



Vegan vs. Omnivore Diet Paradox: A Before and After Study Design Using Whole-Metagenomic Methods to Define Metabolic Networks in Ultra-Marathoners during the Race

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Abstract

When faced with feeding animal items to their omnivorous dogs and carnivorous cats, people who choose not to eat animal products frequently live with animal friends. Feeding pets a food devoid of animal products—a “plant-based” or “vegan” diet—is one way to resolve this dilemma. It is unknown how many pet owners refrain from feeding their animals any animal products at this time [1, 2]. This study’s goals were to quantify the number of pet owners who avoid feeding their animals meat, pinpoint issues with traditional pet food made from animals and plants, and calculate the number of animals fed a plant-based diet. To gather information on the demographics of pet owners, their diets, the kind of pets they own, their diets, and their worries about pet foods, a questionnaire was distributed online to 3,673 English-speaking pet owners. The findings showed that, compared to the general population, pet owners were more likely to be vegetarians (6.2%; 229/3,673) or vegans (5.8%; 212/3,673). Only vegans (1.6%; 59/3,673) were the only pet owners that fed their animals a plant-based diet, with the exception of one dog owned by a vegetarian [3]. A significant fraction (45%; 269/599) of pet owners who said they were interested in feeding plant-based meals but did not currently do so wanted greater proof of the foods’ nutritional sufficiency. Concerns for the welfare of farm animals were voiced by pet owners more frequently than any other concern (39%; 1,275/3,231) [4].

Keywords: Vegan; Omnivore Diet; Vegetarians; Farm animals

Materials and Methods

Study population

65,429 men and women who are 20 years of age or older who were recruited from all throughout the United Kingdom between 1993 and 1999 make up the EPIC-Oxford cohort. In order to evaluate food, lifestyle, and cancer risk among individuals with various dietary practises, the study sought to enrol both vegetarians and vegans as well as participants from the general community [5]. The recruitment method has been described in length elsewhere. In short, general practise offices were used to find participants from the general community, and mail recruitment, which aimed to find many vegetarians and vegans, also attracted many non-vegetarians. In the current study, 71%, 97%, 99% and 100% of meat eaters, fish eaters, vegetarians and vegans, respectively, were recruited via post. The protocol for the EPIC-Oxford study was approved by a multi-centre research ethics committee (MREC/02/0/90), now called “Scotland A Research Ethics Committee”, and all participants gave written informed consent [6].

The present cross-sectional analysis includes men and women who (i) had provided a blood sample at recruitment, (ii) had a known smoking and diet group, (iii) had responded to $\geq 80\%$ of the relevant questions in the FFQ (130 questions for meat eaters and fish eaters, and 113 questions for vegetarians and vegans) and had an energy intake between 3.3 and 16.7 MJ (800–4,000 kcal) for men or between 2.1 and 14.7 MJ (500–3,500 kcal) for women, (iv) did not have prior cancer (excluding non-melanoma skin cancer) or cardiovascular disease, (v) were not receiving treatment for any long-term illness or condition, (vi) were not pregnant or taking oral contraceptives or hormone therapy for menopause (women only), and (vii) were younger than 90 years at time of blood collection. In order to maximise the heterogeneity of dietary exposure, approximately equal numbers of participants in each of the four diet groups were randomly selected from participants who were stratified by sex and by 10 year age categories [7]. This resulted in

424 meat eaters, 425 fish eaters, 422 vegetarians and 422 vegans being included in this study.

Assessment of diet and lifestyle

At recruitment, participants completed a validated semi-quantitative food frequency questionnaire (FFQ) with additional questions relating to prior disease, anthropometry and lifestyle factors such as smoking [8].

Participants were categorised into one of four diet groups based on their answers to the questions: “Do you eat any (i) meat, (ii) fish, (iii) dairy products and (iv) eggs?” The derived diet groups were: meat eaters, fish eaters (do not eat meat but do eat fish), vegetarians (do not eat meat or fish) and vegans (do not eat meat, fish, dairy products or eggs).

In the FFQ, participants were asked to report their average intake of 130 food items over the preceding 12 months in nine categories ranging from “Never or less than once per month” to “6 or more times per day”. The mean daily intakes of food items were estimated by multiplying the frequency of consumption by a specified portion size (mostly taken from Ministry of Agriculture, Fisheries and Food, Food portion sizes) [9]. The mean nutrient intake was estimated by multiplying the

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amount of food consumed by the nutrient content of the food item (mainly based on the fifth edition of McCance and Widdowson's The Composition of Foods and its supplements. The individual food items were categorised into food groups where appropriate, e.g. total meat (red meat, processed meat, liver and poultry) and fructose-rich drinks (fruit juice and sugar sweetened soft drinks).

