Long-term change in healthy food consumption in Finland during 1985-2016: An age-period-cohort analysis

ANTTI KÄHÄRI[a]

Abstract.

Societal change is reflected in food consumption habits. In post-industrial societies, consumers are increasingly emphasising health, ethical, and ecological aspects in their consumption habits. This study investigated the changes in food consumption in Finland during 1985−2016. Fruits and berries, vegetables, and fish were used as indicators of healthy and contemporary food habits. To untangle the dynamics of change, time series data of Finnish household budget surveys from 1985 to 2016 and novel age-period-cohort models were used. The share of total expenditure of all examined foods increased incrementally during the study period. Increasing vegetable and fruit consumption was reflected in the younger birth cohorts consuming more than the preceding ones. Cohort differences could not be explained by rising incomes, educational level, or urbanisation. The food expenditure shares of fruit, berries, and fish were highest and rose most in over-50 age groups. However, the food expenditure shares of vegetables and fruit and berries also rose in younger age groups during the most recent period.

KEYWORDS: food consumption; health; social change; age-period-cohort; life course

Word count: 8,990

1 INTRODUCTION

Food consumption habits of consumers are constantly evolving as societies experience social, economic, political, and cultural changes (Kearney 2010). Western societies underwent major nutritional changes, as modernisation processes improved living standards and revolutionised food production. The resulting increased consumption of fat, sugar, processed foods, and caloric beverages combined with a sedentary lifestyle has made chronic diseases, such as diabetes and heart disease, the main health burden of advanced societies (Popkin 2006). However, the nutrition transition model proposes that in higher-income countries, behavioural change might begin to reverse the detrimental effects of unhealthy modern lifestyles (Popkin 2006). Indeed, recent decades have witnessed such changes in consumer culture in general and food culture in particular, as contemporary consumers are increasingly concerned by the health, ecological, and ethical aspects of consumption, which, in turn, influence food producers and marketers (Carrier & Luetchford 2012; Lowe et al. 2008; Wiseman et al. 2018).

Antti Kähäri
Department of social research, University of Turku, Turku, Finland
E-mail:akakah@utu.fi
Phone: +358407689170
Address: 20014 University of Turku

Previous literature suggests that long-term changes in food consumption habits should be studied from the life-course perspective (Devine 2005). In the life-course perspective, societal changes are studied simultaneously with human life-courses, which are, in turn, situated in that societal history. Newer generations grow up in sometimes dramatically differing food environments than their predecessors. Thus, it has been suggested that birth cohort and generation play a role in changing food consumption patterns (Mori & Saegusa 2010; Warde 1997). However, studies examining changing food consumption from the cohort perspective are scarce. A handful of studies have touched on healthy food consumption in the United States and Japan, and uncovered a tendency for younger birth cohorts to consume less fish, fruit, and vegetables (Mori et al. 2000; Mori & Stewart 2011; Mori et al. 2016; Stewart & Blisard 2008).

This study extends the existing literature in multiple ways. First, the long-running Household Budget Surveys (HBS) collected between 1985 and 2016 enable us to study long-term change over a 30-year observation window. Comparable long-running data are crucial if we want to investigate historical developments in consumption patterns. Second, changes are studied from the cohort perspective. Studies concerning changing consumption habits have traditionally focused on socioeconomic differences. Additionally, an age-period-cohort analysis sheds light on which age groups are most sensitive to change, which is important information for policymakers. Third, the existing cohort studies that have analysed food consumption do not go any further in explaining the observed patterns. Drawing on the nutrition transition model (Popkin 2006), this study considers income, education, and urbanisation as possible mechanisms explaining long-term change. These are typical characteristics of the modernisation process, and are associated with healthier food habits in cross-sectional settings (Ricciuto et al. 2006). Fourth, this study demonstrates the fruitfulness of applying age-period-cohort models originally developed to analyse other phenomena in other contexts as well.

Against this background, it is important to study how healthy food consumption has evolved between generations (operationalised here as birth cohorts), while considering age effects. Thus, we gain a deeper understanding about who are the forerunners in changing health habits. This study asks the following research questions: (1) How has healthy food consumption developed over time?; (2) How does healthy food consumption vary by birth cohort?; (3) How does healthy food consumption vary by age?; and (4) Can long-term change be explained through income, education, or urbanisation?

Through an age-period-cohort analysis, this study investigates long-term changes in the consumption of vegetables, fruit (including berries), and fish. These food categories are used as indicators of healthy food consumption, as reflected by international nutrition recommendations (World Health Organization 2013), but they also signify more ecological and ethical choices for many consumers (Vanhonacker & Verbeke 2014).

The article is structured as follows. The following section provides the theoretical framework underlying this study and reviews the results from previous literature. Subsequently, the research data and methods used are presented. This is followed by an age-period-cohort analysis on food consumption patterns in Finland. The last section reviews and discusses the main findings, concluding the article.

2 BACKGROUND

2.1 Food consumption in flux

Social change is reflected in lifestyles in general and food consumption in particular. Industrialisation set in motion a cascade of economic, social, cultural, and political changes that together have been termed 'modernisation' (Inglehart 1997). The modernisation process

lifted living standards and opportunities for people in the Western world and entailed significant changes in food consumption. For example, Engel's law was formulated based on the association between income and food consumption: when income raises, the budget share of food decreases (Houthakker 1957). Modernising food consumption patterns were also qualitatively characterised by increasing consumption of animal products and energy-dense and processed foods. As a corollary, chronic diseases came to plague developed societies, entailing significant losses in forms of worsening work ability and rising health care costs (Popkin 2006). This epidemiological transition from communicable to chronic diseases is one of the factors making health a primary goal of the late modern citizen (Cockerham 2005).

As advanced industrial societies experience further economic and technological changes, the value priorities of the public shift from materialist (physical sustenance and safety) to postmaterialist (belonging, self-expression and quality of life) in an intergenerational process (Inglehart 1997). As a parallel development, the nutrition transition model suggests that behavioural change towards healthier lifestyle habits might occur as societies develop further (Popkin 2006). In terms of food consumption, values of contemporary consumers revolve around health, environment, and ethical aspects of food choices and systems (Carrier & Luetchford 2012).

2.2 The dynamic process of change

Classical theories of forerunners in consumption habits concentrated on the upper societal classes as drivers of change. According to scholars from Veblen (1899) to Bourdieu (1984), the upper social strata set standards for legitimate consumption styles. Regarding healthy food consumption, empirical research has established that the lower socioeconomic classes follow the upper classes with a time lag of approximately 10 years, and the gaps between classes has been persistent (Boylan et al. 2011; Giskes et al. 2010; Prättälä et al. 1992). Education, income, and occupational class are all associated with food choices (Lallukka et al. 2007). Several mechanisms, such as diet costs, health knowledge, and purchasing motives, have been found to contribute to this association (Pampel et al. 2010).

