**Supplementary Legends:**

**Figure S1.** **Epitope-HLA Molecular docking results analysis by LIGPLOT+**.The molecules participating in the binding of each epitope-HLA docked complex are illustrated, with each complex labeled below its corresponding plot. Interactions between the molecules are indicated by dashed lines, while sun-like shapes are used to represent molecules involved in hydrophobic interactions. The HLA-A\*02:01 and HLA-DRB1\*15:01 are referred to as A2 and D15, respectively.

**Figure S2. Computational cloning of the vaccine construct.** Using SnapGene software, the multi-epitope vaccine sequence was inserted between the XhoI and NotI enzymes into the pET21b (+) vector. The resulting recombinant plasmid has a length of 6180 bp, with the multi-epitope highlighted in red.