Introduction

Health care costs continue to rise by about 6% per year in various Western countries, such as the US and The Netherlands, and costs are estimated to account for almost 20% of the gross domestic product in 2024 in the US and in 2040 in The Netherlands (Keehan et al., 2015; Van der Horst, Van Erp, & De Jong, 2011). Chronic diseases account for about 75% of these costs in Western countries. Many chronic diseases are almost entirely attributable to environmental factors (Willett, 2002), some of which are modifiable, such as diet. An important goal of research into preventive medicine should therefore be to identify dietary patterns that can help reduce the risk for chronic disease, with the ultimate goal to reduce healthcare costs for preventable chronic diseases.

Research to identify dietary patterns that can reduce chronic disease risk in the normal population could possibly be done through internet to reach large and representative samples. The primary purpose of the present study was therefore to investigate feasibility of a web-based diet intervention in the general population. The primary outcome measures were time to recruit 35 participants, representativeness of the sample, drop-out rate and compliance to the dietary interventions.

In the present study we choose to compare two diets in a cross-over design. The two diets were the Dutch consensus diet and a Paleolithic-like diet. Both diets contain vegetables, fruit, meat, fish and eggs. The Dutch consensus diet is the dietary pattern that is advised to the general Dutch population and includes grains, dairy and vegetable oils, which are excluded from Paleolithic-like diets. The reason that we choose these two diets is that results from a meta-analysis suggest that Paleolithic-like diets improved risk factors for chronic diseases more than any of the control diets in people meeting one or more criteria for metabolic syndrome at inclusion (Manheimer, van Zuuren, Fedorowicz, & Pijl, 2015). Today, only one published randomized-controlled trial investigated health effects of a Paleolithic-like diet in the general population (Genoni, Lyons-Wall, Lo, & Devine, 2016).The major limitation of all these trials is the small sample size, ranging from 13 in a cross-over trial (Jonsson et al., 2009) to 70 in a parallel groups trial (Mellberg et al., 2014). Using web-based study designs could be one way to increase sample sizes.

The purpose of the present study was to investigate feasibility of a web-based cross-over Paleolithic-like diet intervention in the general population. The primary outcome measures were time to recruit 35 participants, representativeness of the sample, drop-out rate and compliance to the dietary interventions.

The secondary aim of the present study was to calculate the sample size needed to reach a statistically significant difference in effect of a Paleolithic-like diet on psychological and somatic symptoms compared with the Dutch consensus

diet. We choose to use physical and psychological symptoms as the secondary outcome measure, because dietary patterns with the potential to reduce risk for chronic diseases should at least reduce physical and/or psychological complaints in the general population, as many, if not all, chronic diseases come hand in hand with common symptoms such as fatigue, pain and breathlessness (Solano, 2006). Additionally, we asked participants if they had suggestions for improvement of the study materials and/or procedures.

Results and discussion

Feasibility

Time to recruit 35 participants
It took the researchers 42 days to recruit 35 participants. In the first 24 days after publishing an initial post on the first author's blog and citation of this post in a local newspaper, 29 participants were recruited. The remaining 6 participants were recruited after sharing the post on Facebook and Twitter by the first and second author.

Representativeness of the sample
Demographic characteristics of the participants are given in Table 1. Participants were representative for the Dutch population regarding, age, body mass index, marital status, work status and depressive and anxiety symptoms. Participants were more often female and higher educated compared to the Dutch population and had significantly lower symptoms of distress. Participants in our feasibility study had significantly higher PHQ-15 scores compared to the general German population.

Earlier research has shown that study samples recruited through the internet are as representative as samples recruited through traditional methods (Gosling & Mason, 2015). Especially in The Netherlands, where over 90% of households has an internet connection, the use of web-based recruitment methods does not seem a limitation for achieving a representative sample. On the other hand, samples in other studies on diet and/or psychological symptoms also contained more females and more higher educated individuals compared to the general population (see for example, Boers et al., 2014 and Van Der Krieke et al., 2016). Thus, it seems more likely that the higher number of females and higher educated participants should be attributed to the topic of the study than to the recruitment method.

DOI: 10.15310/2334-3591.1064

Table 1. Baseline characteristics of participants in the present feasibility study and the general Dutch population.

