Cutting through the Paleo hype: The evidence for the Palaeolithic diet

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Background

General practitioners (GPs) are commonly asked about popular diets. The Palaeolithic diet is both highly popular and controversial.

Objective

This article reviews the published literature to establish the evidence for and against the Palaeolithic diet.

Discussion

The Palaeolithic diet remains controversial because of exaggerated claims for it by wellness bloggers and celebrity chefs, and the contentious evolutionary discordance hypothesis on which it is based. However, a number of underpowered trials have suggested there may be some benefit to the Palaeolithic diet, especially in weight loss and the correction of metabolic dysfunction. Further research is warranted to test these early findings. GPs should caution patients who are on the Palaeolithic diet about adequate calcium intake, especially those at higher risk of osteoporosis.

General practitioners (GPs) are commonly asked about popular diets. Fad diets come and go, some gaining more traction within the public sphere than others. One of the most controversial diets in recent times is the Palaeolithic diet, otherwise known as the Stone Age diet, or simply as Paleo.

Even without controversy, the Palaeolithic diet has been increasing in popularity over the past few years. The diet has been the subject of intense criticism by health professionals because of wellness bloggers' and celebrity chefs' exaggerated claims about its purported effects – for example, that the Palaeolithic diet could prevent or cure polycystic ovary syndrome, autism, mental illness, dementia and obesity.[1]

Does the published medical literature support the vast and extravagant claims made by the Palaeolithic diet's celebrity proponents? Should GPs recommend the Palaeolithic diets to their patients, or caution them? This article seeks to review the published clinical research on the Palaeolithic diet.

Why Paleo? The rationale for the Palaeolithic diet

The rationale for the Palaeolithic diet stems from the evolutionary discordance hypothesis – that human evolution ceased 10,000 years ago, and our Stone Age genetics are ill-equipped to cope with our modern diet and lifestyle, leading to the 'diseases of civilisation'.[2–8] Thus, only foods that were available to hunter–gatherer groups are optimal for human health – 'Could I eat this if I were naked with a sharp stick on the savanna?'.[9] Therefore, meat, fruit and vegetables are acceptable, but grains and dairy products are not.[10]

Such views have drawn criticism from anthropologists, who argue that there is no blanket prescription of an evolutionarily appropriate diet, but rather that human eating habits are primarily learned through behavioural, social and physiological mechanisms.[11] Other commentators have noted that the claims of the Palaeolithic diet are unsupported by scientific and historical evidence.[12] The Palaeolithic diet's anthropological validity notwithstanding, is there scientific support of the various health claims made of it? Pragmatically speaking, is a diet sans dairy and refined carbohydrates beneficial, even if it is not historically accurate?

Published evidence on the Palaeolithic diet

While proponents of the Palaeolithic diet claim that it is evidence-based, there are only a limited number of controlled clinical trials comparing the Palaeolithic diet to accepted diets such as the diabetic or Mediterranean diets (Table 1).

In 2007, Lindeberg et al performed a randomised controlled trial of the Palaeolithic versus Mediterranean-like diet in 29 patients with ischaemic heart disease and impaired glucose metabolism over 12 weeks. Both groups lost approximately the same amount of weight; however, the Palaeolithic group showed a significantly

decreased waist circumference and improved glucose sensitivity.[13] In 2009, Jönsson et al expanded on the study by Lindeberg et al. They published a randomised crossover pilot study of 13 patients with type 2 diabetes, randomised to either the Palaeolithic or diabetic-like diet over two consecutive three-month periods. Compared with patients on the diabetic-like diet, patients on the Palaeolithic diet showed improved HbA1c, diastolic blood pressure, lipid profile, weight and waist circumference, and no statistically significant change in C-reactive protein (CRP).[14]

Osterdahl and colleagues published a pilot study in 2008, in which 14 healthy volunteers were placed on the Palaeolithic diet over the course of three weeks. Six participants gave a complete dietary assessment. Across all participants, there was a significant mean weight loss of 2.3 kg over the three weeks and a mean decrease in waist circumference by 0.5 cm. Systolic blood pressure improved slightly and there was a stark rise in CRP, although it did not reach significance. The authors noted that the Palaeolithic diet was significantly lower in calcium compared to the subjects' pre-study diet.[15]

Frassetto et al performed a metabolically controlled study in 2009 in nine non-obese, sedentary, healthy volunteers, comparing the Palaeolithic diet to their usual diet. The Palaeolithic diet led to significant reductions in blood pressure with improved arterial distensibility, insulin

