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## The health impact of substituting meat with plant-based meat alternatives: findings from a Systematic Review

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Sales of plant-based meat alternatives (PBMA) are increasing<sup>(1)</sup>. While these products are becoming more popular, little is known about their impact on health<sup>(2)</sup>. Therefore, the aim of this work was to systematically review the evidence on PBMA consumption and associated health outcomes.

A wider systematic review looking at the environmental impact, ingredient composition, nutritional impact and health outcomes associated with PBMA was conducted. A search strategy combined terms “meat alternatives” AND “environment” OR “ingredients” OR “nutrition” OR “health.” Five databases were searched, MEDLINE, EMBASE, Web of Science, Scopus and Greenfile, as well as reference lists of relevant articles. All study designs reporting primary data were included, except for animal studies and *in vitro* studies. Non-English studies and studies published before 2011 were excluded (PROSPERO Registration Number: CRD42021250541).

2184 papers were identified, 1802 papers remained after duplicates were removed, 1536 were excluded at title and abstract screen stage, 266 full texts were assessed for eligibility and 54 papers were included in the analysis for all outcomes investigated. Ten studies examined the impact of PBMA vs. meat consumption on health outcomes. Three studies measured postprandial response to single test meals<sup>(3-5)</sup>, four studies were longer-term RCTs<sup>(6-8)</sup> with two further separate publications reporting on different outcomes for the same RCT<sup>(9,10)</sup>. One study was a prospective cohort<sup>(11)</sup> and one a cross-sectional study<sup>(12)</sup>.

Of the single test meal studies, no significant differences were observed for glucose levels in 2/2 studies (100%)<sup>(3,5)</sup>, PYY and GLP-1 levels in 2/2 studies (100%)<sup>(3,4)</sup> and self-reported hunger/fullness in 3/3 studies (100%)<sup>(3-5)</sup>. Significantly lower insulin concentrations and subsequent energy intakes were both reported in 1/2 studies (50%) following consumption of mycoprotein vs. chicken meals<sup>(3)</sup>.

Longer-term full and partial replacement of meat with PBMA resulted in significantly lower body weight (kg) in 2/2 studies (100%)<sup>(6,10)</sup>, significantly lower saturated fat intakes in 2/2 studies (100%)<sup>(6,10)</sup>, significantly higher fibre intakes in 2/3 studies (67%)<sup>(6,7)</sup>, improvements in plasma lipid profile in 2/3 studies (67%)<sup>(7,10)</sup> and positive changes in gut microbiota in 1/2 studies (50%)<sup>(8)</sup> compared to meat diet phases/control groups with no restrictions on meat intakes. There were no significant differences in protein intakes in 3/3 studies (100%)<sup>(6,7,10)</sup>, energy, total fat and carbohydrate intakes in 2/2 studies (100%)<sup>(6,7)</sup>, blood pressure in 2/2 studies (100%)<sup>(6,10)</sup>, glucose levels in 2/2 studies (100%)<sup>(7,10)</sup> and insulin levels in 2/2 studies (100%)<sup>(7,10)</sup>.

No definitive conclusions can be made on the impact of PBMA on health outcomes due to the small number of studies and variation in study designs, outcomes measured and the type of PBMA used. From the limited evidence available, no negative health effects from PBMA consumption were observed, however, further longer-term RCTs are needed to confirm this.

### References

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