Little is known about how changes in food consumption habits occur between birth cohorts. A cohort is a group experiencing an event of interest at the same time. In empirical social research, this typically means birth cohorts (Elder & George 2016). In summary, cohort effects correspond to formative effects of social change at critical ages (see Luo 2015). Living in a particular social context and historical period might produce differences in food preferences across birth cohorts, as contemporary changes affect different age groups differently (Devine 2005; Mannheim 1952; Ryder 1965). Mannheim (1952) emphasised the potential of shared formative experiences, for which the sensitive age was at roughly 17, to develop generation consciousness. Ryder (1965) emphasised cohort replacement in social change, also noting that the potential for change lies in the younger cohorts. For example, in the 1990s in the United States, younger cohorts developed a taste for carbonated soft drinks, while the older cohorts' preference for coffee persisted (Drescher & Roosen 2013). According to an example from Finland, the generations that witnessed the shortages of World War II and the following expansion of food markets still remember their first bananas or oranges (Sillanpää 2003).

2.3 Previous findings

Food supply and consumption data show that meat consumption has more than doubled in Finland since the 1950s. The consumption of grains and potatoes decreased from the 1950s

until the 1980s, and milk consumption continues to decrease steadily. Vegetable consumption started rising in the 1980s and has tripled in volume since then. Fruit consumption has also risen, albeit more slowly. (Aalto & Peltoniemi 2014; Natural Resources Institute Finland 2017.) Questionnaire data confirms the rise in vegetable consumption between 1978 and 2014, but the increase has been significantly steeper in women than in men (Helldán & Helakorpi 2015). Therefore, we expect the food expenditure shares of vegetables, fruit, and fish to have risen over the study period (hypothesis 1).

Cohort differences in food consumption have been studied in some contexts. In Japan, younger cohorts are consuming less fruit and fish than older cohorts (Mori et al. 2000; Mori & Stewart 2011; Mori et al. 2016). These are traditional foods in the Japanese diet, and older cohorts consume them more often. Further, in the United States, younger cohorts are consuming less fruit and fewer vegetables than their older counterparts (Stewart & Blisard 2008). Additional analyses reveal cohort differences in milk consumption in the United States (Stewart et al. 2012), and eating-out behaviour in Germany (Drescher & Roosen 2013). However, the results from these contexts cannot be transferred to the Nordic context. Based on the life-course perspective on cohort differences (Elder & George 2016; Mori et al. 2016) and the rapid changes in the Finnish food environment and culture since the 1950s, we expect that younger cohorts stand out in healthy food consumption (hypothesis 2).

2.4 Age effects and the ageing population

Age tends to be reflected in food consumption habits, because people start paying more attention to their heath as they age, being more careful about what foods to eat as a prime example (Cockerham 2005). The populations of many developed countries are ageing because of the rising life expectancy and the declining fertility rates (Christensen et al. 2009). This structural change must be taken into account when examining consumption trends (Mori et al. 2016).

Many follow-up studies have documented food habits among Europeans becoming healthier in the transition from youth to adulthood and from working life to old-age retirement (e.g., Lake et al. 2006; Mikkilä et al. 2004; Plessz et al. 2015). Cross-sectional studies have also found the consumption of fruit, vegetables, and fish to be more common in older adults than it is in younger adults (Bojorquez et al. 2015; Jahns et al. 2014; Mori & Saegusa 2010). These studies cannot separate ageing effects from period and cohort effects (Glenn 2005), but they do suggest that people might adopt healthier food consumption habits as they age (hypothesis 3).

2.5 Explaining cohort and age differences

The nutrition transition model suggests that the modernising pattern and the possible behavioural change towards healthier habits are both influenced by broader socioeconomic changes, such as economic growth, urbanisation, technical change, and culture (Popkin 2006). In addition, succeeding cohorts in the Western world tend to be more educated than the previous ones (Drescher & Roosen 2013). In Finland, absolute incomes rose for cohorts born between 1910 and 1995, and the population has become increasingly educated over the last 50 years (Karonen & Niemelä 2019). In addition, urbanisation has continued to characterise societal change since industrialisation; furthermore, urbanisation occurred quickly in Finland (Karonen et al. 2018). Studies have found that urban dwellers eat healthier diets and are more often obese than rural residents (Berg 2000; Neovius & Rasmussen 2008). In addition, education and income are both associated with food choices (Lallukka et al. 2007). Given these

findings, it is plausible that rising incomes, education, and urbanisation are factors influencing cohort differences in healthy food consumption (hypothesis 4).

According to the life course perspective, age patterns in food consumption can be affected by life transitions and turning points (Devine 2005). Transitions include, for example, the formation of a household or becoming unemployed. Turning points, such as becoming ill or the death of a spouse, are rarer. Family members and close connections are important influences on food choice, which is referred to as the linked lives principle (Elder et al. 2003). Many transitions and turning points relate to changes in the family structure (Plessz et al. 2016). Linked lives are most evident in the influence parents have on their children's food intake (Schwartz et al. 2011). Adult couples who have children and eat at home have more similar food habits than other couples do (Laitinen et al. 1997), but the formation of a joint spousal food system can also lead to unhealthier habits (Burke et al. 2004). Thus, household structure might affect age patterns in food consumption and is considered in the analysis.

2.6 Institutional context: Finland

Finland offers an excellent setting for studying change in food consumption patterns. After Finland's comparatively rapid industrialisation, urbanisation, and transformation towards a service economy, the country's statistics on cardiovascular mortality in the 1960s and 1970s were higher than those of other nations (Alestalo & Kuhnle 1986; Jallinoja et al. 2015). A nutrition transition had taken place towards 'modern' food habits high in animal products and energy-dense fats and sugars. Finnish nutrition policy over the past decades has been internationally recognised as a success story and an example of having driven a subsequent nutrition transition in which 'behavioral change begins to reverse the negative tendencies of the preceding patterns and enable a process of successful aging' (Popkin 2006). This example of a northern welfare state contrasts with countries where healthy food consumption has been found to decrease across cohorts (Mori & Stewart 2011; Stewart & Blisard 2008).

In the big picture, food has become more affordable. Food made up over half of household consumption expenditures until the 1950s, after which it has constantly fallen to its lowest point, 12 percent in 2016 (Official Statistics of Finland 2018). Food prices fell from the 1980s until 2000, especially when Finland joined the European Union in 1994. In the 2000s, food prices have increased slowly.