		Participants present study	Dutch population	Statistics
		% (n)	%	
Age	20-40	34.0 (12)	31.7	Fisher exact = 648, p=.20
	41-65	60.0 (21)	45.8	
	66-80	6.0 (2)	17	
	>81	0 (0)	5.5	
Sex	Female	72 (26)	51	$\chi2(1) = 6.80$ $p < .01$
BMI	<18.5	0 (0)	2	Fisher exact = 215 p = .94
	18.5-25	48.4 (16)	54,2	
	25-30	39.4 (13)	31.6	
	>30	12.2 (4)	12.2	
Marital status	Married or registered partner	47.2 (17)	40.3	$\chi2(1) = 2.04$ $p = .15$
Educational level	Elementary school or lower vocational education	13.9 (5)	44.5	Fisher Exact = 1928 p < .01
	Intermediate vocational training	11.1 (4)	16.5	
	Pre-university degree	8.3 (3)	11.0	
	University degree	66.7 (24)	28.3	
Work status	Paid work	75.0 (27)	70	$\chi2(1) = 0.429$ $p = .51$
		Mean (SD)	Mean (SD)	
DASS	Depression	5.7 (6.8)	7.3 (8.2)	T(8005)=1.16, p=.25
	Anxiety	3.1 (4.1)	4.0 (5.4)	T(8005)=0.94, p=.35
	Distress	6.9 (6.1)	9.4 (7.3)	T(8005)=1.99, p<.05
PHQ-15		5.7 (4.7)	3.8 (4.1)	t(5056)=2.40, p<.05

Another potential limitation of our recruitment method was the use of social media. Using social media might make it more likely that individuals who were familiar with the investigators and their work were overrepresented. This may have led to an overestimation of adherence to the intervention. We did not ask participants through which medium they heard about the study, preventing us from analyzing differences in adherence between participants who heard about the study through the investigators' Facebook, Twitter or blog and participants who heard about the study through the local newspaper that cited our call.

Drop-out rates

The drop-out rate was 20%, 28 out of 35 participants completed measurements at all time-points. One participant did not return the final RoSI. Seven participants dropped-out from the study; one during the Dutch consensus diet phase, six during the Paleo diet phase. One participant dropped-out during the Paleo diet phase because she experienced symptoms of dizziness, trembling, headaches and fatigue. This participant was taking blood-pressure lowering medication at baseline. One participant dropped-out during the Paleo diet phase because the time investment was too high. Reasons for discontinuing participation are unknown for the other five drop-outs.

Drop-out rates were comparable to other Paleolithic-like diet interventions in the normal population (Frassetto, Schloetter, Mietus-Synder, Morris, & Sebastian, 2009; Genoni et al., 2016; Osterdahl, Kocturk, Koochek, & Wandell, 2008). Reasons for discontinuing participation were unknown for most drop-outs, most did not respond to requests to fill-out questionnaires, nor did they reply to personal e-mails inquiring about their reasons for discontinuation. One participant indicated during the Paleolithic-diet phase that the time investment was too high. Another participant experienced symptoms of dizziness, trembling, headaches and fatigue and dropped-out within one week of adopting the Paleolithic-like diet. It turned out that this participant was taking blood-pressure lowering medication. Although speculative, it might be that the Paleolithic-like diet enhanced the efficacy of her medication. Dietary modifications, especially when including reductions in sodium intake in combination with increased potassium and magnesium intake, can further lower blood pressure in individuals already taking blood-pressure lowering medication (Appel et al., 2006). We therefore recommend that investigators carefully assess which participants are taking medication and ensure that those participants are closely monitored by their physician when participating in web-based dietary interventions.

Compliance

Overall compliance to the diets can be found in Table 2. A summary of the different food groups consumed during both intervention phases can be found in Figure 1. It should be noted that no conclusions about absolute numbers of portions or caloric intake can be drawn from these data, as the dietary compliance questionnaire was designed to measure intra-individual differences in compliance. Participants reported significantly greater consumption grains and dairy and significantly lower consumption of eggs during the Dutch consensus diet than during the Paleo diet. The group that was randomly allocated to first follow the Dutch consensus diet, also reported significantly higher consumption of sweet snacks and drinks and processed meat and fish and significantly lower consumption of vegetables and nuts than during the Paleo diet. These differences were not seen in the Paleo diet first group.