Table 1. Summary of selection methodology and reviewed articles*

Lindeberg et al (2007)	29 patients; IHD and impaired glucose metabolism	RCT – Paleo versus Mediterranean-like diet for 12 weeks	Weight – no difference; Paleo – decreased WC, increased glucose sensitivity
Osterdahl et al (2008)	14 healthy volunteers	Pilot	Paleo – mean weight loss of 2.3 kg, decreased WC 0.5 cm, improved SBP, increased CRP (non-significant) and significantly lacked calcium
Jönsson et al (2009)	13 patients; T2DM	RCT – crossover, two consecutive three-month periods, Paleo versus diabetic-like diet	Paleo – improved HbA1c, DBP, lipid profile, weight, WC; no significant change in CRP
Frassetto et al (2009)	Nine non-obese, sedentary volunteers	Metabolically controlled – Paleo versus diet as usual	Paleo – improved SBP, DBP, arterial distensibility, insulin sensitivity, plasma lipids
Jönsson et al (2013)	13 patients; T2DM	RCT – crossover, two consecutive three-month periods, Paleo versus diabetes diet	Paleo – increased satiety for energy, energy density and glycaemic load. Difficult to adhere to.
Boers et al (2014)	34 patients; metabolic syndrome	RCT – two weeks, Paleo versus isocaloric diet based on Dutch Health Council guidelines	Paleo – decreased SBP, DBP and weight (1.32 kg); improved lipid profile. No change to intestinal permeability, inflammation, salivary cortisol
Whalen et al (2014)	University of Minnesota Cancer Prevention Research Unit data	Case controlled – incidence colorectal polyps, Paleo versus Mediterranean diet	Similar non-significant decreased incidence colorectal polyps
Mellberg et al (2014)	70 patients; females who were obese and post-menopausal	RCT – two years, Paleo versus Nordic Nutrition Recommendations diet	Paleo – increased weight loss at six months, no difference at two years. Improved BP, CRP and lipid profile in both groups. No difference glucose/insulin both groups
Bligh et al (2015)	24 healthy male volunteers	Acute, double-blinded, RCT – two different Paleo diets and WHO-based reference meal	No significant difference in glucose and insulin responses between different meals

*Controlled human trials of the Paleolithic diet selected for review. Papers retrieved from Pubmed search for 'Paleolithic Diet' limited to 'humans' { ('diet, paleolithic'[MeSH Terms] OR ('diet' [All Fields] AND 'paleolithic' [All Fields]) OR 'paleolithic diet' [All Fields] OR ('paleo' [All Fields] AND 'diet' [All Fields]) OR 'paleo diet' [All Fields]) AND 'humans' [MeSH Terms]}

CRP, C-reactive protein; DBP, diastolic blood pressure; IHD, ischaemic heart disease; Paleo, the Palaeolithic diet; RCT, randomised controlled trial; SBP, systolic blood pressure; T2DM, type 2 diabetes mellitus; WC, waist circumference; WHO, World Health Organization

sensitivity and plasma lipids, all unrelated to body weight.[16]

In 2013, Jönsson et al studied the satiety of the Palaeolithic diet, compared with the diabetic diet, in a randomised crossover trial of 13 patients with type 2 diabetes. The Palaeolithic diet resulted in greater satiety quotients for energy, energy density and glycaemic load per meal. While the Palaeolithic diet was more satiating per calorie than the diabetic diet, they also noted that it was difficult to adhere to.[17]

In 2014, Boers et al compared the Palaeolithic diet with an isoenergetic, healthy control diet based on Dutch Health Council guidelines in 32 subjects with metabolic syndrome. The Palaeolithic diet resulted in lower systolic and diastolic blood pressure, and improved plasma lipid profile. Despite both diet arms being isocaloric, bodyweight decreased in the Palaeolithic group, compared with the reference (–1.32 kg; $P = 0.012$). No significant difference was found in intestinal permeability, inflammation and salivary cortisol as secondary outcome measures.[18]

Whalen et al in 2014 used data collected as part of a previous case-controlled research program at the University of Minnesota Cancer Prevention Research Unit between April 1991 and April 1994 to analyse the incidence of colorectal polyps versus the diet history given on a standardised dietary questionnaire. They found that for both the Palaeolithic and Mediterranean diets, there was no statistically significant change in risk.[19]