3 MATERIALS AND METHODS

3.1 Data and variables

The data were drawn from the Household Budget Surveys collected by Statistics Finland (2018). All the available (eight in total) cross-sectional samples representative of the Finnish household population and covering the period 1985−2016 were used. The HBS have been collected in approximately 3- to 5-year intervals in 1985, 1990, 1995, 1998, 2001, 2006, 2012, and 2016. These data were gathered through household interviews, phone interviews, receipts, and consumption diaries. Statistics Finland drew income and education information to the dataset from population registers. Consumption was measured as monetary expenditure and reported in annual terms. Each household were assigned a head of household (HH), defined as the individual in the household with the highest earnings. The sample sizes ranged between 3,551 and 8,258 households.

The model's dependent variables were the shares of total food expenditure of (1) vegetables, (2) fruit (including berries), and (3) fish. These dependent variables are referred to

as food expenditure shares (FES). This type of measurement had the advantage of measuring specific food categories relative to the whole food basket (see Healy 2014). Information about expenditure on foodstuffs was collected using consumption diaries and receipts during a two-week accounting period (Statistics Finland 2018). Foodstuffs foraged by the household (e.g., berries and fish) were included in the expenditures using producer prices.

The independent variables in the model were the age of the HH, study period, and birth cohort of the HH. These variables were categorised into five-year intervals due to the requirements of the models used. The control variables used in the study were education, income, household structure, and urbanisation level of the household's home municipality. Education and income represented those of the HH. The education variable was divided into four categories: primary level or less, secondary level, lower tertiary, and upper tertiary. The income variable measured household disposable annual income, equivalised using the Organisation for Economic Co-operation and Development (OECD) modified equivalence scale and corrected for inflation. Household structure was measured by two variables: number of adults in the household and number of children in the household. Three categories were used to indicate the level of urbanisation of the household's municipality: city, densely populated, and rural. The variables used in this study are summarised in Table 1.

Table 1. Variables used in the study

	Description	Mean	Standard deviation	Median	Min.	Max.	Mode
Dependent variables							
VEGETABLE FES	Share of total food expenditure of vegetables, %	8.62	5.79	7.83	0	100	
FRUIT FES	Share of total food expenditure of fruit and berries, %	6.82	6.42	5.43	0	100	
FISH FES	Share of total food expenditure of fish, %	3.67	4.80	2.23	0	100	
Independent variables							
AGE 5	Age of head of household, five-year grouping	−	−	−	20−24	75−79	40−44
YEAR 5	Survey year, fitted to a five-year grouping	−	−	−	1985	2015	1995
COHORT 5	Birth year, five-year grouping	−	−	−	1915−1919	1990−1994	1945−1949
Control variables							
EDU	Educational level of head of household. 1) primary, 2) secondary, 3) lower tertiary and 4) upper tertiary.	−	−	−	1	4	1
DECILE	Household income decile, equivalised with the OECDmod equivalence scale: 1-10.	−	−	−	1	10	7
ADULTS	Number of adults in the household.	−	−	−	1	4 or more	2
CHILDREN	Number of children under the age of 17 in the household.	−	−	−	0	4 or more	0
URBAN	Urbanisation of household's home municipality. 1) urban, 2) densely populated, and 3) rural.	−	−	−	1	3	1

3.2 Statistical analysis

Estimating age, period, and cohort effects poses an identification problem (Glenn 2005). The linear dependency of age (A), period (P), and cohort (C) results in a situation where the unique effects of each are impossible to empirically or logically disentangle from one another. This leaves statistical methods as the sole tool for the researcher seeking to separate age, period, and cohort (APC) effects.

The traditional methodology for modelling APC effects has been the use of constrained generalised linear models (Mason et al. 1973). It is argued that the estimation of APC effects becomes possible if at least two age groups, two periods, or two cohorts are assumed to have identical effects. These identifying constraints break the linear dependency of age, period, and cohort, making an ordinary least squares solution possible. However, this methodology produces meaningful estimates only if the identifying constraints are properly chosen. Accomplishing this task requires prior information, which is seldom available (Yang et al. 2004.) The Intrinsic Estimator was developed as a model that could be applied without prior information, but it has also been shown to be problematic, for example, in terms of implicit assumptions and sensitivity to variable coding (Luo 2015).

This study utilised the APC-Trended (APCT) and APC-Detrended (APCD) models (Chauvel 2011). The APCT model estimates the absolute development of consumption across cohorts and age groups, whereas the APCD model estimates the relative differences between age groups, cohorts, and periods when compared to a linear trend.

The separation of linear age, period, and cohort effects is basically impossible, whereas nonlinear effects are not confounded with one another to the same extent (Glenn 2005). Therefore, the APCD method focuses on estimating the nonlinear variation around a calculated linear trend (Chauvel & Schröder 2015). The results then show which groups have the steepest slopes. The following formula illustrates the APC-detrended model:

$$\begin{cases} y^{apc} = \alpha_a + \pi_p + \gamma_c + \alpha_0 rescale(a) + \gamma_0 rescale(c) + \beta_0 + \sum_j \beta_j x_j + \varepsilon_i \\ \quad \begin{cases} \sum_a \alpha_a = \sum_p \pi_p = \sum_c \gamma_c = 0 \\ Slope_a(\alpha) = Slope_p(\pi_p) = Slope_c(\gamma_c) = 0 \\ \quad \min(c) < c < \max(c) \end{cases} \end{cases} \quad (APCD)$$

In the formula, $\alpha_a, \pi_p,$ and γ_c refer to detrended age, period, and cohort effects, respectively. The coefficients for age and cohort are standardised by rescaling them to the range -1 to +1 in '$\alpha_0 rescale(a) + \gamma_0 rescale(c)$'. This also absorbs the linear trend. The constant is expressed as β_0, and control variables β_j and x_j are considered, while ε_i denotes the error term. The model is made identifiable by applying the zero-sum and zero-slope constraints. The *a*, *p,* and *c* vectors are made to sum to zero in '$\sum_a \alpha_a = \sum_p \pi_p = \sum_c \gamma_c = 0$', and the slopes are assigned to zero in '$Slope_a(\alpha) = Slope_p(\pi_p) = Slope_c(\gamma_c) = 0$'. The first and last cohort are excluded in '$\min(c) < c < \max(c)$'. These constraints do not require the researcher to exercise choice.

The APCT model shows how cohorts differ from one another in an absolute sense, but it cannot discern whether the differences are due to cohort or period. However, the cohort coefficients are age-controlled and the age coefficients are controlled for cohort (Chauvel & Schröder 2015). The equation for the APCT model differs from the APCD model described above in that the zero-slope constraint ($Slope_c(\gamma_c)$) in the cohort coefficients is excluded, as is the rescale

function ($\gamma_0 rescale(c)$) for the cohort coefficients. Therefore, the cohort and age coefficients absorb the long-term linear progression.

