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Work participation and physicality of work in young adulthood and the development of obesity and unhealthy lifestyle habits later in life: A prospective cohort study

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Conflict of interest

The authors declare that they have no conflicts of interest.

Authors' contributions

RS, JIH, AS, NH-K, OR, JV, JV and TL meet the criteria of authorship and planned the study.

RS analysed the data and drafted the manuscript. All authors contributed to the interpretation of the results and critical revision of the manuscript and approved the final version of the manuscript for publication.

What is already known about this subject?

- The effects of work-related factors in young adulthood and early entry into employment on the development of adverse health behaviours later in life are unclear.

What are the new findings?

- Physicality of work in young adulthood increased the rate of future obesity and smoking, particularly among women.
- The rates of smoking and obesity were higher, and the rate of leisure-time physical activity was lower in people who entered the labour market at ages 18–21 or younger compared to those who entered the labour market at ages 22–24.

How might this impact on policy or clinical practice in the foreseeable future?

- The roots of unhealthy behaviours and obesity begin in young adulthood. Thus, preventive measures or interventions that start in midlife could be too late to be effective. Prevention of obesity and unhealthy behaviours should start in adolescence and young adulthood, paying special attention to young people in physically heavy jobs and those who enter the labour market early.

Abstract

Objective: To determine the effects of early entry into the labour market and physicality of work in young adulthood on the development of obesity and unhealthy lifestyle habits later in life.

Methods: This study is a part of the Young Finns Study. Entry into the labour market and physicality of work were measured at baseline, when participants were aged 18, 21, or 24 years in 1986, or 18 years in 1989. Follow-up of lifestyle habits were conducted in 2001, 2007 and 2011. The outcomes were obesity (N=5558 observations), abdominal obesity (N=4060 observations), daily smoking (N=5628) and leisure-time physical activity (N=5946) and analysed with generalized estimating equation.

Results: Compared with sedentary work, physicality of work in young adulthood increased the odds of future obesity (adjusted odds ratio (OR)=1.32, 95% CI 1.01-1.74 for light/moderate work and OR=1.44, CI 0.99-2.08 for heavy manual work [particularly in women OR=2.03, CI 1.07-3.84]) and future smoking (OR=1.79, CI 1.39-2.30 for light/moderate work and OR=2.01, CI 1.47-2.76 for heavy manual work [particularly in women OR=2.81, CI 1.60-4.91]). For those who entered the labour market at ages 18-21 or younger, the odds of smoking was 1.85 times (CI 1.26-2.73) and that of obesity 1.45 times (CI 1.01-2.10) higher, and the rate of leisure-time physical activity was 0.73 times (CI 0.58-0.93) lower compared with those who entered the labour market at ages 22-24.

Conclusion: Early entry into the labour market and physicality of work in young adulthood shape the development of obesity and unhealthy behaviours in later adulthood.

Keywords: Exercise; overweight; weight gain; work engagement; workload; smoking

Introduction

Unhealthy lifestyle habits such as smoking, lack of physical activity, and also excess body mass are among the leading contributors to deaths and disability-adjusted life-years worldwide.¹ The role of work-related factors in the development of adverse health behaviours is unclear. Previous research has primarily focused on midlife and older adults, with few studies exploring whether entry into paid employment and adverse work exposure in early adulthood shape the development of unhealthy lifestyle habits and obesity in later life.

Associations between adverse working conditions and body mass index (BMI) remain unclear. A study conducted in Australian adults reported that inflexible working hours and working on weekends predicted weight gain.² Sex difference has also been observed between adverse working conditions and weight gain. For example, in a Finnish prospective cohort study, unfavourable physical working conditions increased the risk of weight gain in men, but not in women.³ On the other hand, in a Swedish cohort, high job demands increased the risk of weight gain in women, but not in men.⁴ Studies have also observed that physical demands,⁵ psychological demands^{2 5} and job type² do not increase the risk of obesity. A review of 22 cross-sectional and prospective studies found inconclusive results on the association between work stress (effort/reward imbalance and job strain) and body weight.⁶ Furthermore, a meta-analysis of prospective cohort studies reported that job strain does not increase the risk of weight gain or obesity.⁷

Early entry into employment can be stressful for some young adults. As a consequence of high stress, young adults may adopt unhealthy behaviours, for example, they may start to smoke as a coping mechanism.⁸ First jobs could also be lower-paid occupations and workers may have poor access to healthy foods in the workplace. Moreover, co-workers' behaviours may influence

young workers' lifestyle habits.⁹ Previous prospective cohort studies on smoking reported that early transition from education to employment in young adults⁸ and working long hours in adults^{10 11} increased the risk of smoking. Working long hours not only increased the number of cigarettes smoked daily, but also increased the rate of smoking among former smokers and reduced the rate of quitting smoking among current smokers.¹¹ However, working longer hours predicted lower risk of smoking among middle aged Finnish and Japanese men.¹² On the other hand, high physical exertion and high psychological demands predicted heavy smoking among adults.¹³

