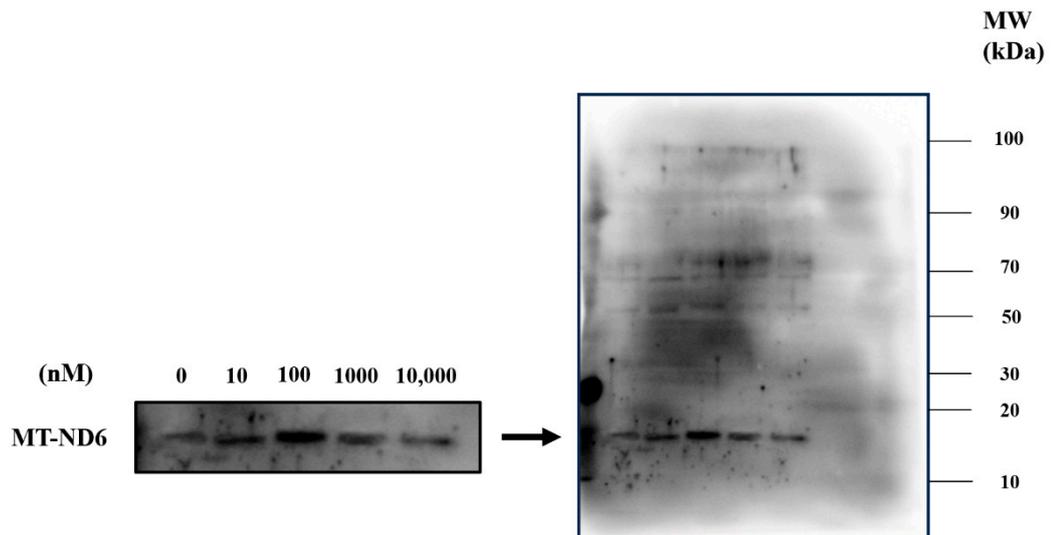
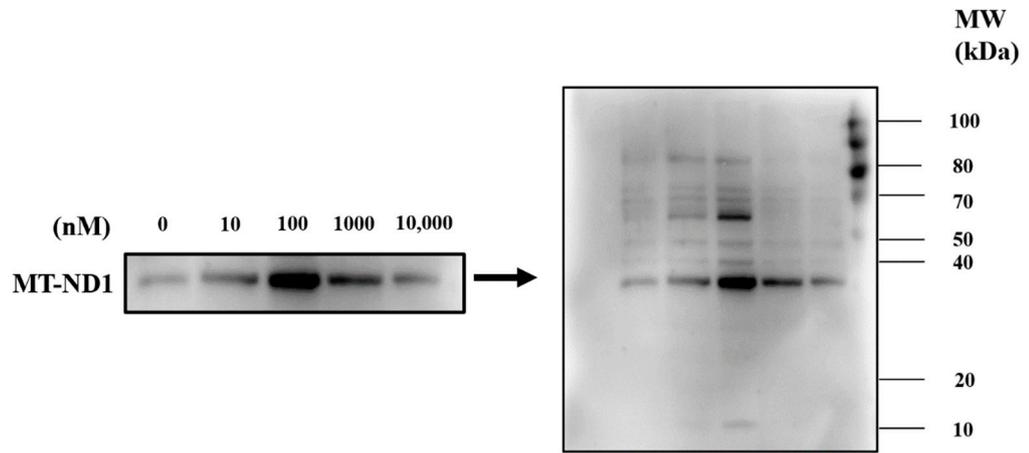
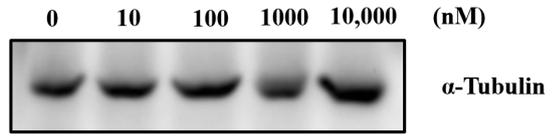
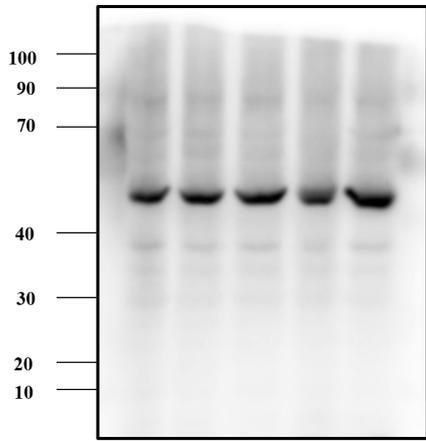


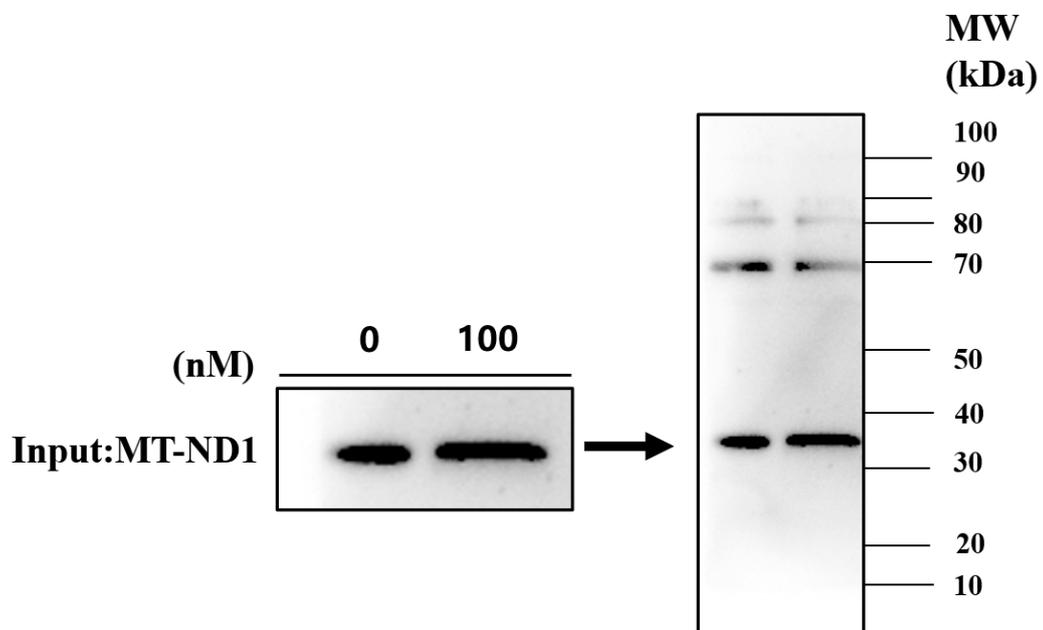
