Clinical Nutrition ESPEN 45 (2021) 206–212

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Original article

Retirement is associated with a decrease in dietary quality

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ARTICLE INFO

Article history:
Received 25 May 2021
Accepted 23 August 2021

Keywords:
Diet
Retirement
Prospective study
Dietary guidelines
Dietary patterns

SUMMARY

Background and aim: Retirement has been associated with changes in dietary intake. We evaluated dietary intake and compliance to dietary guidelines after retirement in a population-based survey.
Methods: Data from a prospective study conducted in Lausanne, Switzerland. Dietary intake was assessed using a validated food frequency questionnaire in 2009–2012 (first survey) and 2014–2017 (second survey). Total energy intake (TEI), macro and micronutrients, foods, dietary scores and compliance to dietary guidelines were assessed. Three approaches were used comparing changes in dietary intake: 1) before and after retiring (paired analysis); 2) in participants who retired with gender- and age-matched participants who did not retire (two-group comparison), and 3) in participants who retired, who did not retire or who were retired at both surveys (analysis of variance).
Results: Using the first approach, newly retired participants (n = 215) increased their intake of total (median and [interquartile range]: 15.2 [13.7–17.5] vs. 14.9 [13.3–17.1] % of TEI) and animal (11.1 [9.1–13.0] vs. 10.0 [8.5–12.6] %TEI) protein; total (35.8 [32.1–40.7] vs. 34.6 [30.0–39.1] %TEI), saturated and monounsaturated fat; alcohol; cholesterol; vitamin D and fish, and decreased their intake of vegetable protein; total carbohydrates and monosaccharides, and of the Mediterranean diet score. Those findings were confirmed for total and saturated fat, alcohol, total carbohydrates and monosaccharides; vitamin D and fish intake, and of the Mediterranean diet score in the other two approaches.
Conclusion: Retirement was associated with an unhealthier dietary intake.

1. Introduction

Retirement is an important life event characterized by a reduction in income and changes in everyday life, with possible effects on cardiovascular risk factors [1]. Retirement can also impact diet: the Health and Retirement Study - Health Care and Nutrition Survey in the US showed that only 10.7% of respondents had a good quality diet [2] The reduction of social networks after retirement can further worsen the diet: another US study showed that elderly people who lived alone with no children or friends nearby had the lowest fruit and vegetable consumption [3]. An Australian study showed that being retired was associated with lower baseline animal protein pattern scores, but no other differences in dietary patterns between retired and professionally active participants was found [4].

People who retire tend to decrease their food expenditures [5], while increasing cooking time [6]. The decrease in food expenditures leads to a higher intake of unhealthier, cheaper foods [7]. Thus, retirement has been considered as a risk factor for weight gain [8] but also for malnutrition [9]. In turn, the decreased diet quality could impact subjective well-being, thus creating a vicious circle where poor diet decreases well-being, which in turn leads to an unhealthier diet [10].

Still, the impact of retirement on diet is unclear. Retirement has been associated with an improvement [11,12] or a worsening [7] on diet. Similarly, most reviews on the effect of retirement on diet failed to provide a definite conclusion [1,13,14]. A recent study [15] reported that retirement could lead both to favourable and unfavourable changes in diet, and concluded that more high-quality, longitudinal research was needed. Further, many studies assessing the impact of retirement on diet focused on specific foods such

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https://doi.org/10.1016/j.clnesp.2021.08.026

as fish [16], vegetables [12], fruits and vegetables [17] or alcohol [18], while the number of studies assessing dietary intake as a whole is small [7,19].

Switzerland is a high-income European country, where dietary intake has slightly improved in the last decades [20–22]. Previous studies assessed the socio-economic determinants of diet at the cross-sectional [23,24] or longitudinal [25] level, but didn't assess the effect of retirement on dietary intake.

Hence, the objective of our study was to study the impact of retirement on a large panel of dietary markers, by comparing dietary intake 1) before and after retirement, 2) between newly retired people and age-matched professionally active counterparts, and 3) between people newly retired, who did not retire or who were retired at two timepoints. Our hypothesis was that retirement is associated with a change in dietary intake quality.