Compliance to the Dutch consensus diet was lower in the group that followed the Dutch consensus diet after following the Paleolithic-like diet during four weeks that in the group that followed the Dutch consensus diet first. Looking at within-group differences, we see that the Dutch consensus diet first group consumed significantly more sweet snacks and

DOI: 10.15310/2334-3591.1064

Table 2. Compliance and psychological and somatic symptoms after four weeks on the paleo diet or the Dutch consensus diet.

		Baseline	Paleo diet first (n=14)	Consensus diet second (n=13)	Baseline	Consensus diet first (n=18)	Paleo diet Second (n=15)	Number needed
			%	%		%	%	
Compliance			73	68		75	83	
			Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
DASS	Total	17,94 (16,96)	9,14 (6,50)	12,15 (9,70)	13,72 (14,08)	10,67 (11,77)	4,53 (5,42)	25
	Depression	6,59 (7,10)	2,93 (3,20)	4,46 (4,56)	4,83 (6,59)	3,50 (4,77)	1,13 (2,50)	37
	Anxiety	3,71 (4,92)	1,71 (2,16)	3,00 (2,89)	2,61 (3,20)	2,00 (2,30)	0,87 (0,74)	23
	Distress	7,65 (4,50)	4,50 (2,41)	4,69 (4,07)	6,28 (5,17)	5,17 (6,0)	2,53 (3,58)	113
PHQ-15	Total	11,11 (8,32)	6,81 (5,13)	7,38 (6,85)	7,17 (4,74)	6,72 (5,02)	3,63 (2,78)	18
	Cardio-pulmonary	1,12 (1,32)	1,14 (1,51)	1,33 (1,44)	1,11 (1,02)	1,00 (0,97)	0,67 (0,72)	23
	Muscular-skeletal	2,12 (1,87)	1,36 (1,08)	2,25 (1,71)	1,22 (1,44)	1,39 (1,29)	0,80 (0,94)	32
	Gastro-intestinal	2,59 (1,91)	1,86 (1,41)	2,58 (2,28)	1,56 (1,95)	1,61 (1,58)	1,07 (1,28)	61
	General symptoms	6,18 (4,29)	3,93 (2,37)	4,17 (2,62)	3,67 (2,47)	3,17 (3,00)	1,73 (1,49)	125

drinks and processed meat and fish and significantly less vegetables and nuts during the Dutch consensus diet than during the Paleo diet. These differences were not seen in the Dutch consensus diet second group. Although we have not inquired about the reasons for low compliance, we could speculate that participants in the Paleolithic-like diet first group experienced such benefits from consuming high amounts of vegetables and fruit and low amounts of processed foods, that they were still avoiding those foods during the Dutch consensus diet period. Although processed foods are not part of the Dutch consensus diet, it is conceivable that they also made less processed choices within, for example, the grains and dairy food-groups. Nevertheless, we did not find a significant carryover effect in this feasibility study.

Compliance to the Paleolithic-like diet was 73% in the group that was assigned to the Paleolithic-like diet first and 83% in the group that was assigned to follow the Paleolithic-like diet second, meaning that 17-27% of all consumed portions reported in the dietary compliance questionnaire were outside the recommendations. When looking at figure 1, we conclude that participants consumed, on average, two portions of grains each day. The Mediterranean diet also consists of lots of vegetables and fruit and moderate amount of whole grains and seems to be highly effective in depressed patients (Jacka et al., 2017). Our participants also regularly reported consumption of dairy and sweet snacks and drinks. The Paleolithic-diet first group consumed about half a portion of processed meat or fish per day. It would be an interesting question for future research, whether the effects of dietary interventions depend on the type of foods consumed outside the recommendations.