Four APCT and APCD models were fitted for all dependent variables to examine how the added control variables affected the observed variation between age, period, and cohort. The first model had only age, period, and cohort as explanatory variables. In the second model, household structure was added. In the third model, the educational level of the HH and income deciles were added to determine whether they accounted for the cohort differences. In the fourth model, the urbanisation level of the home municipality was added. The model fit statistics indicated that each succeeding model fit the data better. The next section shows the results in graphical form. Full regression tables are presented in Appendix 1.
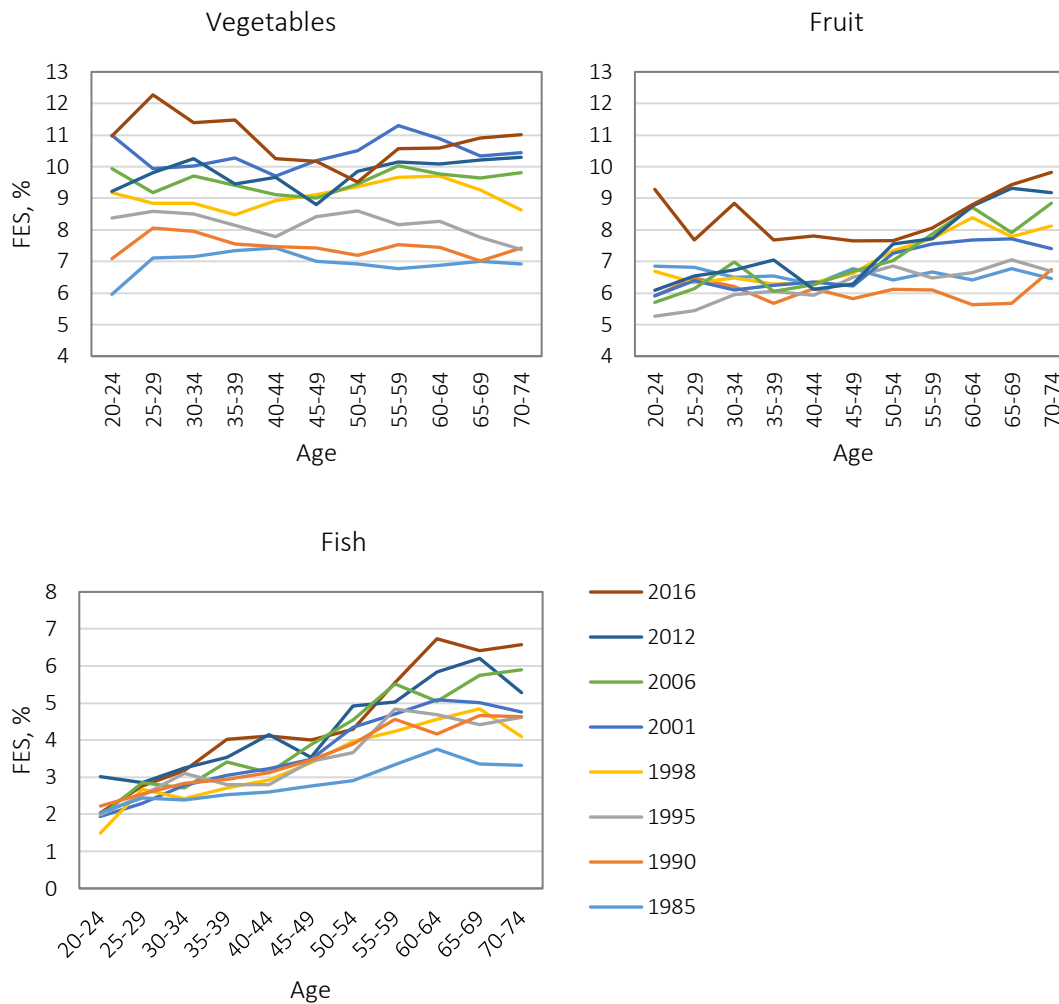
4 RESULTS

4.1 Descriptive results

Table 2 shows the mean food expenditure shares (FES) of vegetables, fruit, and fish calculated for each statistical year and their 95 percent confidence intervals (CI). During the studied period, the FES of vegetables increased by 3.66, fruit by 2.08, and fish by 2.25 percentage points. These results are in accordance with trends observed in individual-level surveys and food balance sheets from national accounts (Helldán & Helakorpi 2015; Natural Resources Institute Finland 2017). In line with hypothesis 1, the roles of vegetables, fruit, and fish in the food basket have grown.

Table 2. The shares of the total food expenditure of vegetables, fruit, and fish in the studied years

	Vegetables	*CI*		**Fruit**	*CI*		**Fish**	*CI*	
Year									
1985	7.06	*6.95*	*7.16*	6.52	*6.37*	*6.66*	2.76	*2.68*	*2.84*
1990	7.42	*7.31*	*7.54*	6.02	*5.89*	*6.14*	3.44	*3.35*	*3.54*
1995	8.16	*8.03*	*8.29*	6.29	*6.13*	*6.45*	3.49	*3.38*	*3.60*
1998	9.00	*8.83*	*9.16*	7.03	*6.84*	*7.21*	3.44	*3.30*	*3.57*
2001	10.26	*10.10*	*10.43*	6.85	*6.70*	*6.99*	3.83	*3.70*	*3.95*
2006	9.45	*9.27*	*9.62*	7.26	*7.07*	*7.46*	4.26	*4.10*	*4.43*
2012	9.77	*9.58*	*9.96*	7.60	*7.39*	*7.81*	4.64	*4.46*	*4.82*
2016	10.71	*10.50*	*10.93*	8.59	*8.35*	*8.83*	5.01	*4.82*	*5.21*
Δ 1985−2016	3.66			2.08			2.25		

Figure 1 presents the FES of vegetables, fruit, and fish by age groups and periods, shedding light on hypotheses 2 and 4 regarding cohort and age differences, respectively. The figure shows how evenly the periodical change has occurred between the age groups. If the estimates rise evenly for all the age groups, we can infer that age does not play a major role in long-term change and that any intrinsic cohort effects are unlikely. Cohort and age effects are likely if the change has occurred specifically in certain age groups, as cohort effects refer to the formative effects of social change at critical ages.

Figure 1. The share of total food expenditure of vegetables, fruit, and fish by age and cohort

The FES of vegetables has generally risen each year for all age groups, with a few exceptions. The change seems to have been slightly faster in the youngest age groups, particularly during the most recent period, 2012–2016. These results point to a negligible age effect and to a cohort pattern in which younger cohorts spend a larger FES on vegetables than older cohorts. Thus,

in terms of vegetable consumption, hypothesis 3 does not gain support, but hypothesis 2 remains plausible.