Regarding leisure-time physical activity (LTPA), a study¹⁴ reported that middle-aged employees with physically demanding jobs may reduce their LTPA, while sedentary workers may increase their LTPA. Another study¹⁵ found that working long hours is associated with a lower rate of LTPA. However, prospective cohort studies have reported inconsistent results; some reported that working long hours is not significantly associated with LTPA among working age adults,^{10 12 16} while others reported reduced LTPA in those who worked longer hours.^{17 18} A lower grade job (lower supervisory and technical) has also been associated with reduced LTPA among adults aged 16 or older.¹⁷

As demonstrated above, the adverse effects of early entry into employment and physicality of work in early adulthood on the risk of excess body mass and unhealthy lifestyle habits later in life are unclear. Longitudinal studies examining the association between adverse working conditions in young adulthood and health behaviours and BMI in later adulthood are scarce. If the roots of unhealthy behaviours and obesity in midlife begin in one's early career, preventive measures in midlife would be too late. Furthermore, unhealthy behaviours and obesity predict work disability and premature exit from paid employment.^{19 20} It is thus important to identify modifiable determinants, such as adverse early career work exposures.

In the current study, we aimed to determine whether early entry into first employment and physicality of work in young adulthood shape the development of unhealthy lifestyle habits in adulthood. In addition, we aimed to identify sensitive periods in young adulthood when entry into labour market is most harmful regarding the development of obesity and adverse health behaviours.

Methods

Population

This study is a part of the Young Finns Study. Of 4,320 children and adolescents aged 3-18 years, 3,596 (83%) participated in the baseline assessment in 1980 (Figure S1).²¹ The participants were invited from five Finnish university cities. The follow-ups were conducted in 1983, 1986, 1989 (subpopulation, N=632), 1992 (subpopulation, N=891), 2001, 2007 and 2011. The local ethics committees approved the study protocol and the participants gave written informed consent. Work exposures were not relevant for most of the initial baseline participants, and physicality of work was introduced in the later surveys. We therefore considered 1986 and 1989 follow-ups as the baseline of the current study, and included participants aged 18, 21, or 24 in 1986, and those who turned 18 in 1989. Subsequent surveys (2001, 2007 and 2011) were used for the follow-up of the unhealthy lifestyle habits when the participants were aged 30-49 years. There were 5558 observations with data on obesity, 4060 with data on abdominal obesity, 5628 with data on smoking and 5946 observations with data on LTPA.

Independent variables

Information on physicality of work, entry into first employment and age at entry into paid employment was based on data collected in 1986/1989. The question on physicality of work had six alternative responses: 1) 'lightweight sitting', 2) 'other sedentary work', 3) 'physically light standing or light mobile work', 4) 'physically light to moderate mobile work', 5) 'heavy manual labour', and 6) 'very heavy manual labour'.^{22 23} We classified physicality of work into three groups: 1) sedentary work (1 and 2), 2) light standing or light/moderate mobile work (3 and 4), and 3) heavy manual work (5 and 6). Information on entry into first employment was inquired as a yes/no question as well as the year of employment between 1978 and 1989. For participants

who entered the labour market, we classified the age when entering first employment at baseline into: 1) 18 years or younger, 2) 19-21 years, 3) 22-24 years, and 4) 25-27 years.

Outcomes

Obesity. Body weight and height were measured at baseline and three follow-up study waves and obesity was defined as a BMI ≥ 30 kg/m².²⁴ Waist circumference was measured in 2001, 2007 and 2011 (N=4060 observations) and *abdominal obesity* was defined as waist circumference ≥ 102 cm for men and ≥ 88 cm for women.^{24 25}

Smoking. We used a self-administered questionnaire to collect data on smoking at all time points. Smoking status was classified into four groups: 1) never smoked; 2) former smokers; 3) occasional smokers; and 4) daily smokers. We used daily smoking as an outcome.

Leisure-time physical activity. LTPA was assessed by the same questionnaire at all time points. The questions and construction of the LTPA index have been published in an earlier report.²⁶ The five questions assessed: 1) intensity of LTPA, 2) frequency of vigorous LTPA, 3) number of hours spent in vigorous LTPA, 4) average duration of a LTPA session, and 5) participation in organized LTPA.²⁶ The participant's responses to the five questions were summed to calculate a LTPA index for each time point. The LTPA index ranged between 5 and 15. We used a cut-off point of 11 or higher to define moderate or vigorous LTPA at least twice a week.²⁶

Other covariates

A self-administered questionnaire was used to collect information on age, gender, and parental and participant's socioeconomic status. Parental occupation and education, and household income were assessed in 1980.²⁷ Parental occupation was assessed in five classes: 1) upper non-manual, 2) lower non-manual, 3) upper manual, 4) lower manual, and 5) farmers. Parental

education was classified into three levels based on years of education of the more educated parent: 1) <9 years, 2) 9-12 years, and 3) >12 years. The household income was classified into three levels: 1) below average (lowest quartile), 2) mean (two middle quartiles), and 3) above average (highest quartile). Participant's educational status (comprehensive school; secondary education, not academic; and academic) and occupational status (manual; lower-grade non-manual; and higher-grade non-manual) were assessed in 2001, when they were aged 30-39 years.

