Kyllä
○ En

2) * Kuinka monta henkilöä kotitalouteenne kuuluu tällä hetkellä sinut itsesi mukaan lukien?
○ 1 henkilö
○ 2 henkilöä
○ 3 henkilöä
○ 4 henkilöä
○ 5 henkilöä
○ 6 henkilöä tai enemmän
Kirjoita riveille montako kuhunkin ikäryhmään kuuluvaa henkilöä talouteesi kuuluu. Jos taloudessasi ei ole tämän ikäisiä, kirjoita 0

3) * Kuinka moni kotitalouteenne kuuluvista on:
* alle 7-vuotias?
* 7–17-vuotias?
* 18–24-vuotias?
* 25–64-vuotias?
* 65 vuotta täyttänyt?

4) * Oletko tällä hetkellä:
○ naimisissa tai rekisteröidyssä parisuhteessa
○ avoliitossa
○ eronnut tai asumuserossa
○ leski
○ naimaton

5) * Mikä on koulutusasteesi?
○ perusaste (perus-, kansa- tai keskikoulu) tai vähemmän
○ keskiaste (pääsääntöisesti 2–3 vuotta perusasteen jälkeen, mm. ylioppilastutkinto, 1-3-vuotiset ammatilliset tutkinnot, ammatilliset perustutkinnot, ammattitutkinnot ja erikoisammattitutkinnot. Esim. lähihoitaja, sähköasentaja)
○ alin korkea-aste tai alempi korkeakouluaste (pääsääntöisesti 2-4 vuotta keskiasteen jälkeen. Ammattikorkeakoulututkinnot ja yliopistojen alemmat korkeakoulututkinnot, esim. teknikko, hortonomi, artenomi, sairaanhoitaja, insinööri)
○ ylempi korkeakouluaste tai tutkijakoulutusaste (pääsääntöisesti vähintään 5-6 vuotta päätoimista opiskelua keskiasteen jälkeen. Ylemmät korkeakoulututkinnot, lääkäreiden erikoistumistutkinnot, lisensiaatin tai tohtorin tutkinnot)
○ jokin muu, mikä?

6) * Millainen on terveydentilasi omasta mielestäsi?
○ hyvä
○ melko hyvä
○ keskitasoinen
○ melko huono

○ huono

RUOKAOSIO

Ajattele edellistä kuukautta. Kuinka monta kertaa olet syönyt seuraavia ruokia?
Ilmoita kunkin elintarvikeryhmän kohdalla, kuinka usein olet käyttänyt kyseistä elintarviketta. Merkitse rasti siihen sarakkeeseen, joka parhaiten kuvaa elintarvikkeen käyttöä viimeisen **kuukauden aikana**. Mikäli et ole syönyt kyseistä ruokaa viimeisen kuukauden aikana, valitse vaihtoehto ”ei ollenkaan”. Tutkimuksessa ollaan kiinnostuneita vain tietyistä ruoka-aineista. Niitä ruoka-aineita, joita ei erikseen kysytä, ei tarvitse merkitä mihinkään.

10) *
Kuinka monta kertaa olet syönyt kasviksia, hedelmiä ja marjoja viimeisen kuukauden aikana?

	Ei ollenkaan	Harvemmin kuin kerran kuussa	1-3 päivänä kuussa	1-2-päivänä viikossa	3-5 päivänä viikossa	Päivittäin tai lähes päivittäin	Useammin kuin kerran päivässä
a) Tuoreet kasvikset (esim. salaatti, porkkanaraaste, tomaatti, kurkku)	○	○	○	○	○	○	○
b) Kypsennetyt kasvikset ja säilykekasvikset (lisukkeena, osana ruokia, esim. sienet)	○	○	○	○	○	○	○
c) Peruna (kaikissa muodoissa)	○	○	○	○	○	○	○
d) Herne, pavut, linssit ja soija (esim. tofu, falafel, kikherneet, nyhtökaura, härkis, seitan, hummus)	○	○	○	○	○	○	○
e) Tuoreet hedelmät	○	○	○	○	○	○	○