2. Materials and methods

2.1. Study design

The CoLaus (**Co**horte **Laus**annoise) study is a population-based prospective study assessing the clinical, biological, and genetic determinants of cardiovascular disease in the city of Lausanne, Switzerland [26]. Recruitment began in June 2003 and ended in May 2006; the first follow-up was performed between April 2009 and September 2012 and the second follow-up between May 2014 and April 2017. The information collected at follow-ups was similar to the baseline examination, except that dietary assessment was also performed. Hence, for this study, only data from the follow-up examinations (2009–2012 and 2014–2017) were used.

The institutional Ethics Committee of the University of Lausanne, which afterwards became the Ethics Commission of Canton Vaud (www.cer-vd.ch) approved the baseline CoLaus study (reference 16/03, decisions of 13th January and 10th February 2003). The approval was renewed for the first (reference 33/09, decision of 23rd February 2009) and the second (reference 26/14, decision of 11th March 2014) follow-ups. The study was performed in agreement with the Helsinki declaration and its former amendments, and in accordance with the applicable Swiss legislation. All participants gave their signed informed consent before entering the study. Data analysis was conducted in Switzerland and no data was shared with outside groups.

2.2. Population and sample

The target population was people aged between 35 and 75 living in the city of Lausanne, Switzerland. Initial recruitment was performed by mail and telephone. At baseline and both follow-ups, participants responded to several questionnaires, underwent a physical examination at the Lausanne University Hospital, and had blood drawn for analyses.

2.3. Retirement

In both follow-ups, professional status was assessed by questionnaire. Participants were considered as being retired between the first and the second follow-up if they fulfilled two conditions: 1) they responded positively at first follow-up and negatively at second follow-up to the question "do you have an occupational position?", and 2) answered "retirement" to the question "Reason for not working" at second follow-up.

Participants were considered as professionally active if they responded positively to the question "do you have an occupational position?" at both follow-ups.

2.4. Dietary intake

Dietary intake was assessed using a self-administered, semi-quantitative food frequency questionnaire (FFQ) which also included portion size [27]. This FFQ has been validated in the Geneva population [27,28]. Briefly, this FFQ assesses the dietary intake of the previous 4 weeks and consists of 97 different food items accounting for over 90% of the intake of calories, proteins, fat, carbohydrates, alcohol, cholesterol, vitamin D and retinol, and 85% of fibre, carotene, and iron. For each item, consumption frequencies ranging from "less than once during the last 4 weeks" to "2 or more times per day" were provided, and the participants indicated the average serving size (smaller, equal, or bigger) compared to a reference size.

We computed the Mediterranean dietary score according to Trichopoulou et al. [29]. The score uses consumption frequencies instead of amounts. Briefly, a value of 0 or 1 is assigned to each of seven foods using their sex-specific medians as cut-off. Participants whose consumption frequencies for "healthy" foods (vegetables, fruits, fish, cereal) were above the median were given the value of 1, while for "unhealthy" foods (meat, dairy products), consumption frequencies below the median were given the value of 1. Two other items were considered: ratio of monounsaturated to saturated fats and moderate alcohol consumption (between 5 and 25 g/day for women and 10 and 50 g/day for men). The score ranges between 0 and 8, higher values represent a healthier diet.

The alternative healthy eating index (AHEI) was adapted from McCullough et al. [30]. In our study, the amount of trans fatty acids could not be assessed, and we considered all participants taking multivitamins as taking them for a duration $\geq$5 years. Thus, the modified AHEI score ranged between 2.5 and 77.5 instead of 2.5 and 87.5 for the original one, higher values represent a healthier diet.

Participants were dichotomized according to whether they followed the dietary recommendations for fruits, vegetables, meat, fish, and dairy products from the Swiss Society of Nutrition [31]. The recommendations were $\geq$2 fruit portions/day; $\geq$3 vegetable portions/day; $\leq$5 meat portions/week; $\geq$1 fish portion/week and $\geq$3 dairy products portions/day. In this study, we did not use portion size to compute compliance, but relied on consumption frequencies. This was done as the portion sizes recommended by the Swiss Society of Nutrition do not take into account a subject's corpulence and caloric needs [32]. As the FFQ queried about fresh and fried fish, two categories of compliance to fish consumption were considered: one included and one excluded fried fish. For each participant, the number of guidelines complied to was computed. Two sums were computed: one used compliance to fish consumption using all types of fish preparation (i.e., including fried fish); the other used compliance to fish consumption using fresh fish only.

Presence of a diet (to reduce, low fat, low sugar, or low salt) was assessed by questionnaire and categorized as present/absent.

