Trends and determinants of change in compliance to dietary guidelines in a Swiss community-dwelling sample

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ABSTRACT

Adherence to dietary guidelines is associated with significantly better health outcomes. Studies across the world shows that compliance with the guidelines was low, but data in Switzerland are lacking. Hence, we aimed to assess the 5-year trends in dietary compliance regarding food guidelines in Switzerland in a prospective, population-based observational study. Data from 2882 participants (1591 women, 35–75 years), from the first (2009–2012) and second (2014–2017) follow-up. Dietary intake was assessed using a validated food frequency questionnaire. Compliance with the guidelines of the Swiss society of nutrition was assessed at baseline and 5.5 years afterwards. Prevalence rates for compliance were calculated using the exact Poisson method. Factors associated with changes in compliance (never, shifter or maintainer) were assessed by multinomial logistic regression using "Never compliers" as reference. Overall, improvements in compliance to fruits (42.4% to 45.1%) vegetables (6.9% to 8.6%) and fish (66.6 to 60.5%) were found, while compliance to meat decreased (61.1% to 58.5%). The prevalence of participants complying with at least three dietary recommendations did not change (24.1% to 25.2%). During follow-up, only 11.6% of participants maintained compliance to at least three dietary recommendations, and 62.4% never managed to comply. Female gender and older age were associated with maintaining compliance during the two study periods. In conclusion, compliance with dietary guidelines is a dynamic status, and only a small fraction of the population achieves sustained compliance with at least three guidelines. Almost two thirds of the population never achieve compliance with three guidelines.

1. Introduction

Diet is one of the main determinants of health (World Health Organization, 2002). Adherence to dietary guidelines is associated with significantly better health outcomes, and individuals are encouraged to improve their dietary quality by decreasing the consumption of certain types of foods and to increase the consumption of others such as fruits and vegetables (Schmidhuber and Traill, 2006). Accordingly, the Swiss society of Nutrition (SSN) has issued guidelines regarding food and nutrient intake (Société Suisse de nutrition, 2017). In a previous study, we have shown that compliance with the guidelines was low (de Abreu et al., 2013), a finding in agreement with studies conducted in the USA (Bodnar et al., 2017) or in China (Yu et al., 2014).

Similarly, in a previous study conducted in Geneva (Switzerland), we have shown that compliance regarding nutrient intake did not

improve between 1999 and 2009 and that intakes deviate substantially from SSN guidelines (de Abreu et al., 2014). Still, the study relied on multiple cross-sectional surveys in Geneva and no prospective data collected on the same individuals is available. Indeed, we failed to find any study which assessed changes in compliance to dietary guidelines in a prospective setting. Such studies are important as they allow identifying individual factors related to changes in compliance. Further, in another study based on a national sample, we showed a sharp reduction between 2007 and 2012 in the prevalence of several barriers to healthy eating such as price, taste, limited options at markets and restaurants, and lack of will power (de Mestral et al., 2017). This favorable trend could theoretically increase the likelihood of complying with the dietary guidelines.

Hence, our study aimed to assess the 5-year trends and determinants in dietary compliance regarding food guidelines of the SSN in a

population-based prospective study. Our hypothesis was that the prevalence rates of compliers to any food guideline would increase and that this increase would be more pronounced in women and in more educated people.

2. Methods

2.1. Study setting and participant selection

The CoLaus study is a population-based study assessing the clinical, biological and genetic determinants of cardiovascular disease in the city of Lausanne, Switzerland. Its aims and sampling strategy have been reported previously (Firmann et al., 2008). The source population was defined as all subjects aged between 35 and 75 years registered in the population register of the city, which also includes information on age and sex. A simple, non-stratified random sample of 19,830 subjects (corresponding to 35% of the source population) was drawn and the selected subjects were invited to participate. The following inclusion criteria were applied: (a) written informed consent; (b) willingness to take part in the examination and to provide blood samples.

The baseline study was conducted between 2003 and 2006 and included 6733 participants; the first follow-up visit was conducted between April 2009 and September 2012 and included 5064 participants; the second follow-up was conducted between May 2014 and April 2017. The first and second follow-ups included all participants willing to be re-contacted. At both follow-ups, participants attended a single visit, which included an interview, a dietary assessment, a physical exam, and blood and urine collections in the fasting state. For this study, only data from the first (2009–2012) and second (2014–2017) follow-up examinations was used as dietary intake assessment was introduced at the first follow-up.