During the study period, the FES of fruit rose most in the age groups over 50, which supports hypothesis 3. However, between 2012 and 2016, the FES also increased notably among those below 50 years. A rising age pattern has been consistent every year in the FES of fish, which also supports hypothesis 3. The increases between years for fruit and those for fish have been biggest in those above 50 years, which also indicates a possible cohort effect (hypothesis 2).

4.2 Modelling results

The examination of the modelling results begins with period effects. Coefficients from the APCD models indicate differences relative to the linear trend. In other words, they measure at which points the change was most intense. As the results regarding periods were identical across models (see Appendix 1), only the first will be presented. Figure 2 shows that the FES of vegetables deviated positively (+10.6 percent) from the linear trend at the turn of the millennium. In the case of fruit, the slope was steeper than the general trend in 1985 (+5.9 percent) and 2015 (+4.8 percent) and less prominent than the general trend in 1995 (-5.8 percent). The FES of fish was above the linear trend in the 1990s (+6.6 percent) and 2015 (+5.0 percent) and below it in the 2000s.
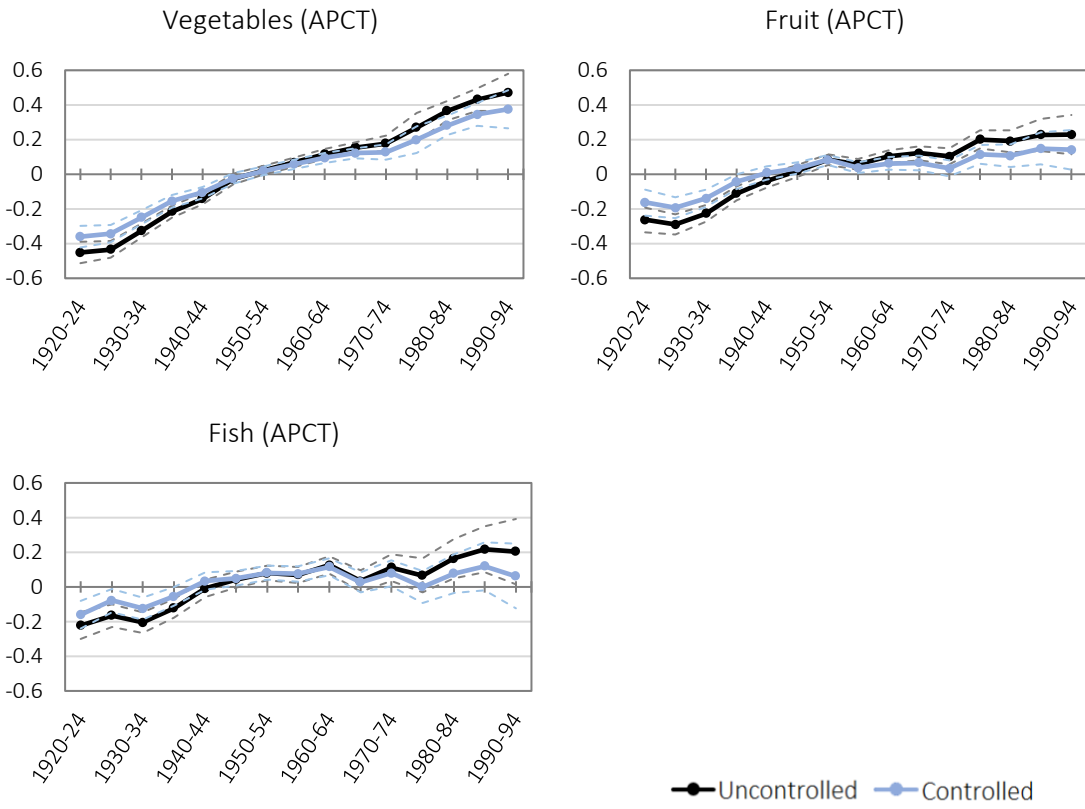
Figure 2. APCD coefficients for periods
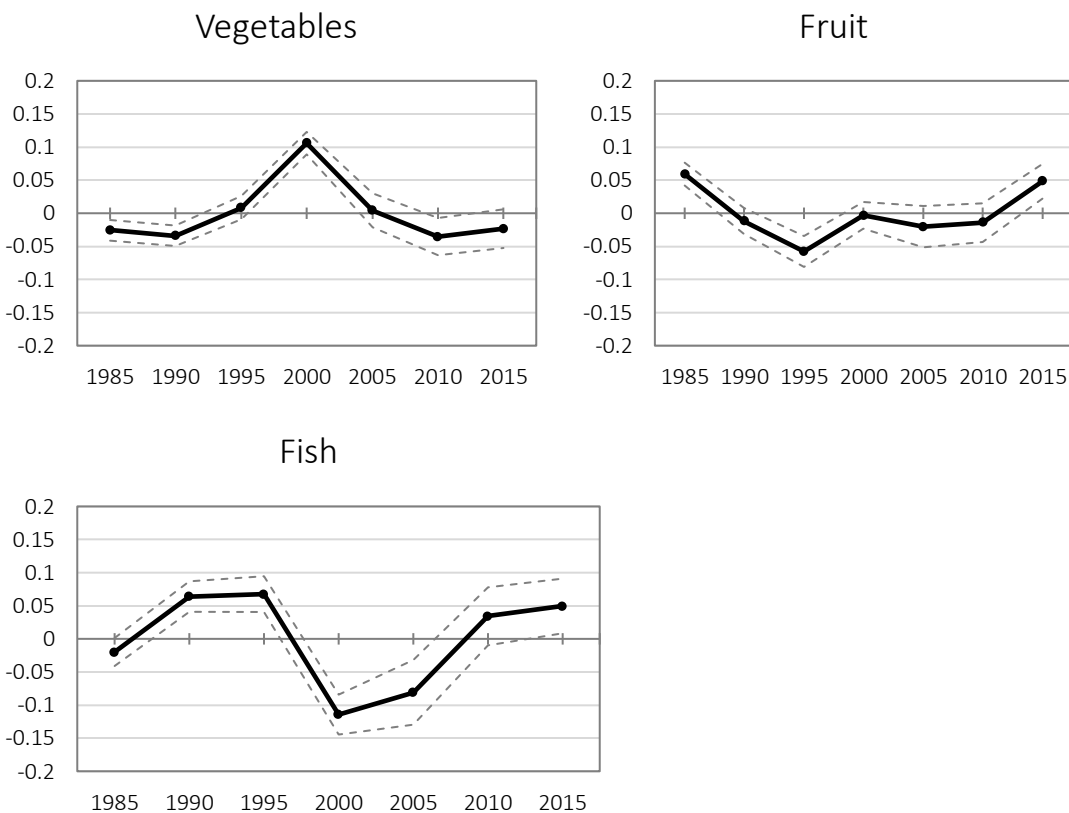
The estimates of cohort differences are presented in Figure 3. In an absolute sense, the FES of vegetables has risen for succeeding cohorts when controlled for age. This indicates that the development of vegetable consumption happened independent of age. The APCD model measuring relative differences shows that cohorts born between 1945 and 1959 had the strongest increase with the 1945−49 cohort deviating 5.3 percent from the linear trend. Conversely, the 1925−29 birth cohort deviated negatively from the linear trend (-6.0 percent). However, these differences are modest, so no intrinsic cohort effect can readily be inferred.
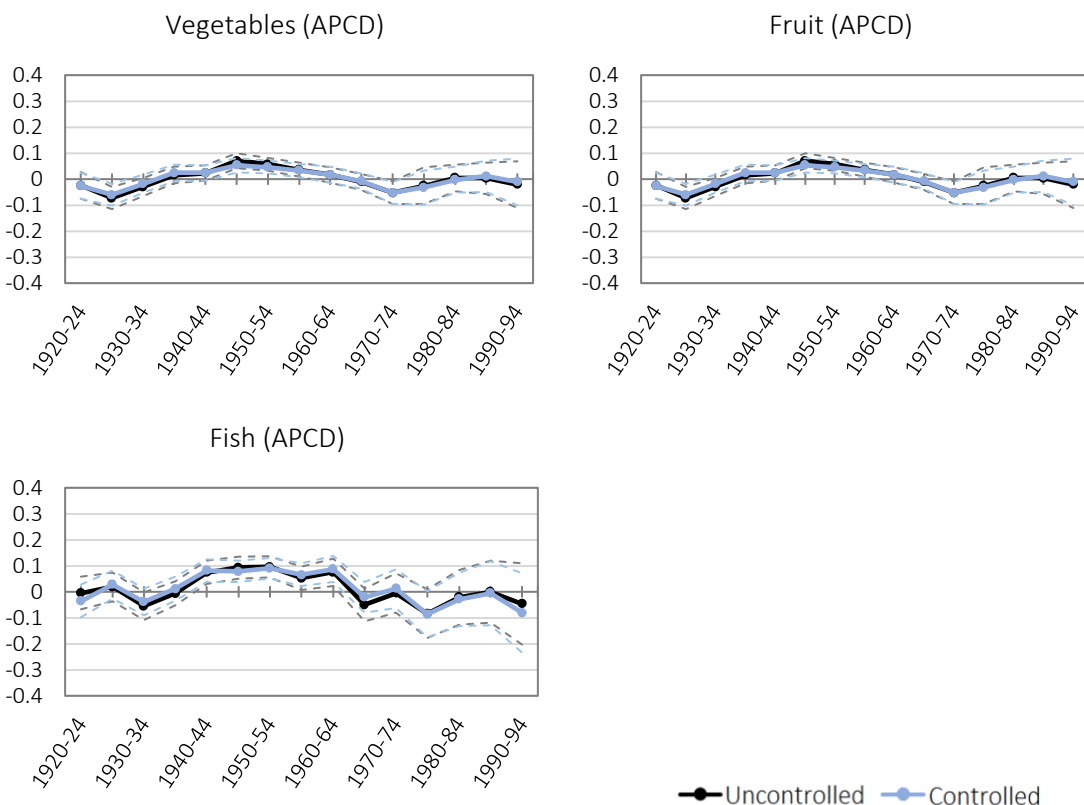
The APCT cohort estimates show that the FES of fruit has increased from the oldest cohort to the youngest, although estimates stagnate for those born between 1955 and 1974. The APCD model tells us that the cohorts born between 1940 and 1959 have experienced the strongest increase, whereas cohorts born in 1925−29 and 1970−74 deviated negatively from the linear trend.