Statistical analysis

Missing data at baseline ranged between 0.9% and 3.4% for parental education and occupation, household income, BMI, smoking and physical activity. It was 17.1% for participants' education and 26.2% for participants' occupational class. We used multiple imputation to impute the missing data on the covariates and created 10 datasets. We included age, sex, educational level, occupational status, parental education and occupation, income, physicality of work, entry into first employment, and lifestyle habits (in all time points) in the imputation models. A generalized estimating equation²⁸ was used to analyse the associations of physicality of work, entry into first employment and age at entry into employment with unhealthy lifestyle habits using repeated measures data on lifestyle habits. For age at entry into the labour market, those who entered the labour market at ages 22-24 years served as the reference group, because this age group includes typical age to finish education (by 23 years) and was considered to enter employment neither too early nor late, and a majority had already entered into employment. The estimates were adjusted for age, gender, parents' education and occupation, household income, participant's educational level and occupational status at age 30 years or older, physicality of work, entry into first employment, smoking (a 4-group variable), BMI (continuous variable), and LTPA (continuous variable). Gender-specific analyses were performed to determine whether the adverse effects of early entry into the labour market on

lifestyle habits differ by gender. Furthermore, as sensitivity analyses, the participants with the unhealthy outcome of interest prevalent already in 1986/1989 (overweight/obesity [BMI \geq 25 kg/m²], smoking), or participants who turned 18 in 1989 were excluded from the analyses. Stata, version 15, (StataCorp, College Station, TX, USA) was used for the analyses.

Results

Of the study population, 58% had entered the labour market for the first time at ages 15-27 years in 1978-1989 and 15.5% had heavy manual work at baseline in 1986/1989 (Table 1). At baseline, 13% were overweight or obese, 24% were daily smokers and 21% were physically active during leisure-time. In 2001, 17% were abdominally obese.

Obesity

After controlling for confounders, the odds of obesity during the follow-up was higher among participants whose work in young adulthood had required light standing or light/moderate mobile work (adjusted odds ratio (OR)=1.32, 95% CI 1.01-1.74) and among those with heavy manual work (OR=1.44, CI 0.99-2.08) compared with sedentary workers (Table 2). In gender-specific analyses, the association reached statistical significance after adjustment for confounders in women only (OR=2.03, CI 1.07-3.84 for heavy manual work, Table S1). The odds of obesity did not differ between participants who entered the labour market at baseline and those who entered later. In age-specific analysis, the prevalence of obesity was 2.2% in 1996/1998, 18.0% in 2001, 22.6% in 2007 and 28.6% in 2011 in participants who entered the labour market at age 18 years or younger. The corresponding estimates were 0.9%, 11.3%, 14.5% and 17.3% respectively in those who did not enter the labour market at age 18. After adjustment for covariates, the odds of obesity was higher in participants who entered the labour market at ages 18-21 or younger (OR=1.45, CI 1.01-2.10), especially at age 18 or younger (OR=1.60, CI 1.06-2.41, Table 3), than in those who entered the labour market at ages 22-24. In contrast, in older participants, the odds of obesity was higher among those aged 27 who did not enter the labour market in 1978-1989 (OR=2.13, CI 1.12-4.06, Table 3) compared with participants who entered the labour market at ages 22-24. Excluding participants with overweight/obesity (N=191 observations) in 1986-89 did not change the magnitude of the

associations, however, the estimate for heavy manual work (OR=1.50, CI 1.04-2.18) became stronger. In age- and gender-specific analyses (Table S2), the odds of obesity was higher in women who entered the labour market at age 18 or younger compared with women who entered the labour market at ages 22-24 (OR=1.90, CI 1.13-3.20). In a sensitivity analysis, we explored the cohort effect and excluded participants who turned 18 in 1989. The OR of obesity increased from 1.60 (CI 1.06-2.41) to 1.79 (CI 1.14-2.80) for participants who entered the labour market at age 18 or younger.