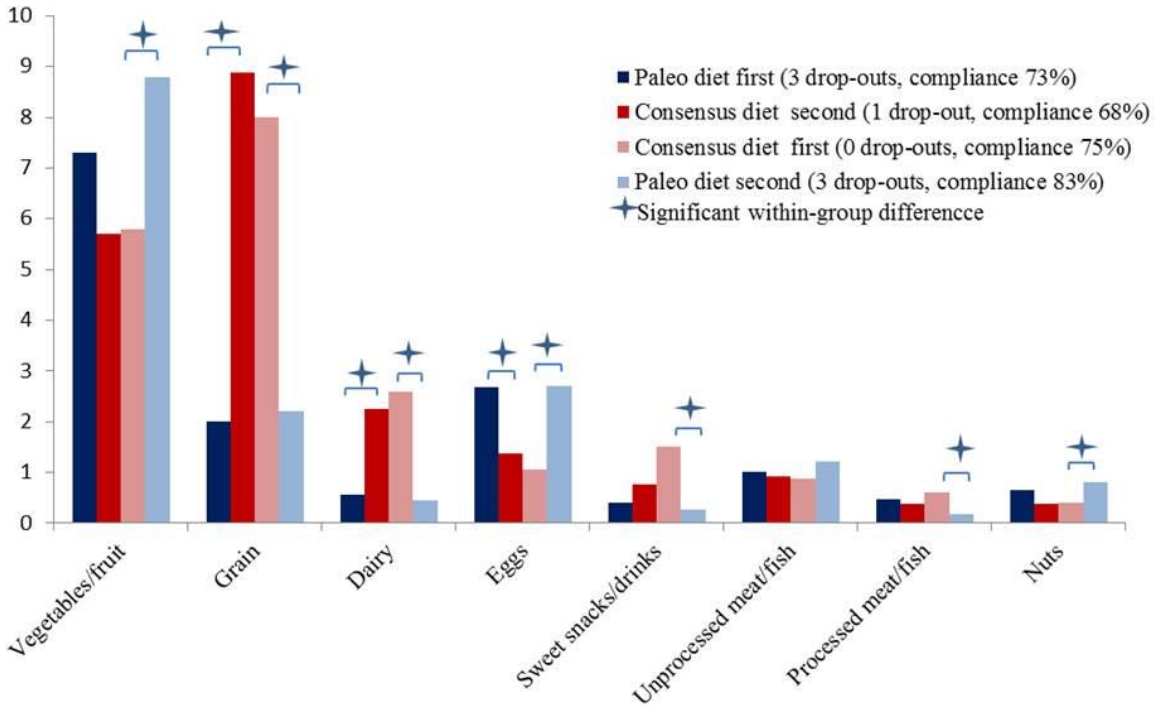

Figure 1. Consumption of different food-groups during the Paleolithic-like diet and Dutch consensus diet period of both groups as indicated in a dietary compliance questionnaire.

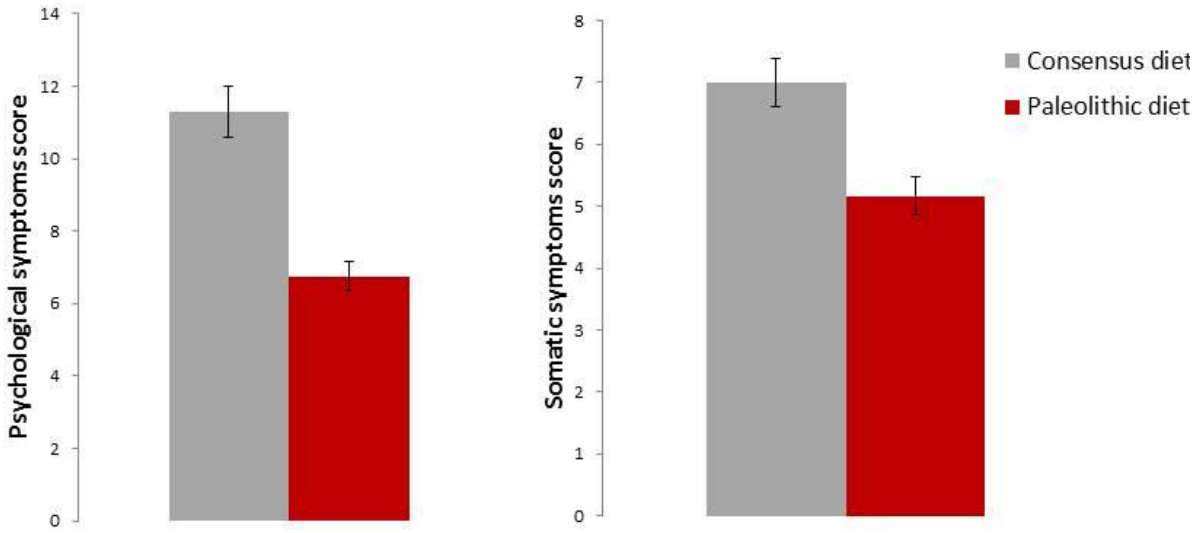

Figure 2. Means and standard errors for the psychological and somatic symptom scores after consuming the Dutch consensus diet during four weeks and after consuming a Paleolithic-type diet during four weeks.