The APCT model for fish suggests that the FES has increased among those born through 1960−64 but declined somewhat among younger cohorts. The APCD model shows the steepest slopes for those born between 1940 and 1954.

These results confirm that cohort differences in healthy food consumption can be observed (hypothesis 2). Taken together, these results suggest that younger cohorts expend a greater share of their food budget on vegetables and fruit than older cohorts do. Relatively speaking, the FES of vegetables, fruit, and fish have increased most among the baby boomer cohorts born between 1945 and 1954. No cohort differences could be explained by education, income, or the urbanisation level of the home municipality. Thus, hypothesis 4 is rejected.

Figure 3. APCT / D coefficients for cohorts

Vegetables (APCT)

Fruit (APCT)

Fish (APCT)

Uncontrolled   Controlled

Vegetables (APCD)

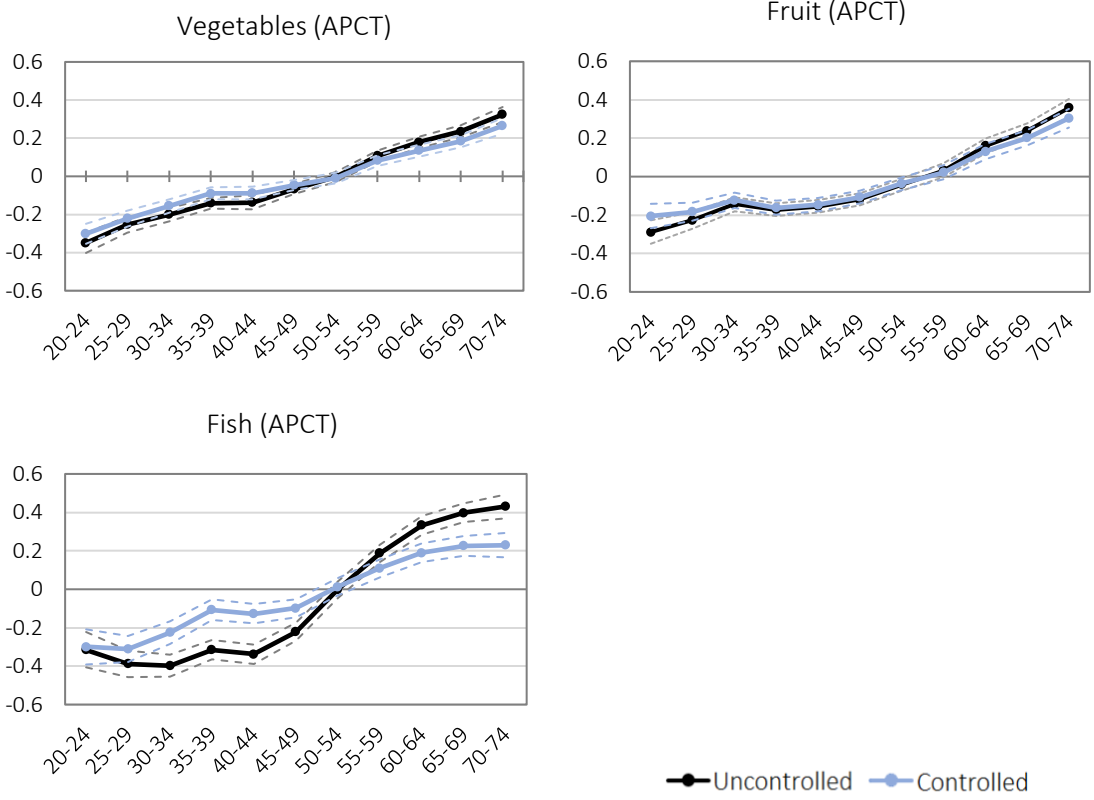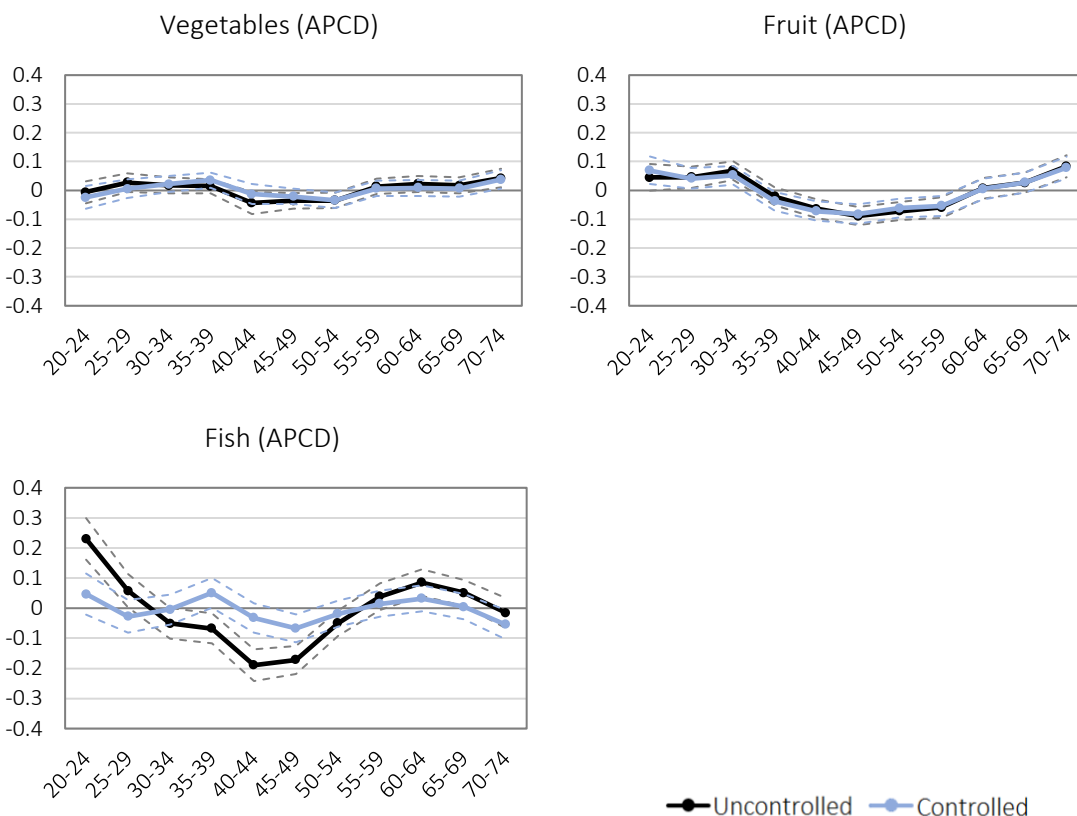Fruit (APCD)

Fish (APCD)

Uncontrolled   Controlled

In Figure 4, APCT and APCD models are presented according to age group. The APCT model shows that the FES of vegetables has typically risen by age when controlled for cohort. However, the almost linear increase by age is likely a product of intense periodical change, as the APCD coefficients show that only age groups between 40−54 years deviate negatively from the linear trend. In addition, this result is not significant in the controlled model. Thus, hypothesis 3 does not gain support in the case of vegetables.

The model results for fruit suggest a more distinctive age effect. The APCT model shows a significant increase in the FES in age groups older than 50. Younger groups have a sub-average estimate that stays relatively stable. The APCD model confirms that age effects are more prominent in the consumption of fruit than they are in the consumption of vegetables. Age groups 35−59 deviate negatively from the linear trend, meaning that they have increased their FES of fruit the least during the study period. Age groups 20−29 and 65−74 differ positively from the linear trend with the highest value in the oldest age group. Hypothesis 3 gains support in the case of fruit in that the older age groups are highlighted.

The uncontrolled APCT model for fish shows that the FES is lowest for age groups below 45 and highest for age groups over 50. Controlling for household structure makes the differences more modest. In the uncontrolled APCD model, the FES of fish deviates negatively from the linear trend in age groups 30−54 and positively in age groups 20−29 and 60−64. Again, controlling for household structure makes the pattern more closely follow a linear trend. Thus, hypothesis 3 is strongly supported in the case of fish. In addition, household structure seems to play a role in the differences between younger and older age groups.

Figure 4. APCT/D coefficients for age groups

Vegetables (APCT)

Fruit (APCT)

Fish (APCT)

Uncontrolled   Controlled

Vegetables (APCD)

Fruit (APCD)

Fish (APCD)

The FES of vegetables was progressively lower in households with more children compared to households without children. The FES of fruit and vegetables was lower in households with more adults, but it was not associated with the number of children in the household. These differences in household structure did not account for the observed age patterns. The FES of fish was gradually lower in households with more children and more adults. The number of adults and children partly explained the lower FES of fish in the age groups 30–49.

The FES of vegetables was lower in households that are located in rural areas compared to those in urban areas. Rural households also had a lower FES of fish than urban ones. The FES of fruit did not differ between rural or urban households. The FES of vegetables, fruit, and fish were higher in households whose head was highly educated. Household disposable income was not associated with the FES of vegetables. However, the FES of fruit was positively associated with household disposable income. Higher income was also associated with higher FES of fish. Regardless of these overall associations, the added variables did not account for intra-cohort differences in the food expenditure shares of vegetables, fruit, or fish.

4.5 Robustness check

Food expenditure shares could be sensitive to differential price developments between various food groups. Thus, the robustness of the results was tested by examining absolute expenditures. Statistics Finland provides individual inflation rates for each food group, which make it possible to consider changes in prices. Comparability of expenditures between different kinds of households was achieved by dividing the expenditures with the number of consumption units (the OECD modified equivalence scale).

The results from this exercise were generally in line with those gained from the analyses using food expenditure shares, with a few exceptions. According to the trended APC models (APCT), the differences between the youngest and oldest cohorts and age groups were of a similar pattern but wider in absolute expenditure than in food expenditure shares, in all studied food categories. Absolute expenditure on fruit was notably lower in age groups 20−29 than in older groups. This age difference was smaller in the examination of food expenditure shares. The detrended APC models (APCD) for absolute expenditures provided results that were in line with those for food expenditure shares.