	Ei ollenkaan	Harvemmin kuin kerran kuussa	1-3 päivänä kuussa	1-2-päivänä viikossa	3-5 päivänä viikossa	Päivittäin tai lähes päivittäin	Useammin kuin kerran päivässä
f) Säilyke- ja pakastehedelmät	○	○	○	○	○	○	○
g) Marjat (tuoreet ja pakastetut)	○	○	○	○	○	○	○
h) Marja- ja hedelmäkiisselit ja -keitot, mehukeitot	○	○	○	○	○	○	○

16) * Mitä mieltä olet seuraavista väittämistä? Valitse se vaihtoehto, joka parhaiten kuvaa mielipidettäsi.
Minulle on tärkeää…

	Ei lainkaan tärkeää	Ei kovin tärkeää	Melko tärkeää	Erittäin tärkeää
a) että ruokani on kotimaista.	○	○	○	○
b) syödä paljon lihaa.	○	○	○	○
c) syödä paljon kasviksia, hedelmiä ja marjoja.	○	○	○	○
d) että syömäni ruoka auttaa pitämään painoni kurissa.	○	○	○	○
e) että syömäni ruoka on hyväksi terveydelleni.	○	○	○	○
f) että syömäni ruoka aiheuttaa ympäristölle mahdollisimman vähän haittaa.	○	○	○	○
g) että valmistamani ruoka on helppo- ja nopeatekoista.	○	○	○	○
h) että voin syödä mitä mieleni tekee.	○	○	○	○
i) olla murehtimatta ruokani ympäristövaikutuksia.	○	○	○	○
j) olla murehtimatta terveysvaikutuksia.	○	○	○	○

32) * Kun taloutenne kaikki tulot otetaan huomioon, saatteko tavanomaiset menonne niillä katetuiksi?

- ○ suurin vaikeuksin
- ○ vaikeuksin
- ○ pienin vaikeuksin
- ○ melko helposti
- ○ helposti
- ○ hyvin helposti

Appendix 2. SPSS syntaxes of certain analyses

Vegetable, fruit, and berry consumption modifications

```
RECODE p1_marja (1=0) (2=0.12) (3=0.47) (4=1.5) (5=4) (6=6) (7=8) INTO marja_freq.
EXECUTE.
RECODE p1_tuorehedelma (1=0) (2=0.12) (3=0.47) (4=1.5) (5=4) (6=6) (7=8) INTO
tuorehedelma_freq. EXECUTE.
RECODE p1_tuorekasvis (1=0) (2=0.12) (3=0.47) (4=1.5) (5=4) (6=6) (7=8) INTO
tuorekasvis_freq. EXECUTE.
RECODE p1_kypsakasvis (1=0) (2=0.12) (3=0.47) (4=1.5) (5=4) (6=6) (7=8) INTO
kypsakasvis_freq. EXECUTE.

COMPUTE marja_freq_ln=LN(marja_freq+0.01). EXECUTE.
```

Demographic variables

```
RECODE p1_koulutusaste (1=1) (2=1) (3=2) (4=2) INTO koulutus_binary.
EXECUTE.

RECODE p1_tulotvsmenot (1=1) (2=1) (3=1) (4=2) (5=2) (6=2) INTO
tulotvsmenot_binary.
EXECUTE.
SPSSINC CREATE DUMMIES VARIABLE=tulotvsmenot_binary
ROOTNAME1=dummy_tulotvsmenot_binary
/OPTIONS ORDER=A USEVALUELABELS=YES USEML=YES OMITFIRST=NO.

RECODE p1_nykytilanne (1=1) (2=2) (3=2) (4=2) (5=2) (6=2) (7=2) (8=2) (9=2) (10=2)
INTO nykytilanne_binary.
EXECUTE.

COMPUTE
taloudenaikuiset=sum1.(p1_kotital_18_24,p1_kotital_25_64,p1_kotital_65yli).
EXECUTE.
COMPUTE taloudenlapset= p1_kotital_lkm-taloudenaikuiset.
EXECUTE.
COMPUTE kotitaloudetlapsia = p1_kotital_alle7 + p1_kotital_7_17.
EXECUTE.
RECODE kotitaloudetlapsia (0=0) (1=1) (2=1) (3=1) (4=1) (5=1) (6=1) (7=1) (8=1) (9=1)
(10=1) (11=1) (12=1) INTO kotitaloudetlapsia_binary.
EXECUTE.
```