2.5. Covariates

Marital status was categorized as living alone or in a couple. Educational level was categorized into university, high school, apprenticeship, and mandatory. Smoking status was self-reported and categorized as never, former and current. Physical activity was assessed by questionnaire [33] and categorized as sedentary/active; sedentary status was defined as spending more than 90% of the daily energy in activities below moderate- and high-intensity.

Body weight and height were measured with participants barefoot and in light indoor clothes. Body mass index (BMI) was computed and categorized into normal (<25 kg/m^2), overweight (25–29.9 kg/m^2) and obese ($\geq$30 kg/m^2).

2.6. Exclusion criteria

Participants were excluded if they 1) did not participate at both follow-ups; 2) had missing data regarding their work status at both follow-ups; 3) lacked any dietary data or reported extreme energy intakes (<850 or >4000 k cal/day) at both follow-ups and 4) missed any covariate (education, marital status, smoking, BMI or physical activity) at the first follow-up.

2.7. Statistical analysis

Statistical analyses were performed using Stata version 16.0 for Windows (Stata Corp, College Station, Texas, USA). Descriptive results were expressed as number of participants (percentage) for categorical variables and as average ± standard deviation or median [interquartile range] for continuous variables. The effect of retirement on dietary intake was assessed using three approaches.

The first approach compared the dietary intake at follow-ups 1 and 2 of participants who retired between first follow-up and second follow-up. Bivariate analyses were performed using McNemar's test for categorical variables and Wilcoxon's sign test for continuous variables.

The second approach compared changes in dietary intake of participants who retired with gender- and age-matched participants who did not retire. Comparison of changes in dietary intake between participants who retired and gender- and age-matched (±1 year) participants who remained active was performed using paired student's t-test as the distribution of the differences within each group was Gaussian.

The third approach compared changes in dietary intake between the first and the second follow-up between participants who retired and participants who did not retire or who were retired at both follow-ups. Differences in dietary intake between the second and the first follow-ups were computed, and between-group comparisons were performed using analysis of variance (ANOVA) or Kruskal–Wallis test. Multivariable analyses were performed using ANOVA; adjustment for the following covariates collected at the first follow-up was performed: age (continuous), gender, education, marital status, smoking, BMI categories and physical activity. Post-hoc between-group comparisons were performed using Scheffe's method.

Statistical significance was assessed for a two-sided test with $p < 0.05$.

3. Results

3.1. Characteristics of participants

Of the initial 5064 participants in the first follow-up, 3029 were excluded. The detailed reasons for exclusion are provided in Supplementary Fig. 1 and the characteristics of excluded and eligible participants are provided in Supplementary Table 1. Excluded participants were older, with a lesser educational level, were more frequently single, current smokers, sedentary and obese than eligible participants.

Of the 2421 participants eligible, 218 (9.0%) retired between the first and the second follow-up. Their clinical characteristics are summarized in Supplementary Table 2. Significant differences between groups were found regarding gender, educational level, smoking status, sedentary, overweight or obesity status.

3.2. Changes in dietary intake before and after retirement

The changes in weight and in dietary intake before and after retirement are summarized in Table 1. Weight increased 0.8 kg on average, corresponding to an increase of 0.4 kg/m^2 in BMI. No statistically significant difference was found in total energy intake (TEI). Total and animal protein, total saturated and monounsaturated fat, alcohol cholesterol and vitamin D intake increased, while vegetable protein, total carbohydrates and monosaccharide intake decreased after retirement.

Fish intake (total and excluding fried) and compliance to the dietary recommendation on fish increased while Mediterranean dietary scores and presence of a low-fat diet decreased. No differences were found for all the other dietary markers (Table 1).

3.3. Comparison of dietary intake between retired and gender- and age-matched active participants

The changes in weight and in dietary intake before and after retirement are summarized in Table 2. Due to absence of adequate matches, only 168 pairs could be analyzed. No statistically significant difference was found for weight, BMI and in TEI. Total carbohydrates and monosaccharides decreased; saturated and polyunsaturated fat and alcohol intake increased, and any fruit and fruit juice decreased.

3.4. Changes in dietary intake between retired, active, and newly retired participants

The changes in weight and in dietary intake between retired, active, and newly retired participants are summarized in Table 3. On unadjusted analysis, differences were found for weight, BMI, TEI, saturated fat, alcohol, cholesterol, and calcium. Differences were also found for dairy, wholegrain, fish (excluding fried), ultraprocessed foods and the Mediterranean and the AHEI scores.

