

Citation for published version:

Richard Hoffman, 'Can the paleolithic diet meet the nutritional needs of older people?', *Maturitas*, Vol. 95: 63-64, January 2017.

DOI:

<https://doi.org/10.1016/j.maturitas.2016.09.005>

Document Version:

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1 **Can the paleolithic diet meet the nutritional needs of older people?**

2 Richard Hoffman

3 School of Life and Medical Sciences, University of Hertfordshire, Hatfield, Herts,
4 AL10 9AB, UK

5 Tel. +44 1707 284526

6 Fax: +44 1707 285046

7 E-mail: r.hoffman@herts.ac.uk

8 Conflicts of interest: none

9 Key words: paleolithic diet, elderly

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11 The paleolithic diet aims to emulate the dietary pattern of people of the "Old
12 Stone Age" and is currently one of the most fashionable diets in the world.
13 Although a few short-term studies have shown beneficial effects of this diet on
14 biomarkers for diabetes (see [1]) and cardiovascular disease [2, 3], studies using
15 disease endpoints are scarce. In the absence of these studies, one way to help
16 predict potential long term health outcomes in people following this diet,
17 including the elderly, is to determine if it is likely to meet their nutritional needs.

18 The paleo diet basically advocates lean meat, fish and shellfish, fruit, vegetables,
19 eggs, nuts and seeds. It excludes grains and cereals, dairy, processed foods,
20 refined sugars and added salt. A number of nutrient analyses of people following
21 a paleo diet have been carried out, albeit mainly on younger subjects (< 65
22 years). Protein intake on a paleo diet is generally found to be similar to or
23 slightly higher than on a normal diet. This high protein intake would be
24 particularly beneficial for the elderly because their protein requirements for
25 maintaining muscle mass and preventing sarcopenia may be higher than those
26 recommended for the general population [4]. Advice for the elderly on
27 consuming meat as the main source of protein - as is the case in the paleo diet - is,
28 however, controversial [5]. In the general population, there is evidence of an

29 association between consumption of red meat (though possibly not of white
30 meat such as chicken) and an increased risk of developing colorectal cancer,
31 though the evidence is probably confounded by factors like the type of red meat
32 (eg beef versus pork) [6] and the way the meat is cooked [7]. Subjects on a paleo
33 diet should however benefit from not consuming processed meat since the
34 evidence that processed meat increases the risk for colorectal cancer is strong.

35 As might be predicted from the high intake of fruit and vegetables in the paleo
36 diet, some micronutrients, including vitamins C and E and β -carotene, are
37 consumed in high quantities, while sodium intake has been found to be
38 substantially lower than in control diets [8, 9]. However, several short term
39 clinical studies have found that calcium intake in subjects following a paleo diet
40 is low, ranging from 355 - 395 mg/day [2, 8, 9]. Although, the optimal level of
41 calcium intake required specifically to reduce the risk of osteoporotic fractures is
42 currently the subject of considerable debate [10], these values are nevertheless
43 well below current recommended daily intake levels for healthy adults (700 mg
44 in the UK and 1200 mg in the US).

45 The paleo diet's low calcium content is probably attributable to the absence of
46 dairy and cereals, which the UK National Diet and Nutrition Survey found
47 contributed 42 % and 29 % respectively to the intake of calcium in the over 65's
48 [11]. It has been estimated that, for the US, adequate intake for calcium is not
49 possible with dairy-free diets while also meeting other nutrient
50 recommendations [12]. Modeling studies on the paleo diet have also confirmed
51 its difficulties in meeting current recommended intakes of calcium [13].
52 Although calcium supplements are an option, these are at odds with the basic
53 philosophy of the paleo diet as one reflecting a Stone Age diet.

54 Dairy is also the main dietary source of iodine - essential for thyroid hormone
55 production. In the one study that has examined this, iodine intake on the paleo
56 diet was only about half the UK recommended requirement of 140 μ g/day [8].
57 Some types of fish and shellfish are also good sources of iodine but - at least in
58 this study - these did not compensate for the shortfalls. Iodised salt is available,
59 but its iodine content is low, availability of this product is poor in some countries

60 like the UK [14], and the paleo diet discourages added salt. Increased salt
61 consumption is not advisable, in any case.

62 Dairy and cereals are also important sources of other micronutrients, including
63 some (thiamine, riboflavin and iron) that have been reported to be reduced in
64 some studies of the paleo diet. Most of these nutritional assessments of the paleo
65 diet are based on young or middle aged subjects, but they do nevertheless raise
66 concerns that the absence of dairy products and cereals will prevent adequate
67 intake of some key micronutrients for the elderly. Although micronutrient
68 deficiencies frequently occur in the elderly who do not follow a paleo diet, it does
69 seem likely that the absence of dairy and cereals in this diet will exacerbate the
70 risk of deficiencies. Dairy also provides protein in the omnivore diet without the
71 need to trade off against cancer risks, as is the case with red meat.

72 The paleo diet has been reported to induce a feeling of satiety. This may be a
73 useful short term strategy to lose weight [15], but for many elderly people poor
74 appetite is a significant concern, so the benefit of a diet with high satiety is
75 questionable. In addition, the acceptability of any diet is key to compliance, and
76 there are anecdotal comments on the difficulty of adhering to a paleo diet as it
77 lacks many of the sources of carbohydrates (bread, pasta, etc) that form a major
78 part of many western meals [16].

79 Long term studies on the health consequences of adhering to a paleo diet may
80 currently be lacking, but to quote Austin Bradford Hill "that does not confer upon
81 us a freedom to ignore the knowledge we already have, or to postpone the action
82 that it appears to demand at a given time". The knowledge we have is that the
83 healthiest diet is one based on minimally processed foods, mostly coming from
84 plant foods [17]. Currently the diet with the strongest evidence for preventing
85 nutrient deficiencies and protecting long term health, including in the elderly, is
86 the plant-based Mediterranean diet [18].

87 Contributor: RH is the sole author

88 Conflicts of interest: none

89 Funding: none was sought or secured to write this editorial

90 Provenance and peer review: commissioned; not externally peer reviewed

91

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