Food choice motives

Relative motives

```
COMPUTE ymparisto_relative=p1_ymparisto - Values_total_mean_orig.
EXECUTE.
COMPUTE terveys_relative=p1_tervruoka - Values_total_mean_orig.
EXECUTE.
```

```
COMPUTE kotimruoka_relative=p1_kotimruoka - Values_total_mean_orig.
EXECUTE.
COMPUTE paljonkasvis_relative=p1_paljonkasvis - Values_total_mean_orig.
EXECUTE.
```

Absolute motives

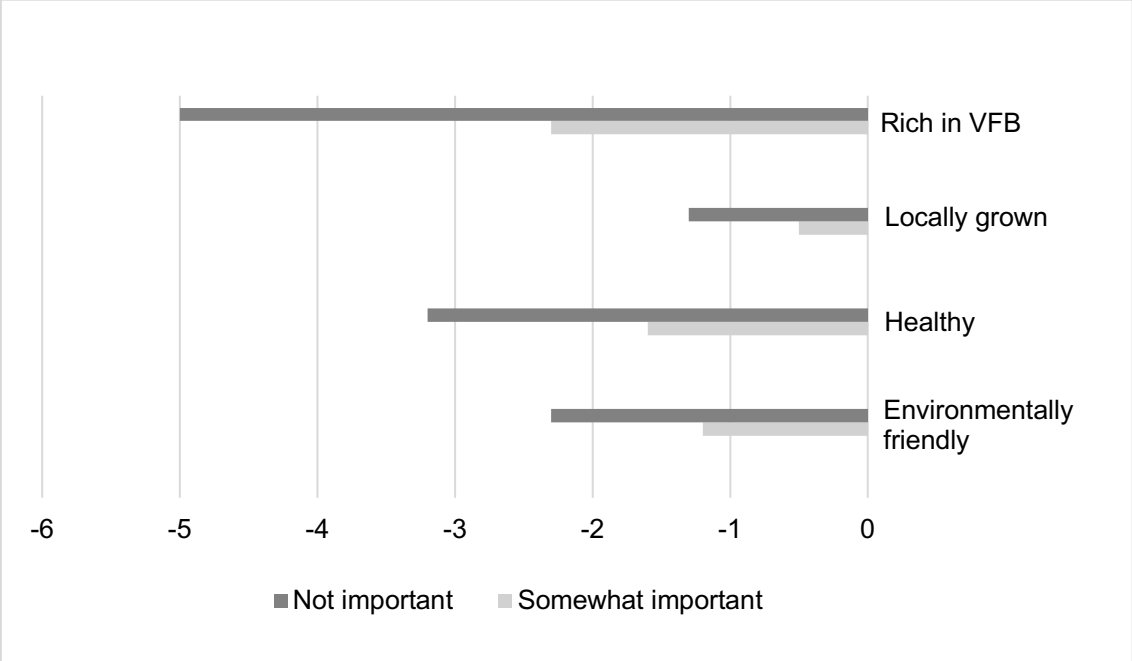
```
RECODE p1_tervruoka (1=1) (2=1) (3=2) (4=3) INTO tervruoka_3luok.
EXECUTE.
RECODE p1_ymparisto (1=1) (2=1) (3=2) (4=3) INTO ymparisto_3luok.
EXECUTE.
RECODE p1_paljonkasvis (1=1) (2=1) (3=2) (4=3) INTO paljonkasvis_3luok.
EXECUTE.
RECODE p1_kotimruoka (1=1) (2=1) (3=2) (4=3) INTO kotimruoka_3luok.
EXECUTE.

SPSSINC CREATE DUMMIES VARIABLE=tervruoka_3luok
ROOTNAME1=dummy_tervruoka_3l
/OPTIONS ORDER=A USEVALUELABELS=YES USEML=YES OMITFIRST=NO.
SPSSINC CREATE DUMMIES VARIABLE=ymparisto_3luok
ROOTNAME1=dummy_ymparisto_3l
/OPTIONS ORDER=A USEVALUELABELS=YES USEML=YES OMITFIRST=NO.
SPSSINC CREATE DUMMIES VARIABLE=paljonkasvis_3luok
ROOTNAME1=dummy_paljonkasvis_3l
/OPTIONS ORDER=A USEVALUELABELS=YES USEML=YES OMITFIRST=NO.
SPSSINC CREATE DUMMIES VARIABLE=kotimruoka_3luok
ROOTNAME1=dummy_kotimruoka_3l
/OPTIONS ORDER=A USEVALUELABELS=YES USEML=YES OMITFIRST=NO.
```