Abdominal obesity

After adjustment for confounders, participants with light standing or light/moderate mobile work (OR=1.30, CI 1.04-1.63) and those with heavy manual work (OR=1.48, CI 1.10-1.99) were at a higher odds of abdominal obesity during the follow-up compared with sedentary workers (Table S3). Participants who entered the labour market during 1978-1989 were not at higher odds of abdominal obesity compared with those who entered the labour market later. In the age-specific analysis, the odds of abdominal obesity was higher in participants who entered the labour market at age 18 or younger compared with those who entered it at ages 22-24 (OR=1.43, CI 1.01-2.01, Table S4). However, after further adjustment for participants' education and occupational class, and physicality of work (for entry into first employment), and entry into first employment (for physicality of work), none of the estimates remained statistically significant. The associations did not differ between men and women.

Smoking

Physicality of work was associated with increased odds of smoking (Table 2). After adjustment for confounders, the odds of regular smoking increased in participants with light standing or light/moderate mobile work (adjusted OR=1.79, CI 1.39-2.30) and in participants with heavy

manual work (OR=2.01, CI 1.47-2.76) compared with sedentary workers (Table 2). This increase in smoking rate was observed in both men and women (Table S5).

Entering first employment at baseline was not associated with smoking (Table 2) and this finding was similar among men and women (Table S5). In age-specific analysis, the prevalence of daily smoking was 30.5% in 2007 and 26.9% in 2011 in participants who entered the labour market at age 18 years or younger. The corresponding estimates were 12.1% and 11.1% respectively in those who did not enter the labour market at age 18. After adjustment for confounders, the odds of smoking was higher in participants who entered the labour market at ages 18-21 or younger (OR=1.85, CI 1.26-2.73), particularly at age 18 or younger (OR=2.36, CI 1.55-3.58, Table 3), than in those who entered the labour market at ages 22-24. Excluding daily smokers in 1986-89 (N=347 observations) from the analyses did not change the findings. Both men (OR=2.36, CI 1.25-4.45) and women (OR=2.33, CI 1.32-4.10) who entered the labour market at age 18 or younger had higher odds of smoking (Table S6). On the other hand, in older participants, the odds of smoking was again higher among those aged 27 who did not enter the labour market at baseline (OR=2.08, CI 1.11-3.92, Table 3) compared with participants who entered the labour market at ages 22-24. In the sex-specific analysis, this estimate was statistically significant in women only (OR=2.78, CI 1.09-7.08, Table S6). After excluding participants who turned 18 in 1989, the OR of smoking increased from 2.36 (CI 1.55-3.58) to 2.74 (CI 1.78-4.22) for participants who entered the labour market at age 18 years or younger.

Leisure-time physical activity

Physicality of work at baseline was not associated with the rate of LTPA during the follow-up (Table 2 and Table S7). However, there was a tendency of being less physically active during leisure-time in participants who entered the labour market at baseline than in those who entered later (Table 2). In age-specific analysis, participants who entered the labour market at ages 18-

21 or younger were less physically active in leisure time (OR=0.73, CI 0.58-0.93) than participants who entered the labour market at ages 22-24. The OR was 0.72 (95% CI 0.54-0.96, Table 3) for participants who entered the labour market at age 18 or younger and 0.74 (CI 0.58-0.95, Table 3) for those who entered the labour market at ages 19-21. In age- and gender-specific analyses, the estimates did not reach statistical significance (Table S8). For participants entering the labour market at age 18 years or younger, the OR of LTPA did not change after excluding participants who turned 18 in 1989 (OR=0.71, CI 0.52-0.96).

Discussion

Physicality of work in early adulthood increased the rate of obesity and regular smoking in adulthood even after adjustment for own and parental socioeconomic measures. Entry into the labour market at younger ages increased the rate of obesity and smoking and reduced the rate of LTPA in adulthood.

Of working conditions, working long hours has been well studied in relation to obesity or weight gain. Working long hours has been associated with unhealthy weight gain among adults aged 18-64 years,^{10 29-32} including increased BMI^{29 31 32} and waist circumference²⁹. In contrast, other prospective cohort studies have not observed an association between working hours and the risk of obesity.^{2 5 12 18} To date, only a limited number of prospective cohort studies have determined the effects of physicality of work on the risk of overweight or obesity, and have reported inconsistent associations.^{2 3 5 32} Previous studies have reported that workload,³ job type,² increased physical strain at work³² and physical demands⁵ are not associated with the risk of obesity or weight gain. In addition, another study reported that people exposed to light or moderate work-related physical activity were at a higher risk of weight gain than those exposed to heavy work-related physical activity.³³ In the present study, we found that physicality of work in early adulthood and early entry into first employment increased the risk of obesity, particularly among women. Furthermore, the study adds new knowledge that people aged 27 years who are still without first employment are at higher risk of obesity compared with those who entered the labour market earlier. Physicality of work is more likely linked to low education and low-level jobs, with poor access to healthy food and/or more prevalent unhealthy behaviours. Having lunch at a workplace canteen has been associated with healthier food habits,³⁴ and low education has been linked to lower access to workplace canteen.³⁴ Young

people are more likely to get hired for low level jobs at workplaces having poor access to healthy foods. Young people also often have lower level of education that has been linked to poor health behaviours.³⁵ Eating habits of young workers are also influenced by their older coworkers.^{9 36}

