

Environmental and Nutritional Assessment of Meala's Clean Bite Pea Based

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Introduction

Global food systems are transitioning toward plant-based protein sources to reduce the environmental burden of food production and to respond to growing consumer demand for healthier, cleaner-label products. Animal-derived functional ingredients such as egg-white powder, and synthetic binders and stabilizers such as methylcellulose and gellan gum, remain widespread across the food industry. Both carry environmental and formulation costs: egg powder is associated with substantial greenhouse-gas emissions and water consumption through poultry feed, while synthetic additives run counter to clean-label objectives that brands increasingly need to meet.

Meala has developed Clean Bite Pea Based (PB), a functional ingredient built on pea protein isolate that delivers binding, gelling, and stabilizing performance. Unlike a conventional pea protein isolate, Clean Bite PB is designed to replace eggs, methylcellulose, and gellan gum in a single ingredient swap, without compromising the texture or structure of the finished product.

This report evaluates how replacing these conventional binders and animal proteins with Clean Bite PB affects both the nutritional quality and the environmental footprint of three model food applications: muffins, mayonnaise, and burgers. Nutritional quality is quantified using the Nutrient Rich Food index (NRF9.3), and environmental performance is measured through the carbon footprint and water footprint, following Life Cycle Assessment methodology.

Scope of the study

This report presents the environmental and nutritional impact of Meala's Clean Bite (PB) when used as a functional ingredient in real food applications. The performance of the ingredient was investigated in three model products in which conventional binders and stabilizers were replaced by Clean Bite PB, and each reformulation was compared against its conventional reference formulation.

The assessment was designed to answer a single question: to what extent does replacing common texture ingredients such as egg powder, methylcellulose, and gellan gum, with Clean Bite PB affect the NRF9.3 index, the carbon footprint, and the water footprint of different food applications?

Two functional units were used throughout. Environmental impacts were expressed per kilogram of finished product and, to enable a nutritionally relevant comparison, per kilogram of protein. Because recipes do not substitute ingredients one-to-one, the finished-product comparison rather than an ingredient-only comparison, is treated as the true measure of impact. For the burger, where the NRF9.3 index was positive, impacts were additionally normalized per unit of nutritional value.

Methodology

System boundary. The environmental assessment was performed using a cradle-to-gate system boundary. This includes all life-cycle stages from raw-material extraction through ingredient processing and product manufacturing, up to the point where the finished product leaves the production system. Packaging materials and distribution to retail were excluded from the analysis. The assessment was conducted in accordance with the ISO 14040 and ISO 14044 frameworks for life-cycle assessment.

Databases and impact methods. The life-cycle inventory was based primarily on the Ecoinvent 3.11 database, using the "allocation, cut-off by classification" system model, in which wastes are the producer's responsibility and secondary materials enter the system burden-free. Where food-specific datasets were unavailable in Ecoinvent, the Agribalyse 3.2 database was used; remaining gaps were filled with proxies from technical datasheets and scientific literature. All impacts were calculated with the Environmental Footprint (EF) v3.1 method.

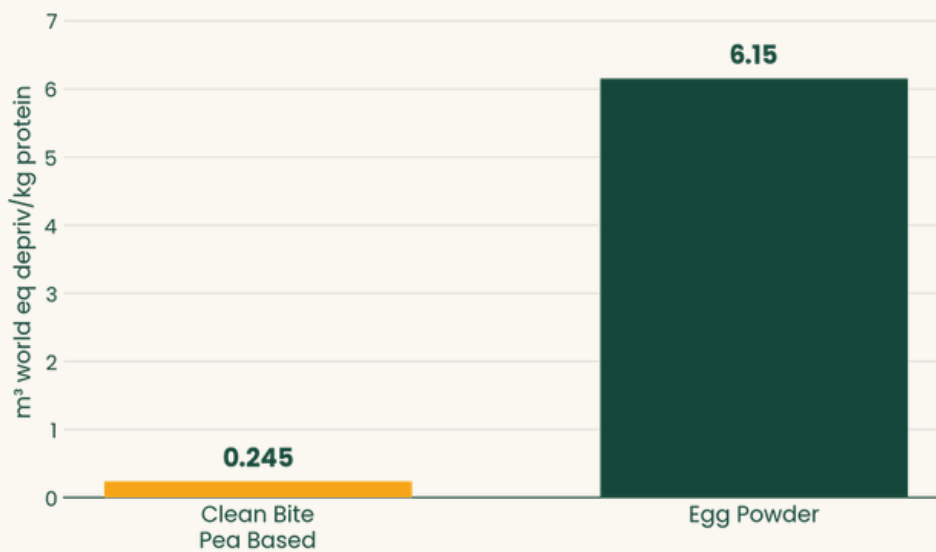
Global warming potential was assessed over a 100-year horizon (GWP100), consistent with IPCC guidance. Water impacts were expressed as cubic metres of water deprivation (m³ deprived) using the scarcity-weighted AWARE method, which weights consumption by regional water scarcity rather than by volume alone. Where available, market-mix datasets were selected to represent realistic supply, with priority given to Israeli datasets reflecting the geography of production, followed by European and then Rest-of-World data.