Appendix 3. Correlations for relative food choice motives and VFB consumption

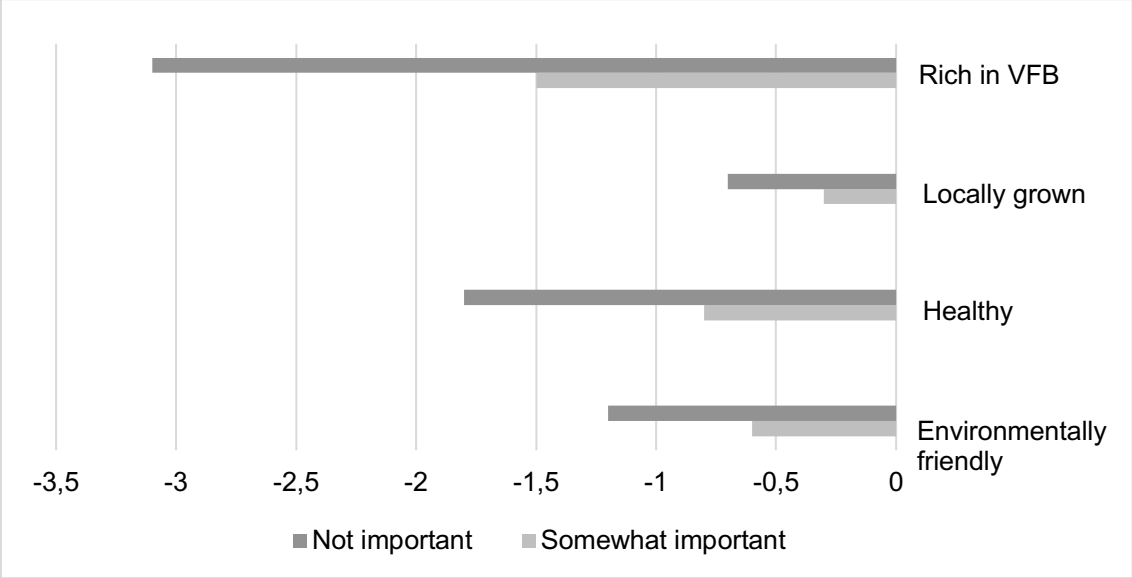
Appendix 3.1. Correlations Between Four Relative Motives and VFB consumption.

		1.	2.	3.	4.	5.	6.	7.
1.	Healthy	-	-	-	-	-	-	-
2.	Environmentally friendly	-0.35**	-	-	-	-	-	-
3.	Locally grown	-0.42**	-0.32**	-	-	-	-	-
4.	Rich in VFB	-0.07**	-0.41**	-0.41**	-	-	-	-
5.	Vegetables	-0.00	-0.02	-0.17**	0.22**	-	-	-
6.	Fruit	-0.02	-0.05**	-0.16**	0.25**	0.44**	-	-
7.	Berries	-0.02	-0.06**	-0.10**	0.20**	0.44**	0.44*	-