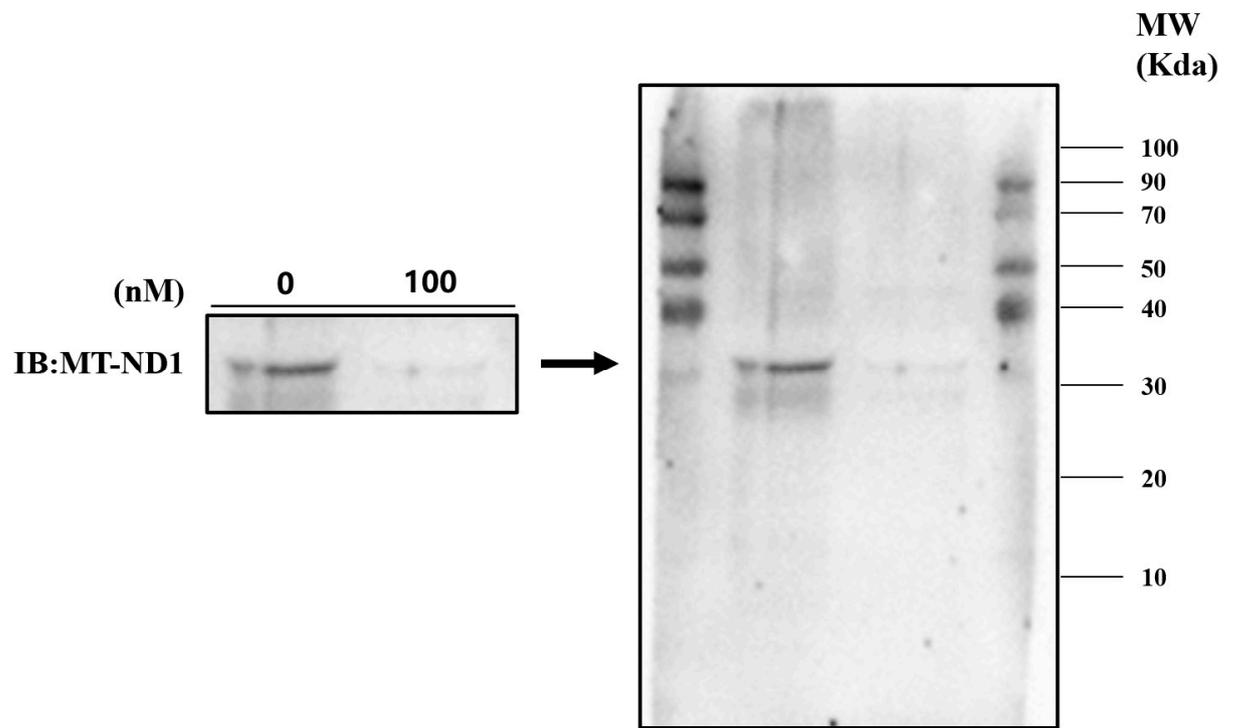
Supplementary Figure S1. Different concentrations of PQQ on the expression of proteins (MT-ND1、 MT-ND6) in ram sperm stored at 4°C.