Nutritional quality – NRF9.3. Nutritional quality was quantified using the Nutrient Rich Food index (NRF9.3), which balances nine nutrients to encourage (protein, dietary fibre, vitamins A, C, and D, calcium, iron, magnesium, and potassium) against three nutrients to limit (saturated fat, total sugar, and sodium). Each nutrient was expressed as a percentage of its reference intake per 100 kcal, with the contribution of individual positive nutrients capped at 100% to avoid over-weighting. Scores were calculated using two reference-value sets, based on EFSA and on FDA intakes, to test the robustness of the result.

Ingredient modelling. The footprint of Clean Bite PB was built on pea protein isolate as the main ingredient, with the environmental impact of the isolate itself drawn from the Life Cycle Assessment conducted by VITO (2022), with values consistent with those reported by Asscherickx et al. (2022). The model calculates meal proteins process and technology.

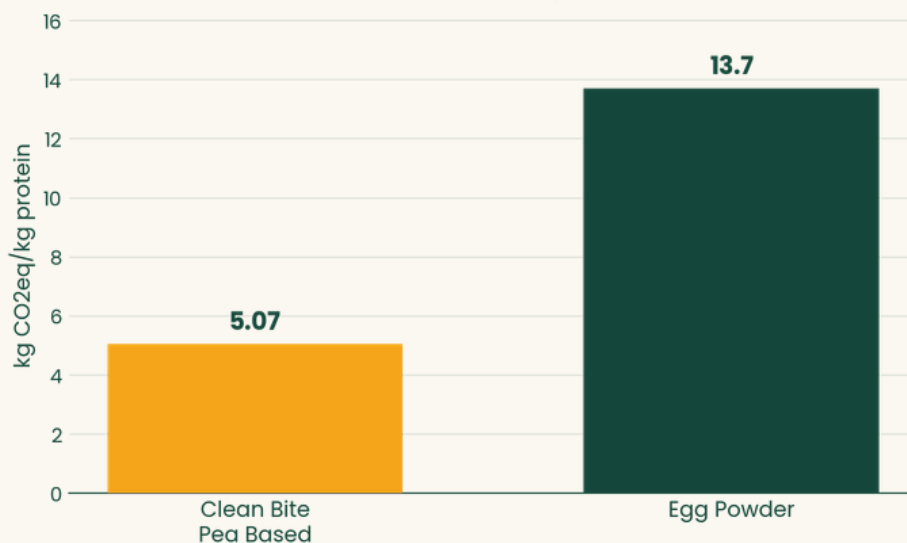
Ingredients

Water footprint



Water footprint
(m³ world eq
depriv/kg protein)
-96% vs egg powder

Carbon footprint



Carbon footprint
(kg CO2eq/kg protein)
-63% vs egg powder

What it means

Reformulating with Clean Bite PB delivered lower carbon and water footprints per kilogram of protein than the reference recipe in every application assessed, while maintaining or improving nutritional quality. For a food brand, that turns a clean label decision into measurable, defensible numbers: a swap that can be reported against tightening Scope 3 targets and CSRD requirements, placed on-pack, and put in front of buyers- while reducing exposure to volatile egg prices.

Methodological considerations

The results are grounded in recognized datasets and established life-cycle methods but remain sensitive to underlying assumptions. Absolute values depend on the composition and geography of raw materials; alternative methods such as ReCiPe would shift the magnitude of results. Nutritional scores likewise depend on the reference-value set and on nutrient-selection choices, such as the inclusion of vitamin D rather than vitamin E in this study. These choices are consistent across all products compared, preserving the validity of the relative differences reported.

Conclusion

Clean Bite PB is an effective clean-label solution that replaces synthetic hydrocolloids such as methylcellulose and gellan gum, as well as functional animal proteins such as whole egg, egg white, egg powder, without compromising the nutritional or environmental integrity of the finished product. Across diverse applications reformulation maintained or improved the NRF9.3 score and, when impacts are normalized per unit of protein, reduced both the carbon and the water footprint in every case. Further gains are achievable through improved energy efficiency in ingredient production and through sodium reduction at the ingredient level.

References

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