Sample size calculations

The secondary aim of this feasibility study was to calculate the number of participants needed to show significant differences in psychological and somatic symptoms in a fully-powered web-based cross-over Paleolithic diet intervention. Means and standard deviations of psychological and somatic symptoms after each diet for each group can be found in Table 2. No significant carryover effect was found for psychological symptoms ($t(26)=0.39$, $p=.70$), or somatic symptoms ($t(25)=0.11$, $p=.92$). Therefore, the means and standard errors for the consensus diet first and the Paleo diet first groups were collapsed (see Figure 2).

The number of participants needed was calculated for paired samples using an online sample size calculator (Clinical & Translational Science Institute, 2017). Results showed that 25 participants are needed to show significant differences in psychological symptoms and that 18 participants are needed to show significant differences in somatic symptoms in a web-based cross-over trial comparing the Paleolithic diet with the Dutch consensus diet (see Table 2). Taking 20% drop-out into account, this would mean that at least 30 participants should be recruited. Higher numbers are needed when focusing on subscales of the DASS and the RoSI, ranging from 23 for anxiety and cardio-pulmonary symptoms up to 125 for general symptoms.

Two participants had DASS-scores more than two standard deviations above the mean. Excluding these participants from sample size calculations gave slightly higher numbers needed, namely 30 for overall psychological symptoms, 49 for depressive symptoms, 30 for symptoms of anxiety and 388 for symptoms of distress. One participant had a RoSI-score more than two standard deviations above the mean. Excluding this participant from sample size calculations gave about the same numbers needed, namely 18 for total somatic symptoms, 22 for cardio-pulmonary symptoms, 37 for muscular-skeletal symptoms, 66 for gastro-intestinal symptoms and 77 for general symptoms.

We also repeated sample size calculations based on an intention to treat analysis, carrying the last measurement forward. This resulted in estimated sample sizes of 33 and 78 for total psychological and somatic symptoms, respectively, and 49 for depressive, 31 for

anxiety, 142 for distress, 33 for cardio-pulmonary, 44 for muscular-skeletal, 83 for gastro-intestinal and 167 for general symptoms.

The effects on psychological and somatic symptoms seemed quite large in the present study. The estimated numbers of participants needed to recruit for future studies should be taken with caution, because small samples, such as in the present feasibility study, are more prone to overestimations of effect sizes (Button et al., 2013). Given the ease of increasing sample size in web-based studies, we recommend recruiting more participants than was estimated here.

It should be noted that sample size calculations for somatic symptoms are based on results obtained with the Rosmalen Somatisation Index (RoSI). The RoSI is based on the Patient Health Questionnaire-15 (Kroenke, Spitzer, & Williams, 2002), complemented with five somatization items from the Symptom Checklist (Arrindell & Ettema, 1986) and eight items derived from an expert committee supervised by J. Rosmalen. The RoSI is currently being validated using data from the HowNutsAreTheDutch study (Van Der Krieke et al., 2016). Pending the outcomes of this validation process, use of the RoSI should be seen as a possible limitation of our sample size estimations.

Prior expectations and bias

Average prior expectations about the effects of the Paleolithic and Dutch consensus diets on psychological symptoms are shown in Table 3. Participants expected significantly greater reductions in both psychological and somatic symptoms when following a Paleolithic-like diet compared with the Dutch consensus diet, which points towards biased results. On the other hand, correlations between prior expectations and actual changes were generally quite low and mostly insignificant (psychological symptoms: r=.15, p=.44 for Paleo; r=-.19, p=.32 for consensus; somatic symptoms: r=.38, p=.05 for Paleo; r=.27, p=.17 for consensus). This indicates that, although on average participants expected greater effects of the Paleolithic-like diet, participants who had greatest expectations did not necessarily show greatest actual changes. Thus, although the effects were likely partly due to bias, the effects were not just bias. When blinding is not possible, such as in a dietary pattern intervention, it is often more justifiable to administer the intervention in its full context, so-called pragmatic trials (Schwartz & Lellouch, 2009). In this case, expectations about the effects of certain dietary advises, apparently are part of that context. When it comes to answering the question which of two dietary advises should be preferred, pragmatic approaches are often more justifiable than approaches that are aimed at understanding (Schwartz & Lellouch, 2009). Nevertheless, in future studies, it would be interesting to include relevant biomarkers to investigate if those individuals with greatest changes in biomarker values, are also the ones with greatest changes in symptoms. Additionally, we advise to collect data about BMI, medical history and medication use, which was omitted in this pilot study.