In the questionnaire, all participants were asked to report their weight and height. Weight and height were also measured in a sub-sample (n=4,808) of the cohort, and self-reported data showed good agreement with the measured data ($r>0.9$). Either self-reported or measured height and weight were used to calculate body mass index (BMI; weight (kg)/(height (m))²). Smoking was categorised as "never", "former", "current light" (<15 cigarettes/day) and "current heavy" (≥ 15 cigarettes/day), and age of the participants was recorded at time of blood collection [10].

Laboratory method

At recruitment or shortly after, participants attended their local general practice surgeries where a blood sample was taken (participants were not required to fast). Blood was transported overnight to a laboratory in Norfolk by mail at ambient temperature, where samples were centrifuged and serum was aliquoted into 0.5 ml plastic straws. These were heat-sealed at both ends and stored in liquid nitrogen (-196°C) until 2011 and subsequently in electric freezers (-80°C) until analysis. A Beckman Synchron DxC autoanalyser (Beckman Coulter, High Wycombe, UK) was used to measure serum uric acid in 2011. Pooled serum samples (n=196) were included in each run (blinded) and the overall coefficient of variation for uric acid was 0.9%.

Discussion

Although the vegan diet has been widely preferable and studies claiming to be adequate for ultra-endurance athletes, there is still no comprehensive investigation of the impact of the vegan diet applied by ultra-endurance athletes. Therefore, we aim to provide an in-depth investigation of vegan diets by analysing blood and faecal analysis in ultra-endurance athletes adhered to this diet for the long term. Previous studies considered vegan diets to be deficient for certain nutrients such as iron, calcium, zinc, iodine, omega-3 fatty acids, vitamin D, and vitamin B12 [11]. However, these nutrients may also be lacking in omnivores and vegetarians. For example, vitamin B12 has been found to be insufficient in older omnivores due to reduced absorption rate and some medications used. Additionally, the common belief that omnivores consuming meat products do not have vitamin B12 deficiency may cause a vitamin B12 deficiency to go undiagnosed. A well-planned vegan diet can provide all these nutrients for the athletic population. The Academy of Nutrition and Dietetics' position statement on vegetarian diets has described well-planned vegan diets as healthy and nutritionally adequate diets that provide currently recommended dietary intakes and follow current dietary guidelines and are beneficial for preventing and treating certain diseases and are suitable for sedentary and athletes of all ages [12]. However, there is also a consensus statement that vegans need to carefully monitor their vitamin B12 intake and provide reliable vitamin B12 sources, including fortified foods or supplements as appropriate. Therefore, a carefully planned vegan diet with vitamin B12 supplement can meet all nutritional and energy needs of athletes. In case of vegan diets are found to be beneficial and sufficient, the study a level of evidence against the belief that the vegan diet may be insufficient for athletes and may provide the framework for future studies to assess veganism's effects in athletic populations. Besides, the athletic population consumes meat

products 2- and more fold compared to the other individuals, which creates a high risk for the world in terms of carbon footprint. If a Vegan diet provides enough energy availability and balance macro- and micronutrients in the body, we can also recommend consuming the diet for the future of planet-saving [13]. On the other hand, if vegan diets are found to be deficient or detrimental for either metabolism, including immunologic or oxidative factors or gut-host crosstalk, veganism's adverse effects could be identified to inform athletes to eliminate its detrimental consequences.

By adding the measurements of oxidant/antioxidant- and muscle fatigue-related parameters, we seek to explore the impact of dietary patterns on body hormesis and fatigue levels in ultra-endurance athletes. Dietary intake data will analyse all diet composition, including nutrient and non-nutrient components, the main determinants of antioxidant defence. We may also determine whether the whole dietary pattern or food intake affects hormesis balance and endogenous antioxidant defence in athletes endured under extreme conditions [14].

One limitation of the study is its small sample size. We plan to include twenty ultra-marathoners in the study, mainly due to the higher costs of the entire metagenomic analysis. However, our findings will provide pilot data for future studies investigating the gut metagenomics and endurance performance of ultra-endurance athletes.

In summary, we will scientifically evaluate the effect of vegan and omnivorous diets on gut metagenomics and the adaptation of the gut microbiome to extreme endurance exercise according to the vegan or omnivorous diet, which might provide a convenient means for regulation of nutritional requirements involving the basic and sports specific needs.

Acknowledgement

None

Conflict of Interest

None

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