## Application of dried carrot pulp as a clean-label phosphate replacer in beef patties

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**Introduction:** Consumer demand for healthy, safe, sustainable and high-quality foods has resulted in the increased reformulation of processed foods. There is a desire to improve the health and sustainability of processed meats, including innovating for cleaner labelled ingredient declarations. Phosphate additives are highly functional in value-added meat formulations as they can improve emulsification, water holding capacity (WHC) and reduce oxidation (Thangavelu et al., 2019). Although addition to meat products is regulated (Regulation (EC) No 1333/2008) and phosphates are generally regarded as safe, they do not fit with the clean label trend. Carrot pulp is a by-product of carrot juice concentrate manufacture with high WHC; hence it could have a role in replacing the water-holding functionality of phosphates in meat products. In addition, discovering and validating new uses of by-product ingredients could lead to reduced global food waste and help to address future food challenges.

**Materials and methods:** Dried carrot pulp was assessed as a partial or full phosphate replacer in beef patties with a fixed beef to water ratio of 4:1. Six formulations of meat patties were manufactured in a 2 x 3 factorial experimental design of 0 or 2% of dried carrot pulp and 0, 0.2 or 0.4% sodium tripolyphosphate (STPP). The sample with no carrot pulp or STPP was regarded as the control. Samples were cooked and analysed for cook loss (%) by weight change. Shrinkage (%) in patty area (cm2) after cooking was calculated using ImageJ software. Other quality analyses included colour, texture (Kramer Shear) and pH.

**Results:** Shrinkage was reduced by 6% with carrot pulp compared to the control ($p<0.001$). With 0.4% STPP, shrinkage increased by 3%, compared to the control ($p<0.001$). All formulations resulted in reduced cook loss compared to the control, except for 0.2% STPP ($p<0.001$). When the formulation contained 0.4% STPP, cook loss was reduced by 5.5%, compared to the control, while carrot pulp resulted in a 9.4% reduction in cook loss. This was reduced a further 2.2 or 2.7% by combining 2% carrot pulp with 0.2% or 0.4% STPP, respectively, but these did not differ significantly from carrot pulp alone. There was no significant effect of carrot pulp or STPP on shear force (N) results or colour parameters ($L^*$, $a^*$ and $b^*$). Carrot pulp did not affect the pH of the formulations, however STPP increased it from 5.64 to 5.76-5.93 ($p<0.001$). The rise of pH in meat products following phosphate addition is hypothesised to be one of the mechanisms responsible for increased WHC. This is due to the shift from the isoelectric point of the acto-myosin complex, resulting in an increase of water entrapment (Long et al., 2011). Future studies could explore water-binding mechanisms within the carrot pulp-meat matrix and assess sensory attributes.

**Conclusions:** This study demonstrated that dried carrot pulp, a carrot concentrate by-product, could potentially have a role in clean label processed meat formulations, leading to healthier meat products and reduced food waste.

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**Literature:**

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