Clean Vaccine: Assessing Antigen Recognition Using a Minimal Excipient Vaccine Formula

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Modern vaccines are effective but often depend on complex formulations containing depot-forming adjuvants and stabilizing excipients. Emerging approaches such as neoantigen cancer vaccines and mucosal delivery require improved antigen stability with minimal chemical additives. The Clean Vaccine Project tested whether a simple water-soluble antioxidant, sodium ascorbate, could regulate protein antigen structure during environmental stress. Ovalbumin (OVA) was used as a model antigen and exposed to thermal (80 °C) and oxidative (H_2O_2) conditions. Antigen recognition was measured by competitive ELISA, where lower normalized concentration indicates stronger antibody binding. Sodium ascorbate (Vitamin C) produced a consistent improvement in recognition across conditions (mean ~ 6.06%, $p = 0.0001$). Heat exposure increased binding, consistent with binding site exposure from partial unfolding, while oxidation altered binding patterns consistent with chemical modification of surface sites. Sodium ascorbate regulated both effects by stabilizing partially unfolded protein during heat stress and preserving natural binding sites under oxidation. These results support a minimal-excipient vaccine strategy in which controlled antigen structure, rather than increased inflammatory response, guides reliable immune recognition.

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