On multivariate analysis (Table 4), newly retired participants had a higher increase in weight and BMI relative to retired participants, but not relative to non-retired participants. Newly retired participants had a higher increase in fish (excluding fried) and wholegrain products relative to retired participants, but not relative to non-retired participants. Newly retired participants had a larger decrease in the Mediterranean score relative to non-retired participants, but not relative to retired participants. Finally, differences in alcohol, calcium and vitamin D were found between groups, but the pairwise comparisons yielded no significant differences.

4. Discussion

Our results show that upon retirement, people tend to consume unhealthier diets, with increased intake of total and saturated fat. The increase in fish consumption does not compensate for the decrease in the Mediterranean diet score.

4.1. Changes in weight after retirement

Despite no significant change in TEI, participants who retired increased their weight. This increase was comparable to age- and gender-matched participants who did not retire, but stronger than for participants who were already retired. People who retire from physically demanding work gain more weight compared to those who retire from sedentary work [14]; still, other studies suggested that retirement is associated with a healthier lifestyle [17]. Older adults may eat more slowly, consume smaller meals and snack less, leading to less food consumption and, ultimately, weight loss [34]. Overall, it is possible that the weight gain observed in the first years after retirement be reduced the subsequent years by other factors. It would be of interest to monitor changes in weight gain rate (i.e., kg/year) after retirement.

Table 1
Dietary intake of the 218 participants who retired between the first (2009–2012) and the second (2014–2017) follow-up, CoLaus study, Lausanne, Switzerland.

	Before	After	*P*-value
Anthropometry			
Weight (kg)	74.1 ± 16.1	74.9 ± 16.4	0.007
Body mass index (kg/m²)	26.0 ± 4.6	26.5 ± 4.8	<0.001
Total energy intake (kcalories/day)	1765 [1328–2239]	1848 [1356–2219]	0.880
Macronutrients (% TEI)			
Total protein	14.9 [13.3–17.1]	15.2 [13.7–17.5]	0.038
Vegetable protein	4.5 [3.9–5.3]	4.4 [3.8–5]	0.012
Animal protein	10.0 [8.5–12.6]	11.1 [9.1–13.0]	0.005
Total carbohydrates	45.8 [40.1–51.7]	43.6 [38.6–48.1]	<0.001
Monosaccharides	22.7 [17.3–29.3]	21.0 [16.8–25.4]	0.004
Polysaccharides	21.6 [17.5–27.3]	21.1 [16.4–26]	0.082
Total fat	34.6 [30.0–39.1]	35.8 [32.1–40.7]	0.008
Saturated	12.5 [10.5–14.9]	13.1 [11.1–15.9]	0.010
Monounsaturated	13.9 [11.3–16.3]	14.2 [12.4–16.8]	0.009
Polyunsaturated	4.6 [4–5.5]	4.8 [4.1–5.8]	0.157
Alcohol	2.4 [0.6–5.8]	2.8 [1.1–6.9]	0.016
Fibre (g/day)	14 [11–21]	15 [10–21]	0.608
Micronutrients			
Cholesterol (mg/day)	283 [213–371]	297 [225–405]	0.001
Calcium (mg/day)	962 [701–1313]	993 [698–1374]	0.608
Iron (mg/day)	10.6 [8.1–13.1]	10.3 [7.9–13.1]	0.561
Vitamin D (/day)	2.1 [1.3–3]	2.4 [1.5–3.6]	0.002
Foods (g/day)			
Dairy	180 [98–268]	183 [111–276]	0.950
Red meat	43 [23–68]	40 [24–62]	0.625
Processed meat	9 [5–18]	10 [5–18]	0.679
Wholegrain	32 [11–71]	35 [9–81]	0.587
Fresh fruits	214 [103–370]	205 [105–330]	0.822
Fresh fruits + fresh juice	242 [110–471]	230 [130–406]	0.819
Any fruit and fruit juice	317 [158–528]	273 [154–484]	0.255
Vegetables	151 [101–212]	166 [111–226]	0.439
Fish, excluding fried	23 [13–41]	30 [14–47]	<0.001
Fish, all	33 [19–52]	36 [21–58]	0.005
Ultraprocessed foods	38 [9–90]	34 [10–94]	0.714
Dietary scores			
Mediterranean	4.3 ± 1.5	3.9 ± 1.6	0.001 §
AHEI	33.4 ± 10.8	33.1 ± 10.1	0.597 §
Compliance to dietary guidelines			
Fruits	112 (51.4)	106 (48.6)	0.550
Vegetables	15 (6.9)	13 (6.0)	0.832
Meat	132 (60.6)	128 (58.7)	0.678
Fish, excluding fried	149 (68.4)	161 (73.9)	0.141
Fish, all	92 (42.2)	111 (50.9)	0.025
Dairy	16 (7.3)	17 (7.8)	1.000
At least three	61 (28.1)	60 (27.7)	1.000
At least three[a]	47 (21.7)	44 (20.3)	0.780
Presence of a diet			
To reduce	21 (9.6)	11 (5.1)	0.053
Low fat	41 (18.8)	26 (11.9)	0.032
Low sugar/for diabetes	14 (6.4)	18 (8.3)	0.481
Low salt	5 (2.3)	8 (3.7)	0.581