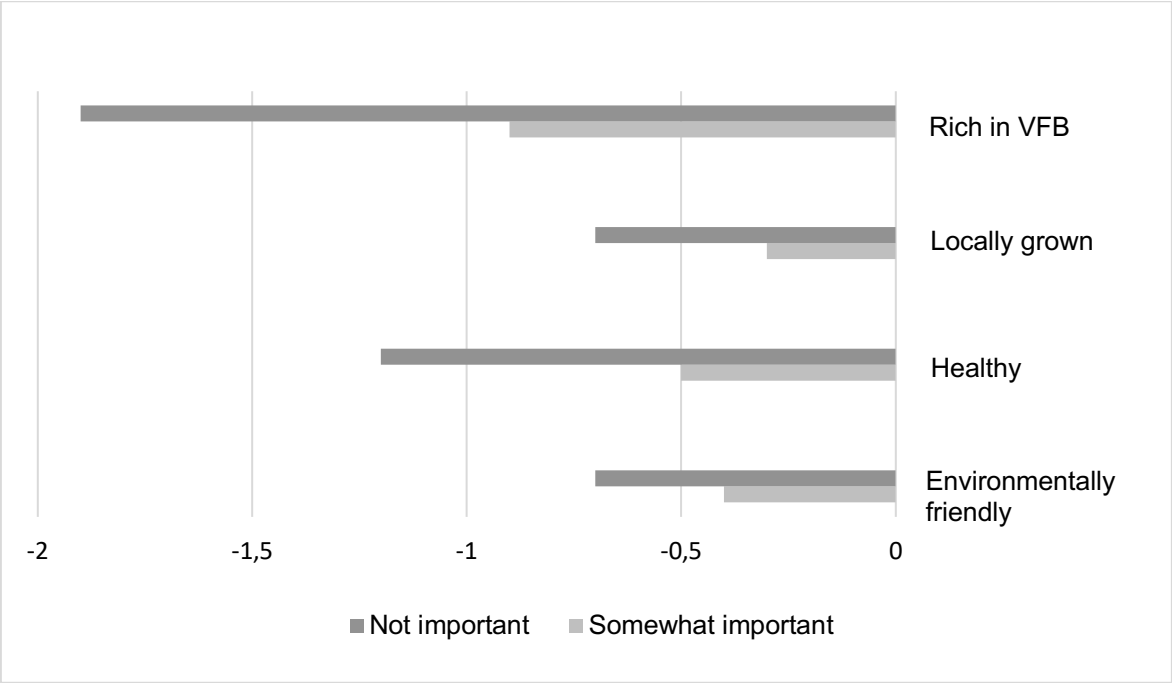
Appendix 4. Figures of regression analyses of food choice motives and vegetable, fruit, and berry consumption frequencies



Appendix 4.1. Vegetable consumption frequencies were reported as times a week by motives. Those finding the motives not important or somewhat important are compared to those who found the motives important (reference group). Maximum consumption frequency was 16 times a week.



Appendix 4.2. Fruit consumption frequencies were reported as times a week by motives. Those finding the motives not important or somewhat important are compared to those who found the motives important (reference group). Maximum consumption frequency was 8 times a week.



Appendix 4.3. Berry consumption frequencies were reported as times a week and logarithmically modified by motives. Those finding the motives not important or somewhat important are compared to those who found the motives important (reference group). LN scale.

Appendix 5. Regression results for relative motives, food choice motives and VFB consumption

Appendix 5.1. Multiple linear regression models of relative motives' association with VFB consumption, when adjusted with age and gender, N=6433

MI	Vegetables				Fruit				Berries			
		CI				CI						
*Relative motives	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2
Environmentally friendly	-0.18	-0.38	0.01	0.03	-0.25	-0.37	-0.13	0.05	-0.20	-0.28	-0.12	0.03
Healthy	0.03	-0.19	0.26	0.03	-0.07	-0.21	0.07	0.05	-0.06	-0.16	0.03	0.03
Locally grown	-1.23	-1.41	-1.05	0.05	-0.72	-0.84	-0.61	0.07	-0.30	-0.38	-0.23	0.04
Rich in VFB	1.88	1.67	2.08	0.07	1.36	1.23	1.49	0.11	0.71	0.62	0.80	0.07

*Adjusted with age and gender

Appendix 5.2. Multiple linear regression models (MII) of relative motives' association with VFB consumption, when adjusted with age, gender, self-perceived health, education, employment status, parental status and marital status, N=6404

MII	Vegetables				Fruit				Berries			
		CI				CI				CI		
Relative motives*	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2	B	LI	UI	Adj R^2
Environmentally friendly	-0.15	-0.34	0.04	0.06	-0.24	-0.36	-0.12	0.07	-0.19	-0.27	-0.11	0.05
Healthy	0.03	-0.19	0.25	0.06	-0.08	-0.23	0.06	0.07	-0.06	-0.15	0.03	0.05
Locally grown	-1.24	-1.42	-1.06	0.09	-0.73	-0.84	-0.61	0.09	-0.31	-0.39	-0.24	0.06
Rich in VFB	1.85	1.64	2.05	0.10	1.36	1.23	1.49	0.13	0.71	0.62	0.80	0.09

*Adjusted with age, gender, self-perceived health, education, employment status, parental status, and marital status

Resources

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