In the present study, we observed that physicality of work and early entry into first employment increased the rate of smoking. There is prior evidence that the work environment may influence smoking behaviour.³⁷ High job demands such as high workload, psychological job demands, and working long hours were also reported to increase the number of cigarettes smoked among smokers and the probability of relapse after quitting smoking among former smokers.³⁷ Furthermore, exposure to high physical workload³⁸ and job stress³⁹ may reduce the rate of smoking cessation. However, unemployment may also increase the risk of smoking in young adults from low socioeconomic backgrounds.⁴⁰ On the other hand, unemployed young adults may decrease their cigarette use because of income loss.⁴⁰ The present study adds additional knowledge that people aged 27 years without first employment are at an increased risk of daily smoking than those who entered the labour market earlier.

The associations of exposure to workload factors in young adulthood and early work participation with the rate of LTPA are not known. Previous studies reported that lower supervisory and technical jobs are associated with lower rates of LTPA in working age adults compared with a higher managerial or professional job.¹⁷ The present study therefore adds to the literature by suggesting that entry into the labour market at ages 18-21 years or younger is associated with a lower rate of LTPA in later adulthood.

Strengths and limitations

Strengths of the study include its prospective nature and that weight, height, and LTPA were measured from childhood to adulthood. However, the study had also some limitations. Information on physicality of work was collected using only a single question and the study lacked data on different types of physical workload factors. Moreover, information on physicality of work was not collected at the 2001 follow-up study and no data on waist circumference were collected before the 2001 survey. We imputed missing data on covariates, but not missing data on physical workload factors and the outcomes. The proportion of the participants who were lost to follow-up or had missing data on the outcomes of the interest at follow-ups ranged between 22% and 40%. A small proportion of the participants had missing data on the lifestyle habits and the main reason of sample attrition was loss to follow-ups. The rate of loss to follow-up or missing data on BMI and lifestyle habits did not differ between the participants with or without work participation and between the participants with different levels of physicality at baseline. Only the rate of loss to follow-up or missing data on LTPA at the 2011 follow-up was significantly higher among the participants with heavy manual work compared with those with sedentary or light/moderate mobile work.

Conclusion

Physicality of work in young adulthood and early entry into the labour market increased the rate of obesity and unhealthy behaviours in later adulthood. Prevention of unhealthy behaviours should start in adolescence and young adulthood, paying special attention to young people in physically heavy jobs and those who enter the labour market early.

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Table 1: Baseline (1986/1989) characteristics of the study population. The results present proportions (%)

Characteristic	%
Age in 1989	
18	25.0
21	27.3
24	25.3
27	22.4
Female	54.4
Body mass index	
Overweight	10.9
Obese	1.9
Smoking	
Past	24.8
Occasional	12.4
Current	24.1
Moderate or vigorous leisure-time physical activity	20.8
Physicality of work	
Sedentary work	56.7
Light standing or light to moderate mobile work	27.8
Heavy manual work	15.5
Entering first employment between 1978 and 1989	58.0
Age distribution of those who entered their first employment	
≤18	33.9
19-21	39.9
22-24	20.7
25-27	5.5

Table 2: The effects of physicality of work and entering first employment between 1978 and 1989 on the risk of overweight or obesity (BMI ≥ 30 kg/m²), daily smoking and the rate of moderate or vigorous leisure-time physical activity in adulthood

Characteristic	Obesity						Smoking					
	Sample	% of outcome	OR*	95% CI	OR†	95% CI	Sample	% of outcome	OR*	95% CI	OR†	95% CI
Physicality of work												
Sedentary work	3122	12.1	1		1		3151	13.1	1		1	
Light standing or light to moderate mobile work	1494	16.3	1.44	1.11-1.87	1.32	1.01-1.74	1521	27.0	2.26	1.79-2.87	1.79	1.39-2.30
Heavy manual work	814	16.5	1.57	1.12-2.21	1.44	0.99-2.08	822	31.6	2.82	2.10-3.79	2.01	1.47-2.76
Entering first employment between 1978 and 1989 ±												
No	2259	12.4	1		1		2285	14.5	1		1	
Yes	3210	15.1	1.24	0.93-1.65	1.03	0.77-1.38	3248	23.3	1.66	1.30-2.13	1.13	0.87-1.46

* Model I: Adjustment for age, gender, parents' education, parents' occupation, household income, body mass index (for smoking and physical activity), smoking (for overweight/obesity and physical activity), and leisure-time physical activity (for overweight/obesity and smoking)