TEI, total energy intake; AHEI, alternative healthy eating index.
Results are expressed as percentage (95% confidence interval) for categorical variables and as average ± standard deviation or median [interquartile range] for continuous variables. Statistical analysis performed using exact Mc Nemar's test for categorical variables and student's paired t-test (§) or Wilcoxon signed-rank test for continuous variables.
[a] Including fried fish.

4.2. Changes in dietary intake after retirement

Consumption of total and saturated fat and alcohol increased, while consumption of carbohydrates decreased, leading to a dietary intake of lesser quality. Our findings are similar to a French population-based study, where retirement was associated with unhealthier dietary intake [7]. Other studies reported that retirement is associated with reduced dietary variety and vegetable intake [13]. Conversely, in the French *GAZEL* study, the odds of consuming vegetables daily increased with ageing for both men and women [12]. Another study found that retired people can have either a better or a worse dietary intake than other socio-economic groups depending on the country, although the differences were relatively small [35].

Newly retired participants increased their total and animal protein and decreased their vegetable protein intake, but those changes were similar to those observed in gender- and age-matched active participants, and no differences were found between active, newly retired and retired participants after multivariable analysis. Those findings are in line with an Australian study, where no changes in fruits consumption were found upon retirement [17]. Conversely, a Finnish study reported a decrease in vegetable intake in women and an increase in fruit intake among men upon retirement [36], while another Australian study reported a decrease in protein pattern scores among retirees [4]. Overall, our results suggest that the changes in protein intake observed upon retirement are part of a general trend and not specifically related to retirement.

Table 2
Changes in dietary intake of the 168 participants who retired between the first (2009–2012) and the second (2014–2017) follow-up (newly retired) compared with gender- and age-matched controls who remained active (not retired) during both follow-ups, CoLaus study, Lausanne, Switzerland.

	Not retired	Newly retired	*P*-value
Anthropometry			
Weight (kg)	0.8 ± 4.0	0.9 ± 4.2	0.807
Body mass index (kg/m^2)	0.5 ± 1.4	0.5 ± 1.5	0.594
Total energy intake (kcalories/day)	−1 ± 566	40 ± 799	0.590
Macronutrients (% TEI)			
Total protein	−0.1 ± 3.6	0.4 ± 3.5	0.208
Vegetable protein	0 ± 1.4	−0.2 ± 1.2	0.109
Animal protein	−0.1 ± 4.2	0.6 ± 3.8	0.116
Total carbohydrates	0.5 ± 8.9	−2.7 ± 8.8	<0.001
Monosaccharides	0.3 ± 7.5	−1.7 ± 7.6	0.015
Polysaccharides	0.2 ± 7.6	−1.0 ± 7.8	0.175
Total fat	−0.1 ± 7.5	1.5 ± 7.4	0.035
Saturated	−0.2 ± 3.5	0.6 ± 3.2	0.019
Monounsaturated	0.2 ± 4.6	0.8 ± 4.3	0.261
Polyunsaturated	−0.1 ± 1.6	0.2 ± 1.8	0.041
Alcohol	−0.4 ± 3.7	0.7 ± 4.5	0.012
Fibre (g/day)	0.1 ± 9.1	−0.3 ± 10.3	0.730
Micronutrients			
Cholesterol (mg/day)	−4 ± 191	35 ± 172	0.056
Calcium (mg/day)	−56 ± 556	60 ± 706	0.081
Iron (mg/day)	0.1 ± 3.8	0.1 ± 5.1	0.965
Vitamin D (/day)	0.1 ± 2.3	0.7 ± 3.1	0.098
Foods (g/day)			
Dairy	−11 ± 175	4 ± 193	0.448
Red meat	0 ± 40.2	0.9 ± 47.3	0.846
Processed meat	1.8 ± 14.7	0.8 ± 17.6	0.590
Wholegrain	4 ± 57	6 ± 68	0.803
Fresh fruits	−2 ± 222	−16 ± 208	0.548
Fresh fruits + fresh juice	14 ± 240	−25 ± 239	0.130
Any fruit and fruit juice	29 ± 273	−46 ± 248	0.007
Vegetables	−5 ± 152	−5 ± 159	0.998
Fish, excluding fried	3 ± 24	10 ± 38	0.061
Fish, all	4 ± 26	10 ± 46	0.167
Ultraprocessed foods	−6 ± 125	−5 ± 133	0.953
Dietary scores			
Mediterranean	0 ± 1.8	−0.4 ± 1.6	0.080
AHE	−0.1 ± 9.4	−0.4 ± 9.3	0.770