Conclusion

Given the time needed for recruitment, drop-out rates, compliance and representativeness of the sample, we conclude that it is feasible to conduct a web-based cross-over Paleolithic-like diet intervention in the general population. Future studies should reveal, or confirm, given the present effect estimates, if advising the general population to consume more Paleolithic-like diets is more effective in reducing psychological and somatic symptoms on the short-term. Separate studies should be designed to investigate if such an approach can actually help reduce the burden of life-style related diseases, such as diabetes type 2, cardiovascular disease and mood and anxiety disorders.

DOI: 10.15310/2334-3591.1064

Table 3. Prior expectations about the effects of the Dutch consensus diet and the Paleolithic-like diet on psychological and somatic symptoms

	Dutch consensus diet	Paleolithic-like diet	Statistics
	Mean (SD)	Mean (SD)	
Psychological symptoms	-0.03 (0.45)	-0.53 (0.84)	t(35)=3.18, p<.01
Somatic symptoms	0.00 (0.77)	-0.91 (0.85)	t(34)=5.35, p<.001

Materials, subjects and methods

Procedures

This study was a two-times four-week cross-over dietary intervention aiming to recruit 35 participants from the general population through internet-based media. First, a post was published at the blog of the first author including a short description of the study and contact details (Nederhof, 2017). This post was cited in an article in a local newspaper a few days later, including contact details for information. Individuals who wrote that they were interested in participation received an e-mail containing detailed information about the study procedures, a short description of the dietary patterns, contact information of the research team and an independent physician, and an informed consent form. Inclusion criteria for participation were 1) aged 18 years or older, 2) good understanding of Dutch, and 3) being able and willing to follow both dietary patterns during four weeks. Exclusion criteria were 1) pregnancy, and 2) following a low-potassium diet. Low potassium diets are usually prescribed to severe renal patients. After returning a signed informed consent form, participants received a password to log-in to a secured web-page. Participants filled-out the intake questionnaire, the Depression Anxiety Stress Scale and a somatic symptoms questionnaire upon first login. After completing the questionnaires, participants were randomized into either the Paleolithic-like diet first group or the Dutch consensus diet first group using Research Randomizer (Social Psychology Network,) and received a pdf containing instructions for the first dietary pattern. After four weeks, participants received an e-mail with a link to the second series of questionnaires, after completion of which they received the pdf with instructions for the second dietary pattern. Four weeks later, they received an e-mail with a link to the final set of questionnaires. Scores were saved in a secure data-base. All procedures were approved by the local medical ethical committee. All participants provided written informed consent.

Dietary patterns

Detailed manuals were developed for both the Paleolithic-like diet and the Dutch consensus diet (available in Dutch from http://hdl.handle.net/10411/C6U43L). The manuals contained information about which foods to eat and which to avoid including short descriptions of the reasons why, and, in case of the Dutch consensus diet, instructions about quantities of each food group.

Paleolithic-like diet

Vegetables and fruit were described as the basis of Paleolithic-like dietary patterns. Participants were instructed to consume fresh or frozen vegetables and fruit, and to avoid preserved vegetables and fruit. Participants were also instructed to avoid peas, beans and corn, which are often considered vegetables in The Netherlands. Pulses, such as green beans or runner beans, were permitted. Potatoes were excluded from the Paleolithic-like diet. Participants were instructed to consume unprocessed, fresh or frozen meat, (shell-)fish, poultry, game and/or eggs for their high quality proteins. Nuts were also allowed on the

Paleolithic-diet. Participants were instructed to avoid peanuts, which are legumes, and salted, oil-fried or coated nuts. Participants were instructed to use olive oil and/or coconut oil for all purposes, and were permitted to use fresh, cold-pressed flaxseed oil for cold preparations. They were instructed to avoid seed-oils because they are high in omega-6 unsaturated fatty acids and vulnerable for oxidation. Participants were instructed to drink water and herbal teas and were allowed to have a maximum of three cups of black tea or coffee and one glass of wine per day. All soft-drinks, vegetable- and fruit juices, dairy-based drinks and all other alcoholic drinks were excluded from the Paleolithic-like diet.