† Model II: Model I + further adjustment for participants' education, participants' occupational class, physicality of work (for entering first employment), and entering first employment (for physicality of work)

± Participants aged between 15 and 27 years in 1978-1989

Table 3: The effect of entering first employment between 1978 and 1989 in different age groups on the risk of obesity (BMI ≥ 30 kg/m²), daily smoking and the rate of moderate or vigorous leisure-time physical activity in adulthood

Age \pm	Entering first employment	Obesity						Smoking					
		Sample	% of outcome	OR*	95% CI	OR†	95% CI	Sample	% of outcome	OR*	95% CI	OR†	95% CI
18	No	1070	10.5	0.80	0.52-1.23	0.88	0.57-1.36	1085	13.7	0.97	0.64-1.49	1.16	0.75-1.80
≤ 18	Yes	1049	17.6	1.72	1.16-2.57	1.60	1.06-2.41	1072	35.3	3.28	2.19-4.90	2.36	1.55-3.58
21	No	666	14.3	1.29	0.82-2.03	1.48	0.94-2.35	667	14.8	1.18	0.74-1.89	1.51	0.93-2.46
19-21	Yes	1251	15.5	1.42	0.96-2.11	1.36	0.91-2.02	1262	20.6	1.71	1.14-2.55	1.50	0.99-2.25
24	No	310	9.7	0.70	0.36-1.37	0.82	0.42-1.61	318	12.3	1.07	0.60-1.90	1.33	0.74-2.39
22-24	Yes	737	11.8	1		1		738	12.6	1		1	
27	No	213	20.2	2.06	1.09-3.90	2.13	1.12-4.06	215	20.5	2.28	1.25-4.16	2.08	1.11-3.92
25-27	Yes	173	10.4	0.86	0.39-1.90	0.93	0.42-2.08	176	13.6	1.34	0.68-2.66	1.57	0.79-3.15

* Model I: Adjustment for gender, parents' education, parents' occupation, household income, body mass index (for smoking and physical activity), smoking (for overweight/obesity and physical activity), and leisure-time physical activity (for overweight/obesity and smoking)

† Model II: Model I + further adjustment for participants' education, participants' occupational class, and physicality of work

\pm Participants aged 22-24 who entered labour market were used as a reference group. Participants aged 18 years who did not enter employment were those who turned 18 in 1989

Work participation and physicality of work in young adulthood and the development of unhealthy lifestyle habits and obesity later in life: A prospective cohort study

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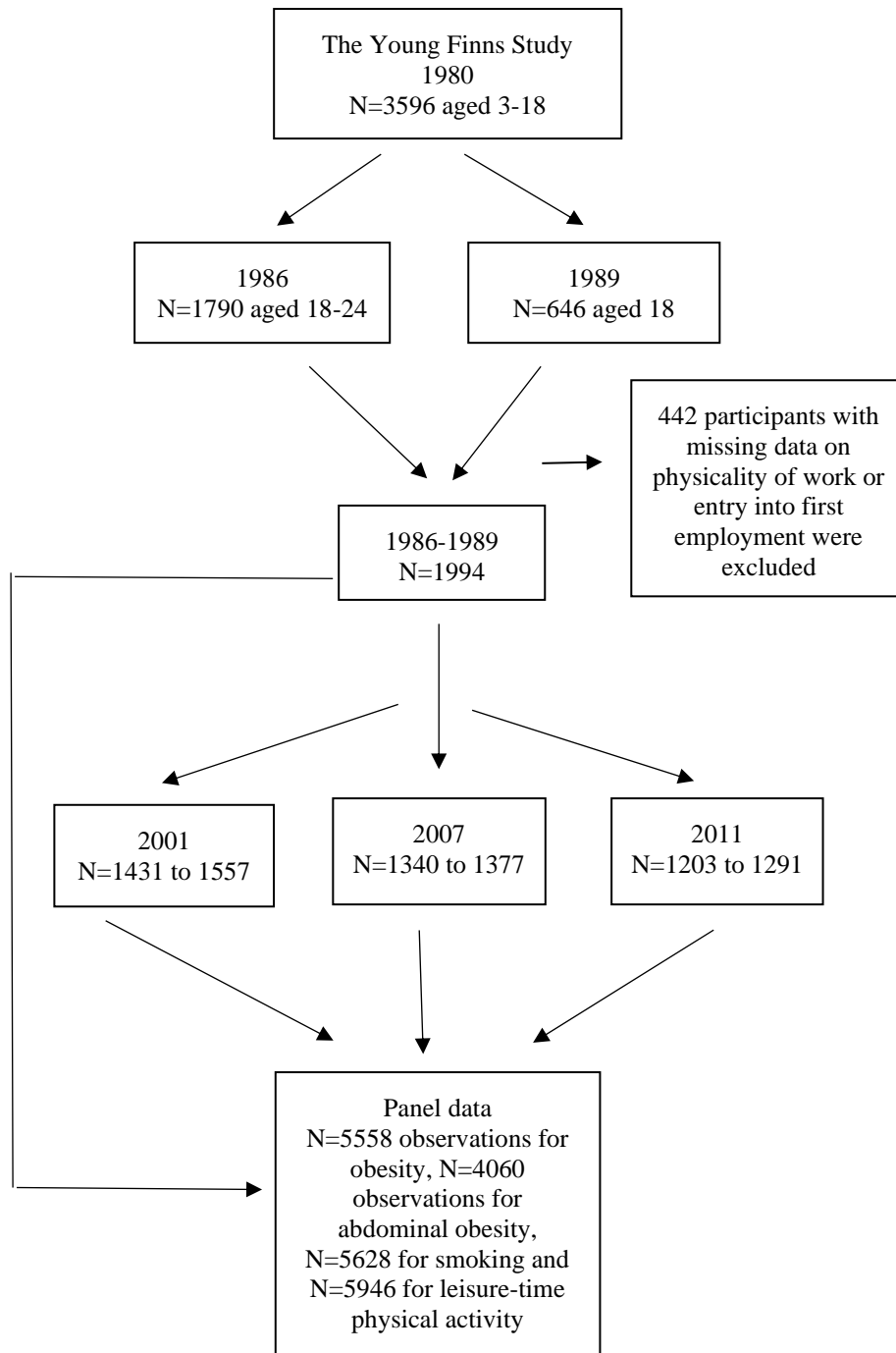