5 DISCUSSION AND CONCLUSION

5.1 Discussion

This study analysed changes in healthy food consumption in Finland through an age-period-cohort analysis. The aim was to assess if the consumption of vegetables, fruit, and fish had changed in the past 30 years, and how this change occurs between birth cohorts and within life courses. The long time series data proved to be valuable in assessing long-term trends. According to the findings, the share of the households' food baskets consisting of vegetables, fruit, and fish rose between 1985 and 2016. This finding is consistent with the nutrition transition model (Popkin 2006), which proposes a possible behavioural change towards healthier food consumption habits in high-income countries.

However, as the literature emphasising generational effects and birth cohort replacement in the processes of social change suggest, this study revealed age and cohort patterns in the three food groups studied. During the study period, vegetable consumption rose in all cohorts, regardless of age. This study, therefore, asserts that the previously observed increases in vegetable consumption by age (e.g., Mikkila et al. 2004) are likely a by-product of periodic change. Fruit consumption rose in cohorts born between the 1920s and 1950s and between the 1970s and 1990s. Fish consumption rose from cohorts born in the 1920s to those born in the 1950s but has fluctuated around a flat trend since then. However, the change in both fruit and fish consumption has primarily occurred in age groups over 50. It is possible that after the age of 50, people become increasingly concerned with their health. Previous research has found that a positive association of age and seafood consumption is mediated by health involvement and that older respondents are more likely than younger respondents to emphasise vegetables, fruit, and fish as components of a healthy diet (Olsen 2003; Wandel & Fagerli 1999). This finding emphasises that cohort and age effects can operate in different directions (see also Mori et al. 2016). Regarding relative cohort differences, Finnish baby boomers (born 1945−1954) were above the long-term trend in all studied food categories. Compared to older cohorts, these cohorts have grown up and come of age in a period of especially rapid societal change characterised not only by rising living standards, urbanisation, and the expansion of markets and the education system but also by rapid cultural change. Possible reasons for this difference could include the pervasive influence, from the 1970s onwards, of nutritional education, as exemplified by the North Karelia project started in 1972 (Puska et al. 2009). In the same year, a new population health law was introduced that shifted the focus of health care from curative to preventive care in line with the focus of the welfare state.

This study extended previous research by testing if cohort differences in food consumption could be explained by indicators of living standards. Surprisingly, the differences between cohorts in healthy food consumption were not explained by increasing urbanisation level, increasing incomes, or rising educational level. This result suggests that the changing food consumption

patterns are related to cultural change or other factors unobserved in this study. In other words, increasing consumption of healthy foods seems to be related to broader societal changes than those related to the living conditions of households. One strand of explanations could be related to the health and nutrition policies that have been a part of the Finnish welfare state since the 1970s (Pietinen et al. 2010).

As for the relative differences between age groups, groups between the age of 35 and 54 years used the smallest food expenditure shares on fruit and fish. In the case of fish, this was explained by household structure. Consumption of vegetables and fish was also lower in households with more children. These results can be interpreted using the linked lives principle provided by the life course perspective (Elder et al. 2003). In a typical Western life course, the 40s are an age period of intense labour force participation and childrearing, both of which consume vast amounts of time and mental resources (Jabs & Devine 2006). On the other hand, a 70-year-old seldom participates in the labour force anymore, and any children are typically subsisting on their own. More often than others, the parents of young children report difficulties buying the foods they consider healthy (Wandel & Fagerli 1999).

As for the control variables, this study found evidence for the associations between healthy food consumption and place of residence, educational level, and income. Urban households spent a higher proportion of their food budgets on vegetables and fish compared to rural households. Higher education was also associated with a higher food expenditure share of all the studied food groups. Higher income was associated with higher food expenditure shares of fruit and fish.

These results highlight the advantages of research conducted on changing food consumption habits in the Finnish context. The picture sketched here differs from the U.S., where studies have found a declining pattern of vegetable consumption in younger cohorts (Stewart & Blisard 2008), and Japan, where younger cohorts have significantly lowered their fruit and fish expenditure (Mori & Stewart 2011). Popkin's (2006) use of Finland as an example of a nutrition transition towards healthier habits appears justified. The APC-Trended and APC-Detrended methods proved to be very useful in the context of consumption research.

A limitation of this study is the observation unit and the resulting omission of gender from the analysis. Women eat more healthily than men. This gender difference has been observed even among young children and cross-culturally (Cooke & Wardle 2005; Wardle et al. 2004). The household budget survey has the household as its observation unit, but the HH does not necessarily make the decisions about food purchases. Therefore, a reliable gender comparison could not be undertaken, as the gender of the HH does not necessarily indicate who makes the decisions about food. Further research on changing food consumption habits should seek to take gender into account.

Another limitation of this study is that the measuring expenditure on food brought home does not consider the potential food waste or eating out behaviour. Not all food that is brought is consumed. Studies show an increasing trend of eating out, which also varies across social groups (Liu et al. 2012; Warde & Martens 2000; Warde et al. 2007; Warde et al. 2019). Eating out, in turn, has been associated with unhealthier food habits and consumption of fast foods (Monsivais et al. 2014; Todd et al. 2010). The evolution of food activities in terms of location and time use warrant more research.

5.2 Conclusion

Through an age-period-cohort analysis of data on household food expenditures, this study found that vegetables, fruit, and fish made up a greater share of food expenditures in the 2010s

than in the preceding decades. In addition, it found that birth cohorts and age groups play a role in this change. The results highlighted that if we are interested in changes in age, period, or cohort, the two other time variables should also be studied, failing which, we risk drawing misinformed conclusions about the drivers of change. For example, vegetable consumption has been linked to increasing age in previous studies. This study showed that these observations are likely due to the increasing periodical trend rather than age. Thus, younger birth cohorts will consume more vegetables across their life-courses. This observation entails a broader lesson, which emphasises that generational and periodical change need to be considered when analysing age patterns in any phenomena.

Further, the results of this study showed that age and cohort patterns might operate in different directions. For example, fruit consumption was highest in younger birth cohorts, but older age groups typically consumed more fruit than younger age groups. This highlights that the sources of change were not always the younger age groups, as the classical works of Mannheim (1952) and Ryder (1965) regarding cohort differentiation suggested. Healthy food consumption appears to be a phenomenon for which the change sensitive age has been rather older adulthood than young adulthood.

Interestingly, cohort differences in healthy food consumption were not explained by rising incomes, educational level, or urbanisation. This result informs further research to focus on different strands of explanations. These could be political or cultural, for example. Future cohort studies should continue to seek explanations for observed trends.

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