Mellberg et al published a longer term trial on the Palaeolithic diet in 2014. Their study was a randomised controlled trial of 70 women who were obese and post-menopausal, and they compared the Palaeolithic diet to a reference diet based on the Nordic Nutrition Recommendations over a two-year period. The end points were body fat percentage calculated by dual-energy X-ray absorptiometry (DEXA) scan, and the level of metabolic markers. The Palaeolithic group lost significantly more weight than the group on the reference diet at six months, although this was not sustained at the 24-month mark. The Palaeolithic diet group lost more body fat and lean tissue than the reference group. Both groups showed similar improvements in blood pressure, CRP and cholesterol, whereas there were no changes in fasting glucose and insulin.[20]

In a double-blind randomised controlled trial of 24 healthy male volunteers in 2015, Bligh et al compared the acute satiety and gut hormone responses of two Palaeolithic-type meals with a reference meal based on the World Health Organization's *Preparation and use of food-based dietary guidelines*. Both Palaeolithic meals were predominantly plant based. The first Palaeolithic meal was based on estimated range ratios for protein and fat that was considered typical of hunter–gatherers, and contained no cereals or dairy products. The second Palaeolithic meal was made with identical plant-based ingredients to the first Palaeolithic meal, but normalised to the reference meal for caloric and macronutrient equivalence. There was no significant difference in the response of glucose and insulin between the meals.[21]

Table 2. Comparison of the current Australian dietary guidelines recommendations[24] with the Palaeolithic diet[15]

Australian dietary guidelines	Palaeolithic diet
Enjoy a wide variety of nutritious foods from the following five groups every day	
Plenty of vegetables, including different types and colours, and legumes/beans	Ad libitum fresh vegetables and fruit
Fruit	
Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties, such as bread, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley	All cereals/grain products prohibited, including maize and rice
Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans	Ad libitum lean meats and poultry, fish, eggs, tofu, nuts and seeds, but all legumes prohibited
Milk, yoghurt, cheese and/or their alternatives, mostly reduced fat (reduced fat milks are not suitable for children younger than two years)	All dairy products prohibited
Drink plenty of water	Ad libitum water (mineral water allowed if tap water unavailable)

Reconciling the research

Looking at the studies as a whole, the Palaeolithic diet was often associated with increased satiety, independent of caloric or macronutrient composition, along with improvements in body weight, waist circumference, blood pressure and lipid profiles. However, the studies were short, heterogeneous in design and underpowered. The strongest of the studies was by Mellburg et al, who showed no long-term differences between participants on the Palaeolithic diet and those on the control at 24 months.[20]

In the studies that measured inflammatory markers, there was no significant difference as a result of consuming the Palaeolithic diet. Adherence and palatability were common issues raised about the Palaeolithic diet. Some studies reported improvements in plasma glucose or other markers of glycaemic control,[10,14,16] though some did not,[20,21] including the study of Bligh et al, which was a high-quality, laboratory-controlled study. It showed no significant difference in glucose and insulin levels for the Palaeolithic diet, compared with their reference meal.[21]

Other factors should be considered when thinking of the Palaeolithic diet in the broader patient context. Modelling of the cost of the Palaeolithic diet suggests that it is approximately 10% more expensive than an essential diet of similar nutritional value, which may limit the Palaeolithic diet's usefulness for those on a low income.[22] Calcium deficiency also remains a significant issue with the Palaeolithic diet; the study by Osterdahl et al in 2008 showed that the calcium intake of the Paleo diet was about 50% of the recommended dietary intake.[15] Uncorrected, this could increase a patient's risk of osteoporosis.[23] Patients on the Palaeolithic diet should be referred to an accredited practising dietitian for individualised medical nutrition therapy (Table 2).

Overall, conclusions about the effectiveness of the Palaeolithic diet should be considered cautiously. Positive findings should be tempered by the lack of power of these studies, which were limited by their small numbers, heterogeneity and short duration. Nevertheless, there appears to be enough evidence to warrant further consideration of the Palaeolithic diet as a potential dietary option in the management of metabolic diseases. Larger independent trials with consistent methodology and longer duration are required to confirm the initial promise in these early studies. Claims that the Palaeolithic diet could treat or prevent conditions such as autism, dementia and mental illness are not supported by clinical research.

Conclusion

The Palaeolithic diet is currently over-hyped and under-researched. While the claims made by its celebrity proponents are not supported by current evidence, the Palaeolithic diet may be of benefit in the management of various metabolic derangements. Further research is warranted to test these early findings. GPs should caution patients on the Palaeolithic diet about adequate calcium intake, especially those at higher risk of osteoporosis.

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