Dutch consensus diet

The Dutch consensus diet consists of the five food-categories: 1) vegetables and fruit, 2) bread, grains, potatoes, rice, pasta and legumes, 3) dairy, meat, fish, eggs and vegetarian alternatives, 4) fats and oils, and 5) drinks. Detailed instructions are given about quantities for each category. Quantities vary by sex and age. The advice for vegetables and fruit is 200g vegetables and 200g fruit per day and does not vary by sex and age (above 18 years old). All fresh, frozen and preserved without additives vegetables and fruits are permitted. Beans and pulses are also considered vegetables in the Dutch consensus diet. Vegetable purees and juices are considered less desirable, and consumption of vegetables with cream or sauce, pickled or salted vegetables or preserved fruit with added sugar is permitted only occasionally.

The Dutch consensus diet advices to consume 5-7 slices of bread and 150-250g potatoes, pasta, rice or legumes each day, depending on sex and age. Whole-grain products are the preferred choice, brown bread and grain products with dried fruit are considered less desirable. Consumption of refined grains is permitted only occasionally. For potatoes, boiled or baked potato (white or sweet) are the preferred choice, mashed potatoes are a less desirable choice and (deep-)fried potatoes should be consumed only occasionally. The preferred choice for pasta or rice is also whole-grain, multi-grain is a less desirable choice and refined pasta and rice should be eaten only occasionally.

The advice for dairy, meat, fish, eggs and vegetarian alternatives is 450-550 ml dairy, depending on sex and age, 30 g cheese, and 100-125 g meat, fish, poultry, eggs or vegetarian alternatives per day. Eggs are limited at three per week, and fish should be chosen at least twice per week, once of which should be fatty fish, like herring, mackerel or salmon. Low-fat dairy products are the preferred choice, full-fat dairy and dairy products with added sugar should be consumed only occasionally. Unprocessed lean meat and poultry are the preferred choice, fatter cuts and processed products should be eaten only occasionally. Unprocessed fish and shell-fish are the preferred choise, deep-fried fish should be eaten only occasionally. For eggs, boiling is the preferred preparation method, frying should be done only occasionally.

The advice for fats and oils is 25-35 g of lower-fat margarine, depending on sex and age, and 15 g of oil or (deep-)fry products. All types of oil or liquid margarines with less than 70% fat are the preferred choice, soft margarines with less than 70% fat and liquid deep-fry products are the less-preferred choice, hydrogenated margarines and (deep-)fry products and butter should be eaten only occasionally.

Finally, people should drink 1500-2000 ml per day, according to the Dutch consensus diet. People should preferably drink water or unsweetened coffee or tea, black or with low-fat milk. Light soft-drinks are less preferable, coffee or tea with sugar and/or milk or cream, soft-drinks, fruit juices, energy drinks and alcohol should only be taken occasionally.

The Dutch consensus diet also has the following five rules: 1) eat a varied diet, 2) do not eat too much and be physically active, 3) eat less saturated fat, 4) eat lots of vegetables, fruit and bread, and 5) ensure food-safety.

DOI: 10.15310/2334-3591.1064

Measures

Intake questionnaire.
Participants were asked to indicate their sex, age, weight, height, postal code, marital status, number of children, educational level, work status, and whether they were currently following a special diet. Additionally, participants were asked to indicate their expectations regarding the effects of both the Dutch consensus diet and the Paleolithic-like diet on their psychological and somatic symptoms on a five-point scale ranging from 1 = much less symptoms, through 3 = no difference, to 5 = much more symptoms.

Psychological symptoms.
The Dutch translation of the Depression Anxiety Stress Questionnaire (DASS) (De Beurs, van Dyck, Marquenie, Lange, & Blonk, 2001; Lovibond & Lovibond, 1995) was used to measure psychological symptoms. The DASS consists of 42 items, including 14 questions on each of the domains of depression, anxiety and stress, which could be answered on a 4-point scale ranging from 0 = did not apply to me at all to 3 = applied to me very much, or most of the time. The scale includes statements such as "I felt sad and depressed", "I felt scared without any good reason", and "I found it difficult to relax". Test retest reliability and internal consistency of the Dutch version of the DASS is good ($r > 0.75$; Cronbach's alpha = 0.90)(De Beurs et al., 2001).