TEI, total energy intake; AHEI, alternative healthy eating index. Results are expressed as average standard deviation. Statistical analysis performed using paired student's t-test.

Table 3
Bivariate analysis of the differences in dietary intake of participants who remained professionally active (not retired), retired (newly retired) or remained retired (retired) between 2009-2012 and 2014–2017, CoLaus study, Lausanne, Switzerland.

	Not retired	Newly retired	Retired	*P*-value
Sample size	1424	218	779	
Anthropometry				
Weight (kg)	1.3 ± 4.7	0.7 ± 3.9	−0.6 ± 4.2	<0.001
Body mass index (kg/m^2)	0.6 ± 1.6	0.5 ± 1.4	0.1 ± 1.5	<0.001
TEI (kcalories/day)	−51 ± 582	55 ± 732	−11 ± 662	0.042
Macronutrients (% TEI)				
Total protein	0.3 ± 3.7	0.4 ± 3.3	0.2 ± 3.3	0.748
Vegetable protein	−0.1 ± 1.3	−0.2 ± 1.1	−0.2 ± 1.2	0.317
Animal protein	0.4 ± 4.3	0.6 ± 3.6	0.4 ± 3.6	0.665
Total carbohydrates	−1.7 ± 8.8	−2.6 ± 8.6	−1.1 ± 8.2	0.068
Monosaccharides	−0.6 ± 7.4	−1.6 ± 7.7	−0.2 ± 8.0	0.063
Polysaccharides	−1.1 ± 8.1	−1.0 ± 7.2	−0.9 ± 7.4	0.852
Total fat	1.1 ± 7.3	1.4 ± 7.2	1.0 ± 7.0	0.813
Saturated	0 ± 3.4	0.6 ± 3.2	0.5 ± 3.3	0.003
Monounsaturated	0.9 ± 4.0	0.7 ± 4.1	0.5 ± 3.6	0.097
Polyunsaturated	0.1 ± 1.6	0.1 ± 1.8	0 ± 1.7	0.420
Alcohol	0.3 ± 3.9	0.7 ± 4.3	−0.2 ± 4.0	0.003
Fibre (g/day)	−0.3 ± 8.3	0.2 ± 9.6	−1.0 ± 9.3	0.117
Micronutrients				
Cholesterol (mg/day)	7 ± 146	35 ± 163	26 ± 161	0.002
Calcium (mg/day)	−60 ± 538	58 ± 667	−28 ± 524	0.010
Iron (mg/day)	−0.1 ± 3.7	0.2 ± 4.7	−0.1 ± 4.1	0.382
Vitamin D (/day)	0.3 ± 2.2	0.6 ± 2.8	0.2 ± 1.9	0.031
Foods (g/day)				
Dairy	−23 ± 181	4 ± 180	−9 ± 170	0.049
Red meat	2 ± 49	2 ± 44	2 ± 48	0.984
Processed meat	0 ± 17	0 ± 17	1 ± 21	0.365
Wholegrain	−1 ± 55	7 ± 65	−6 ± 62	0.013
Fresh fruits	5 ± 210	−7 ± 211	−15 ± 256	0.117
Fresh fruits + fresh juice	11 ± 239	−13 ± 236	−13 ± 282	0.072
Any fruit and fruit juice	4 ± 275	−28 ± 243	−8 ± 328	0.267
Vegetables	10 ± 121	−1 ± 146	11 ± 139	0.450
Fish, excluding fried	4 ± 29	8 ± 37	3 ± 25	0.046
Fish, all	4 ± 34	8 ± 43	3 ± 29	0.116
Ultraprocessed foods	−22 ± 150	−3 ± 128	−4 ± 153	0.014
Dietary scores				
Mediterranean	0.1 ± 1.8	−0.4 ± 1.6	−0.3 ± 1.6	<0.001
AHEI	0.2 ± 9.8	−0.3 ± 9.3	−1.0 ± 9.2	0.020

