Study design APPENDIX 1

Overview

This one-year intervention study was part of the "Healthier food choices, tailored models for eating and exercises" (TERVAS) project in Southern Ostrobothnia, Finland. The study involved the University of Turku, the University of Vaasa, the Seinäjoki Central Hospital and the MTT Agrifood Research Finland. Permission was received from the Ethics Committee of the Central Hospital in Southern Ostrobothnia, Finland. The researcher group included a principal researcher; a medical doctor; a researcher of biotechnology; a qualified nutritionist; a clinical chemist; professors of nutrigenomics, food development and consumer sciences as well as medical laboratory technologists.

Participants

All the participants were healthy adults, aged 20 to 67 years. A major proportion of participants had already previously participated in the TERVAS study through a questionnaire (n = 1706), which was randomly sent to 4,000 people in Southern Ostrobothnia. In this questionnaire, participants had the opportunity to report their willingness to participate in further studies; 520 people agreed to this further participation. Half of the participants were randomized into this intervention (n = 260) and the remaining were randomized into another health intervention study organized by different researchers. First contact was made by telephone, when participants were asked whether they were willing to participate in the intervention along with questions about their demographic details and state of health. They were also given information about the study (schedule, measurements, genetic testing). Every participant who was identified as being on long-term medication (e.g., diabetes, cholesterol, blood pressure, psychiatric) or having a disease (e.g., diabetes, psychiatric) was excluded in this phase (n = 145). A minor proportion of the participants was recruited through newspaper advertisements (n = 36).

Procedure

Baseline interviews with all participants (n = 151) were conducted and first measurements were taken. In this interview, their health state was screened, using the commonly-used form, which means that they were asked about any medication; diseases and use of functional products which affect cholesterol absorption (e.g. plant stanols and sterols). They were also asked about alcohol consumption, smoking habits, physical activity and how they perceived their own health. In this first interview, the participants gave their written consent to participate in the intervention. All participants had the opportunity to refuse to see their blood and gene results: no one refused.

After these interviews, the participants (n = 130) were given blood tests (including serum's lipids, blood glucose (0h and 2h), basic blood count (e.g. hemoglobin), the function of kidneys (fP-Krea), liver (p-ALAT) and thyroid (P-TSH)) and anthropometric measurements (e.g. blood pressure, Body Mass Index, waist circumference and body fat percentage). They also filled questionnaires on psychological factors (threat, anxiety, the stage of change) and behavioral factors (including diet, alcohol consumption, physical activity and health and taste attitudes). On the basis of the first interview (n = 21) and blood tests (n = 8), any participants who had passed the first phone interview, but were still found to be on long-term medication (e.g., diabetes, cholesterol, blood pressure, psychiatric) or have a disease (e.g., diabetes, psychiatric) were excluded (n = 29). These people were directed to public health care. After the first screening, the final number of participants for the intervention was 122.

After these first measurements (T0), all participants attended a lecture on healthy lifestyle and diet (1st communication) held by a qualified nutritionist. This communication session was arranged on the same day as the first measurements (T0), so also the participants who passed the interview, but were excluded based on the blood test (n = 8), attended this lecture. Results of the blood test were not available at this phase. This lecture was compulsory and the purpose of the lecture was that every participant would have the same basic knowledge of healthy diet and lifestyle. It was essential that participants would understand the importance of eating healthy food and the role apoE plays in cardiovascular health. During the lecture, it was emphasized that healthy choices are the cornerstone in decreasing risks for lifestyle diseases, such as CVD, and that genomics have a limited role in increasing or decreasing risks for lifestyle diseases. Also the connection of apoE gene to Alzheimer disease was mentioned, due to ethical reasons. However, the aim was to focus on the role of apoE in cardiovascular health.

This study was single-blinded as the principal researcher, and a medical doctor, followed the anxiety measurements of the participants. The participants (n = 122) were randomized into a control group (n = 61) and an intervention group (n = 61). The randomization was done using the random sampling method of Microsoft Excel. Participants who received the first 61 random numbers were put into the intervention group and the remaining 61 participants were put into the control group. There were 40 participants in the Ɛ4- group and 21 participants in the Ɛ4+ group. The control group included 61 participants.

After eight weeks (2nd communication), the intervention groups (Ɛ4+ and Ɛ4-) received their apoE genotype information and health message by mail. This information was sent together with a tailored health-risk message based on their apoE genotype. The specific threat communicated to the participants was, in this case, CVD, and the effect of the apoE genotype on CVD was emphasized for each participant in the intervention groups. The message for the Ɛ4+ group stressed the importance of the genotype in the response to dietary changes (e.g. improvement of fat quality) and increasing exercise to lower the cholesterol level and prevent CVD. The message for the Ɛ4- group emphasized the interaction between environmental factors and the genotype and highlighted the significance of their own lifestyle. The control group received only general information about the present study and general health messages based on the basic health and nutrition recommendations and studies of the National Institute for Health and Welfare.

Within two weeks of receiving their messages and genotype information (T1), all participants also received web-based questionnaires on psychological factors (e.g. threat and anxiety experiences, the stage of change) and behavioral factors (e.g. diet, physical activity, alcohol consumption, health and taste attitudes). These questionnaires were answered by 117 participants. After 12 weeks, all the participants were offered the opportunity to attend genetic counseling and a lecture given by a professor of nutrigenomics and nutrigenetics (3rd communication). This communication focused more on gene-diet interactions and function on apoE gene than the 1st communication session. Twenty nine participants attended this lecture. At this point, the intervention group also had the possibility to have a personal discussion with a medical doctor (4th communication). In this communication session people had a private discussion about their blood- and gene test and how these results have affected them physically and mentally. This 4th communication session was arranged as recommended the Ethical committee. Seven people used this opportunity. These seven people were also the ones who attended the lecture (3rd communication). After five months (5th communication), the health messages and gene information were repeated.

At the six-month measurement point (T2), the participants were given blood tests (including the cholesterol level, blood glucose (0 h) and basic blood picture) and other measurements (e.g. Body Mass Index, fat percent, waist circumference, blood pressure). These measurements were the same as those taken at the baseline, except for the gene tests and glucose tolerance 2-hours tests. At this phase of the intervention, participants again received web-based questionnaires on behavioral factors (e.g. diet, alcohol consumption, physical activity and health and taste attitudes); this was before they took part in the six-month clinical measurements. Psychological factors (e.g. threat, anxiety and the stage of change) were not gauged at this time. The half-year clinical measurements were attended by 117 participants, and 121 answered the questionnaires.

End measurements, after 12 months (T3), were very similar to the six-month measurements (T2). In this phase participants (n = 117) took part in a glucose tolerance 2-hour test and answered questionnaires regarding threat, anxiety and the stage of change. After 12 months, the control group also had the opportunity to obtain further information about their own apoE genotype and the opportunity to consult with a medical doctor (6th communication). This session was similar to the intervention group (4th communication). Three people used this opportunity for a personal discussion with a doctor.

Of all 122 participants, five people dropped out and participants who had started cholesterol, blood pressure or diabetes medication during the intervention were excluded (n = 4). There were 113 participants who completed the study. For the analyses in this paper, participants who had missing values in their answers (n = 4) or turned out to be outliers (great variation from the mean value) were excluded (n = 2). Thus, results for 107 participants were analyzed. In the intervention, there were 16 participants in the high-risk (Ɛ4+) group and 35 in the low-risk (Ɛ4-) group. The control group had 56 participants.