2.2. Compliance to dietary guidelines

Dietary intake was assessed using a validated, self-administered, semi-quantitative food frequency questionnaire (FFQ) which also included portion size (Bernstein et al., 1995; Beer-Borst et al., 2009). Briefly, this FFQ assesses the dietary intake of the previous 4 weeks and consists of 97 different food items which account for > 90% of the intake of calories, proteins, fat, carbohydrates, alcohol, cholesterol, vitamin D and retinol, and 85% of fibre, carotene and iron. To our knowledge, there is no FFQ (validated or not) assessing dietary intake for the whole year in Switzerland; the other available and validated FFQ assesses the dietary intake of the previous month (Marques-Vidal et al., 2011). Hence, this FFQ provides the best dietary assessment currently available and has been used in several food intake evaluations. Conversely, the FFQ was not validated regarding compliance to guidelines. 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 also indicated the average serving size (smaller, equal or bigger) compared to a reference size.

Reported frequencies were transformed into daily consumption frequencies as follows: "never these last 4 weeks" = 0; "once/month" = 1/28; "2–3/month" = 2.5/28; "1–2/week" = 1.5/7; "3–4 times/week" = 3.5/7; "once/day" = 1 and "2+/day" = 2.5. The frequency of consumption of one food category was obtained by summing up all individual consumption frequencies of foods related to that category. For example, daily fruit consumption was obtained by summing up the daily consumptions of fresh fruits (5 items) and fruit juices (fresh and processed without added sugar).

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 (Federal food safety and veterinary office, 2017). The recommendations were: ≥ 2 fruit portions/day; ≥ 3 vegetable portions/day; ≤ 5 meat portions/week; ≥ 1 fish portion/week and ≥ 3 dairy products portions/day.

Compliance was considered if the participant complied to at least three guidelines. Changes in compliance were assessed using the same methodology as a previous study assessing changes in vitamin use (Marques-Vidal et al., 2017a). Participants were categorized into "never" (no compliance at both follow-ups); "new" (no compliance at the first but compliance at the second follow-up); "former" (compliance at the first but no compliance at the second follow-up) and "full" (compliance at both follow-ups) compliers.

2.3. Other covariates

Age at first follow-up (range: 41–79 years) was categorized into 10-year age groups: 40–49; 50–59; 60–69 and 70–79. Socioeconomic and lifestyle variables were collected using a self-administered questionnaire. Marital status was defined as living alone (single, divorced or widowed) or living in a couple (married or other). Smoking status was categorized into never, former and current smoker. Educational level was collected at baseline and categorized as obligatory school, apprenticeship, high school/college or university. Country of birth was categorized as Swiss/other.

Body weight and height were measured with participants standing without shoes in light indoor clothing. Weight was measured in kilograms to the nearest 0.1 kg using a Seca™ scale (Seca, Hamburg, Germany). Height was measured to the nearest 5 mm using a Seca™ height gauge (Seca, Hamburg, Germany). Body mass index (BMI) was defined as weight/height^2 and categorized as normal (BMI < 25 kg/m^2); overweight ($25 \leq$ BMI < 30 kg/m^2) and obese (BMI ≥ 30 kg/m^2). Due to small numbers ($n = 72$), underweight participants (BMI < 18.5 kg/m^2) were included in the "normal" category.

2.4. Inclusion and exclusion criteria

Participants were excluded from the analyses if they 1) had no follow-up; 2) failed to fill the FFQ and 3) missed any covariate (smoking, BMI, education or country of birth).

2.5. Statistical analysis

Statistical analyses were conducted using Stata version 14.2 for windows (Stata Corp., College Station, Texas, USA). Participants characteristics were expressed as number (percentage) for categorical variables or as average $\pm$ standard deviation for continuous variables. Prevalence rates for compliance for the first (2009–2012) and the second (2014–2017) follow-up were presented as rates (95% confidence interval) using the exact Poisson method. Paired analyses were conducted using the participant as her/his control using the McNemar test for paired proportions. The factors associated with changes in compliance were assessed by multivariable analysis using multinomial logistic regression and the "Never compliers" as reference. A sensitivity analysis was conducted by assessing the prevalence and determinants of an improvement in the number of dietary guidelines complied to. Statistical significance was assessed for a two-sided test with $p < 0.05$.

2.6. Ethical statement

The institutional Ethics Committee of the University of Lausanne, which afterwards became the Ethics Commission of Canton Vaud (www.cer-vd.ch) approved 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. All participants gave their signed informed consent before entering the study.