TEI, total energy intake; AHEI, alternative healthy eating index. Results are expressed as average ± standard deviation. Between-group comparisons performed using analysis of variance.

Newly retired participants increased their alcohol consumption, and this increase was stronger than for participants who remained active or who were already retired. Those findings are in agreement with the French *GAZEL* study, where a temporary increase in alcohol consumption upon retirement was found among men, while the elevated levels of heavy drinking remained unchanged during the entire 5-year study period among women [12]. However, no such increase was found in an Australian population-based study [17]. The increased alcohol consumption could be due to poor self-rated health, low life satisfaction and anxiety after retirement, as suggested in a study from Norway [37].

Newly retired participants increased their fish intake; this increase was stronger than for participants who were already retired while no difference was found compared to gender- and age-matched active participants. A likely explanation is that this increase follows the trend in the general population [20] and cannot be due solely to retirement. Our findings also do not replicate those of a Finnish study, where no changes in fish intake were found [36]. Importantly, the increase in fish consumption did not compensate for the decrease in the Mediterranean score, suggesting that the unhealthy changes in dietary quality outweigh the healthy ones.

Several factors can influence food choices among retired people. Age-related conditions, food environment, economic factors, marital status, social relationships, and psychological factors influence food choices [6,9,34]. Leaving the work environment might prevent access to a nutritionally balanced diet [38]. The decrease in earnings can lead to a reduce food expenditure, which can be partly compensated by a decrease in eating out [39] and an increased home cooking [5]. Still, the impact of retirement on food expenditures is debated [13]. Living in couple is associated with higher affordability of a nutritious diet [40], while being unmarried or living alone increases the odds of being malnourished [9] or having an unhealthier diet [3]. Poor self-rated health, poor life satisfaction and anxiety after retirement increase the risk of excessive alcohol consumption [37]; in turn, an unhealthy diet could decrease subjective well-being [10].

4.3. Implications for public health

Although small, the changes in dietary intake upon retirement could affect health. Increased intake of saturated fat and of alcohol have been shown to increase cardiovascular [41], liver and cancer disease, among others [42]. The increase in fish intake could partly compensate for the deleterious effects of the other dietary changes. Interventions defining retirement as a "window of opportunity" towards a healthier lifestyle could be provided [43,44].

Table 4
Multivariable analysis of the differences in dietary intake of participants who remained professionally active (not retired), retired (newly retired) or remained retired (retired) between 2009-2012 and 2014–2017, CoLaus study, Lausanne, Switzerland.