Somatic symptoms.
The Patient Health Questionnaire-15 (Kroenke et al., 2002) was used, complemented with five somatization items from the Symptom Checklist (Arrindell & Ettema, 1986) and eight items derived from an expert committee supervised by J. Rosmalen, to measure somatic symptoms. Participants were asked to rate to which extent they were bothered by each of the 28 somatic symptoms on a three-point scale, ranging from not at all to very much. Reliability and validity of the Patient Health Questionnaire are moderate to good, with a Cronbach's α of 0.80, intraclass-correlation coefficients between 0.60 and 0.83, strong associations with functional status, disability days and symptom-related difficulty which were discriminative between somatic and depressive symptoms (Kroenke et al., 2002; van Ravesteijn et al., 2009). The full somatic symptoms questionnaire is currently being validated in data from the HowNutsAreTheDutch study (Van Der Krieke et al., 2016) and called the Rosmalen Somatisation Index (RoSI).

Compliance.
A newly developed questionnaire was used to evaluate overall compliance to the two dietary patterns. The questionnaire consisted of 23 questions about the number of portions participants consumed either on average per day or total in the past week. Participants were instructed that the size of their fist equaled one portion. A preliminary validation in 50 individuals, not participating in this feasibility study, against a 7-day food diary showed reasonable validity ($r = .61$ for the Dutch consensus diet and $r = .48$ for the Paleolithic-like diet). Test-retest reliability of this instrument was good ($r = .72$).

Evaluation.
After both dietary patterns participants were asked to rate how easy or difficult it was to follow the dietary pattern, what changes we could make to make participation easier for future participants and how we could improve the instructions.

Data analysis

The primary objective of the study was to investigate feasibility of a web-based cross-over Paleolithic diet intervention. Feasibility was operationalized as the number of days needed to recruit 35 participants, representativeness of the sample, the drop-out rate and compliance to the dietary interventions. To determine representativeness of the sample, sex, age, body mass index, marital status, number of children, educational level, and work status of participants in the present study were compared to the Dutch population using data from (Centraal Bureau voor de Statistiek,) with t-tests for continuous variables and for categorical variables either Chi-square tests, or, in case of low numbers in one or more categories, Fisher's exact tests. Psychological symptom scores were compared to the weighed population means published by Van Der Krieke (Van Der Krieke et al., 2016), using independent samples t-tests. No comparison data from the Dutch population were available for somatic symptoms. Therefore, we compared PHQ-15 scores of our participants with PHQ-15 scores from the German general population, aged 14-92 (Kocalevent, Hinz, & Braehler, 2013) using independent samples t-tests. To determine compliance to the Paleolithic-like diet, we divided the number of portions permitted by the total number of portions consumed as indicated on the compliance questionnaire. To determine compliance to the Dutch consensus diet, we subtracted each portion that was consumed less or more than recommended from the total number of recommended portions, and divided this number by the total number of recommended portions.

The secondary objective of the study was to calculate the number of participants needed to show significant differences in psychological and somatic symptoms in a fully-powered web-based cross-over Paleolithic diet intervention. We first checked whether there were carry-over effects from one intervention to the other by calculating the sum of psychological and somatic symptoms, respectively, after the two intervention periods and comparing the two sequence groups by using an independent samples t-test (Wellek & Blettner, 2012). If no carry-over effect was found, the number of participants was calculated for paired samples, on the other hand, if a significant carry-over effect was found, the number of participants was calculated for independent samples using an online sample size calculator (Clinical & Translational Science Institute, 2017). These analyses were repeated including drop-outs, carrying forward the scores from their last measurement.

Prior expectations about the effects of the Dutch consensus diet and the Paleolithic-like diet on psychological and somatic symptoms were compared using paired samples t-tests. Correlations between prior expectations regarding changes in psychological and somatic symptoms and actual differences between baseline symptom scores and symptoms scores after each diet were calculated to gain insight in possible biases. Data are available from http://hdl.handle.net/10411/C6U43L.

Acknowledgements and disclosures

No funding was received for the present pilot study. The authors report no conflicts of interest. This trial was registered with The Netherlands National Trial Register (NTR) under number 5492 at 14 September 2015. Recruitment started 23 September 2015.The authors acknowledge the contributions of Daniel Vogel and RoQua to data collection. The authors also acknowledge the contribution of all participants and others involved, without whom this study would not have been possible. The data-set and the manuals with dietary instructions (in Dutch) are available from http://hdl.handle.net/10411/C6U43L.

DOI: 10.15310/2334-3591.1064

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