Figure S1: Flow chart of the study population, the Young Finns Study

Table S1: The effects of physicality of work and entry into first employment between 1978 and 1989 on the risk of obesity (BMI ≥ 30 kg/m²) in men and women

Characteristic	Men				Women			
	Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
Physicality of work								
Sedentary work	1123	12.2	1		1999	12.0	1	
Light standing or light to moderate mobile work	603	16.3	1.26	0.80-1.99	891	16.3	1.38	0.96-1.98
Heavy manual work	644	15.8	1.22	0.77-1.92	170	18.8	2.03	1.07-3.84
Entry into first employment								
No	1063	12.5	1		1196	12.3	1	
Yes	1334	15.9	1.03	0.67-1.57	1876	14.5	1.07	0.71-1.62

*Adjustment for age, parents' education, parents' occupation, household income, participants' education, participants' occupational class, physicality of work, entry into first employment, smoking, and leisure-time physical activity

Table S2: The effect of entry into first employment between 1978 and 1989 in different age groups on the risk of obesity (BMI ≥ 30 kg/m²) in men and women

Age	Entry into first employment	Men				Women			
		Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
18	No	492	10.4	0.80	0.39-1.62	578	10.6	0.93	0.53-1.65
≤ 18	Yes	530	16.0	1.28	0.64-2.57	519	19.3	1.90	1.13-3.20
21	No	302	14.2	1.25	0.57-2.73	364	14.3	1.71	0.96-3.03
19-21	Yes	490	16.9	1.36	0.70-2.66	761	14.6	1.35	0.81-2.24
24	No	145	7.6	0.63	0.22-1.83	165	11.5	1.05	0.42-2.61
22-24	Yes	234	12.4	1		503	11.5	1	
27	No	124	22.6	2.10	0.85-5.16	89	16.9	1.90	0.65-5.54
25-27	Yes	80	18.8	2.09	0.73-5.97	93	3.2	0.17	0.02-1.25

*Adjustment for parents' education, parents' occupation, household income, participants' education, participants' occupational class, physicality of work, smoking and leisure-time physical activity

Table S3: The effects of physicality of work and entry into first employment between 1978 and 1989 on the risk of abdominal obesity

Characteristic	Sample	% of outcome	OR*	95% CI	OR†	95% CI
Workload						
Sedentary work	2249	26.8	1		1	
Light standing or light to moderate mobile work	1097	32.8	1.30	1.04-1.63	1.20	0.95-1.51
Heavy manual work	592	29.7	1.48	1.10-1.99	1.32	0.96-1.82
Entry into first employment						
No	1598	25.8	1		1	
Yes	2394	31.0	1.16	0.92-1.45	0.99	0.78-1.26

* Model I: Adjustment for age, gender, parents' education, parents' occupation, household income, smoking and leisure-time physical activity

† Model II: Model I + further adjustment for participants' education, participants' occupational class, physicality of work (for entry into first employment), and entry into first employment (for physicality of work)

Table S4: The effect of entry into first employment between 1978 and 1989 in different age groups on the risk of abdominal obesity