	Not retired	Newly retired	Retired	P-value
Sample size	1424	218	779	
Anthropometry				
Weight (kg)	0.9 ± 0.2[a]	1.0 ± 0.3[a]	−0.1 ± 0.2[b]	0.004
Body mass index (kg/m^2)	0.5 ± 0.1[a]	0.5 ± 0.1[a]	0.2 ± 0.1[b]	0.010
TEI (kcalories/day)	−15 ± 23	34 ± 43	−71 ± 34	0.118
Macronutrients (% TEI)				
Total protein	0.2 ± 0.1	0.5 ± 0.2	0.4 ± 0.2	0.574
Vegetable protein	−0.1 ± 0.1	−0.2 ± 0.1	−0.2 ± 0.1	0.153
Animal protein	0.2 ± 0.1	0.7 ± 0.3	0.6 ± 0.2	0.346
Total carbohydrates	−1.1 ± 0.3	−2.8 ± 0.6	−2.0 ± 0.5	0.054
Monosaccharides	−0.4 ± 0.3	−1.7 ± 0.5	−0.5 ± 0.4	0.078
Polysaccharides	−0.7 ± 0.3	−1.1 ± 0.5	−1.5 ± 0.4	0.481
Total fat	0.9 ± 0.3	1.5 ± 0.5	1.5 ± 0.4	0.462
Saturated	0 ± 0.1	0.6 ± 0.2	0.4 ± 0.2	0.129
Monounsaturated	0.7 ± 0.1	0.8 ± 0.3	0.9 ± 0.2	0.812
Polyunsaturated	0 ± 0.1	0.2 ± 0.1	0.1 ± 0.1	0.724
Alcohol	0.1 ± 0.1	0.9 ± 0.3	0.2 ± 0.2	0.036
Fibre (g/day)	−0.2 ± 0.3	0.1 ± 0.6	−1.2 ± 0.5	0.147
Micronutrients				
Cholesterol (mg/day)	10 ± 6	33 ± 11	22 ± 8	0.177
Calcium (mg/day)	−47 ± 20	50 ± 38	−49 ± 30	0.046
Iron (mg/day)	0 ± 0.1	0.1 ± 0.3	−0.3 ± 0.2	0.269
Vitamin D (/day)	0.3 ± 0.1	0.6 ± 0.2	0.1 ± 0.1	0.031
Foods (g/day)				
Dairy	−19 ± 6	2 ± 12	−15 ± 10	0.320
Red meat	1.4 ± 1.8	1.9 ± 3.4	3.5 ± 2.6	0.858
Processed meat	0.9 ± 0.7	−0.6 ± 1.3	0.1 ± 1.0	0.610
Wholegrain	−1 ± 2[a,b]	8 ± 4[a]	−6 ± 3[b]	0.015
Fresh fruits	2 ± 8	−7 ± 16	−10 ± 12	0.767
Fresh fruits + fresh juice	10 ± 9	−15 ± 18	−12 ± 14	0.405
Any fruit and fruit juice	10 ± 10	−34 ± 20	−18 ± 16	0.182
Vegetables	9 ± 5	−1 ± 9	14 ± 7	0.367
Fish, excluding fried	4 ± 1[a,b]	8 ± 2[a]	1 ± 2[b]	0.031
Fish, all	5 ± 1	8 ± 2	1 ± 2	0.062
Ultraprocessed foods	−19 ± 5	−5 ± 10	−10 ± 8	0.549
Dietary scores				
Mediterranean	0.1 ± 0.1[a]	−0.4 ± 0.1[b]	−0.2 ± 0.1[a,b]	0.012
AHEI	0.1 ± 0.3	−0.3 ± 0.7	−0.8 ± 0.5	0.458

TEI, total energy intake.
Results are expressed as multivariable-adjusted average ± standard error. Between-group comparisons performed using analysis of variance adjusting for baseline age (continuous), gender, educational level (university/high school/apprenticeship/mandatory), smoking (never/former/current), marital status (in couple/single), physical activity (yes/no) and BMI categories (normal/overweight/obese). Post-hoc comparisons using Scheffe's method; numbers with different subscripts differ at $p < 0.05$.

4.4. Strengths and limitations

Contrary to other studies [12,17,35,36] this paper analyzed a large panel of dietary markers, and results were similar when using different approaches.

Some limitations should be acknowledged. First, the analysis was conducted in an urban Swiss population, and the results might not be generalizable to other countries. Second, sample size was small, leading to reduced statistical power.

5. Conclusions

Our data suggest that retirement is associated with unhealthier dietary intakes in an apparently healthy, population-based cohort. Consumption of total and saturated fat and alcohol increased, while consumption of carbohydrates decreased; those unfavorable changes were not compensated by an increased fish consumption. The time of transition or the beginning of retirement represents a window of opportunity for promoting interventions to improve the nutritional status of older adults, contributing for a healthier lifestyle, thereby reducing the risk of diseases and associated complications.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Funding

The CoLaus study was and is supported by research grants from GlaxoSmithKline, the Faculty of Biology and Medicine of Lausanne, and the Swiss National Science Foundation (grants 33CSCO-122661, 33CS30-139468, 33CS30-148401, and 33CS30_177535/1). The funding source was not involved in the study design, data collection, analysis and interpretation, writing of the report, or decision to submit the article for publication.

Credit author statement

The authors had full access to the data and took responsibility for its integrity. All authors have read and agreed to the written manuscript. **Pollyanna Patriota**: Conceptualization, Investigation, Writing – Original draft preparation; Visualization. **Pedro Marques-Vidal**: Methodology, Data curation, Formal analysis, Writing – Reviewing and editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2021.08.026.

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