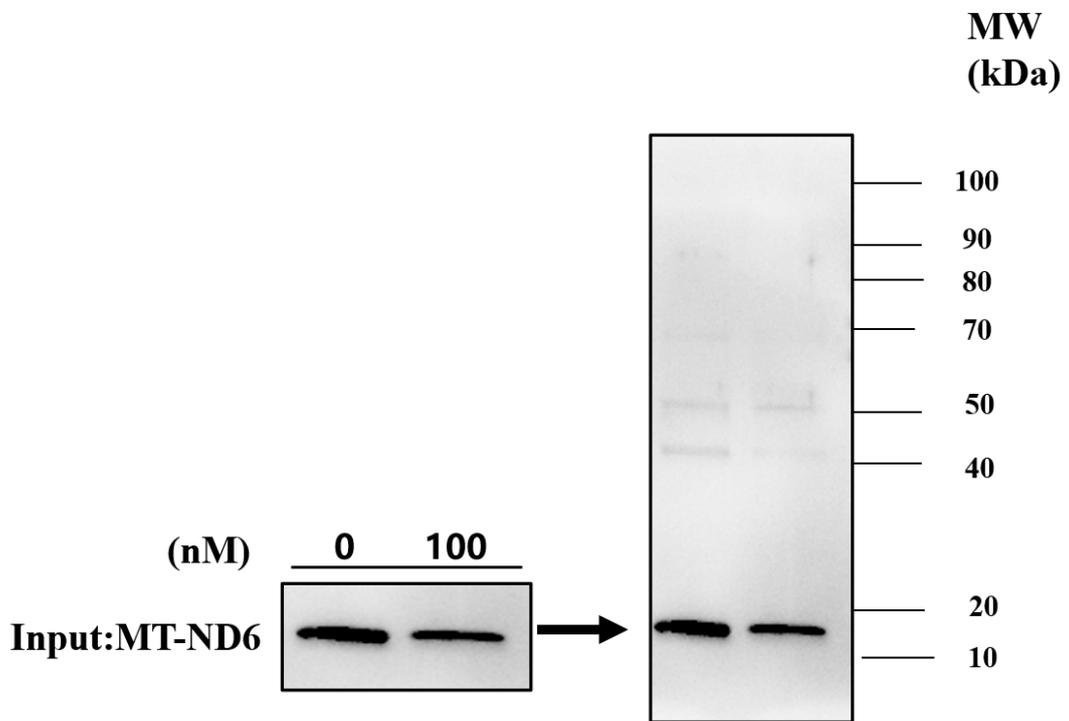
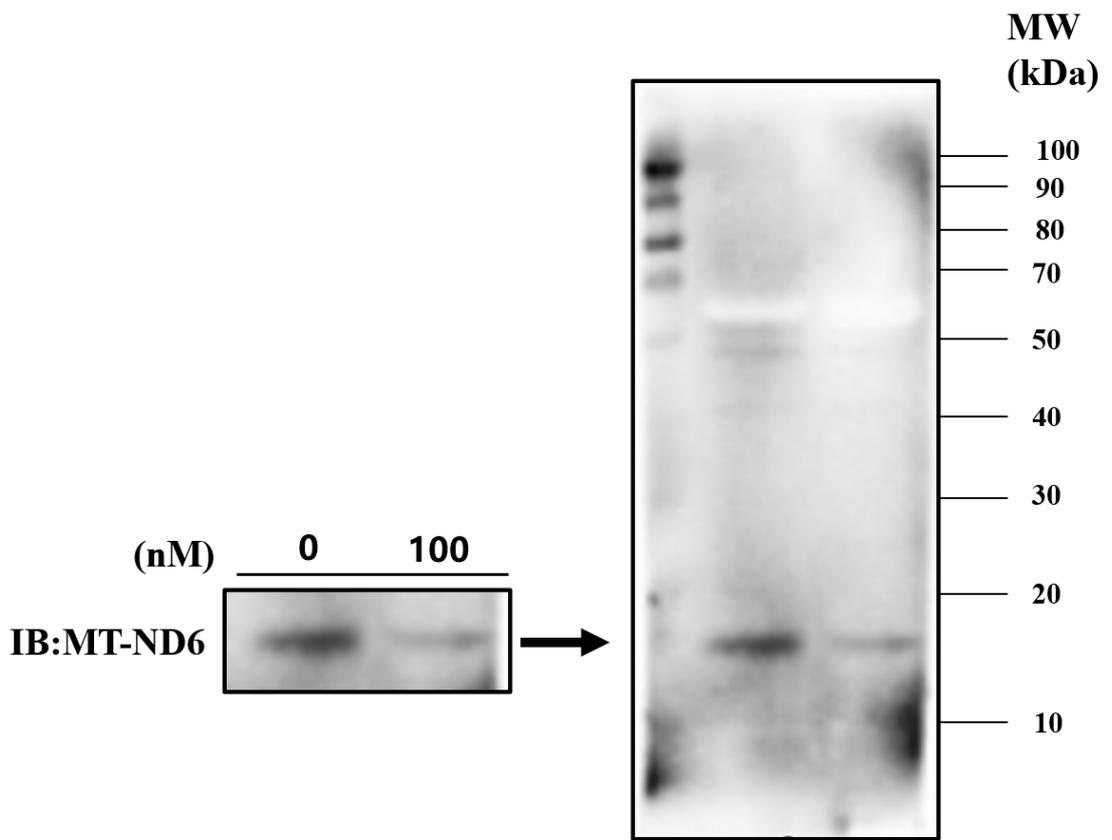