Age	Entry into first employment	Sample	% of outcome	OR*	95% CI	OR†	95% CI
18	No	746	23.1	0.91	0.64-1.31	0.98	0.68-1.42
≤18	Yes	775	33.3	1.43	1.01-2.01	1.28	0.89-1.82
21	No	459	29.2	1.26	0.85-1.86	1.41	0.94-2.10
19-21	Yes	934	32.2	1.32	0.95-1.84	1.26	0.91-1.76
24	No	233	22.3	0.72	0.44-1.18	0.81	0.49-1.35
22-24	Yes	553	27.1	1		1	
27	No	160	33.8	1.62	0.94-2.80	1.61	0.92-2.79
25-27	Yes	132	25.0	1.08	0.59-1.97	1.16	0.64-2.12

* Model I: Adjustment for age, gender, parents' education, parents' occupation, household income, smoking and leisure-time physical activity

† Model II: Model I + further adjustment for participants' education, participants' occupational class, and physicality of work

Table S5: The effects of physicality of work and entry into first employment between 1978 and 1989 on the risk of smoking in men and women

Characteristic	Men				Women			
	Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
Physicality of work								
Sedentary work	1121	14.8	1		2030	12.2	1	
Light standing or light to moderate mobile work	608	32.2	1.92	1.31-2.81	913	23.6	1.72	1.21-2.43
Heavy manual work	647	32.0	1.84	1.24-2.73	175	30.3	2.81	1.60-4.91
Entry into first employment								
No	1063	17.8	1		1222	11.6	1	
Yes	1338	28.9	1.18	0.83-1.68	1910	19.3	1.04	0.71-1.53

*Adjustment for age, parents' education, parents' occupation, household income, participants' education, participants' occupational class, body mass index, leisure-time physical activity, physicality of work (for entry into first employment), and entry into first employment (for physicality of work)

Table S6: The effect of entry into first employment between 1978 and 1989 in different age groups on the risk of smoking in men and women

Age	Entry into first employment	Men				Women			
		Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
18	No	491	16.7	1.11	0.57-2.16	594	11.3	1.25	0.69-2.25
≤18	Yes	534	40.8	2.36	1.25-4.45	538	29.7	2.33	1.32-4.10
21	No	299	18.1	1.47	0.70-3.11	368	12.2	1.56	0.81-3.01
19-21	Yes	490	24.1	1.37	0.72-2.60	772	18.4	1.60	0.93-2.73
24	No	146	17.8	1.38	0.58-3.30	172	7.6	1.21	0.54-2.71
22-24	Yes	232	16.4	1		506	10.9	1	
27	No	127	21.3	1.72	0.72-4.15	88	19.3	2.78	1.09-7.08
25-27	Yes	82	14.6	1.61	0.55-4.68	94	12.8	1.54	0.61-3.87

*Adjustment for parents' education, parents' occupation, household income, participants' education, participants' occupational class, physicality of work, body mass index, and leisure-time physical activity

Table S7: The effects of physicality of work and entry into first employment between 1978 and 1989 on the rate of moderate or vigorous leisure-time physical activity in men and women

Characteristic	Men				Women			
	Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
Physicality of work								
Sedentary work	1193	36.0	1		2135	30.9	1	
Light standing or light to moderate mobile work	656	28.2	0.95	0.70-1.30	969	25.7	0.99	0.78-1.26
Heavy manual work	672	26.3	1.06	0.75-1.48	188	23.9	1.02	0.64-1.63
Entry into first employment								
No	1115	35.7	1		1270	32.4	1	
Yes	1428	27.7	0.86	0.64-1.15	2022	26.7	0.88	0.70-1.12

*Adjustment for age, parents' education, parents' occupation, household income, participants' education, participants' occupational class, physicality of work, entry into first employment, body mass index, and smoking

Table S8: The effect of entry into first employment between 1978 and 1989 in different age groups on the rate of moderate or vigorous leisure-time physical activity in men and women

Age	Entry into first employment	Men				Women			
		Sample	% of outcome	OR*	95% CI	Sample	% of outcome	OR*	95% CI
18	No	519	38.0	1.02	0.65-1.59	614	32.9	0.90	0.66-1.23
≤18	Yes	558	23.1	0.68	0.42-1.10	566	22.6	0.76	0.53-1.07
21	No	301	35.9	0.97	0.58-1.60	382	34.0	0.99	0.68-1.44
19-21	Yes	531	27.7	0.73	0.46-1.14	818	24.3	0.75	0.55-1.01
24	No	157	33.1	0.85	0.46-1.56	186	30.1	0.85	0.55-1.31
22-24	Yes	251	35.5	1		535	32.9	1	
27	No	138	29.7	0.78	0.41-1.50	88	27.3	0.85	0.44-1.62
25-27	Yes	88	35.2	0.88	0.42-1.86	103	35.9	1.08	0.62-1.88

*Adjusted for parents' education, parents' occupation, household income, participants' education, participants' occupational class, physicality of work, body mass index, and smoking