MW
(kDa)

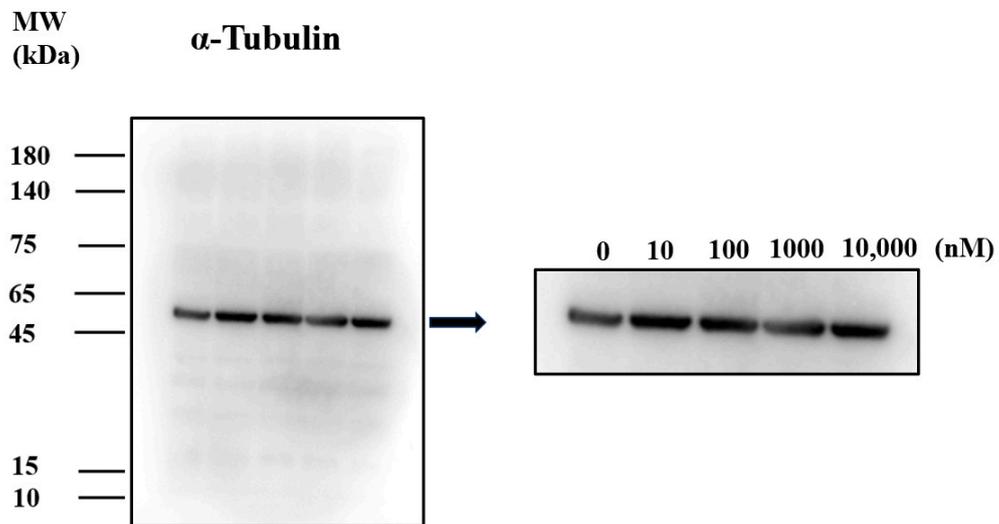
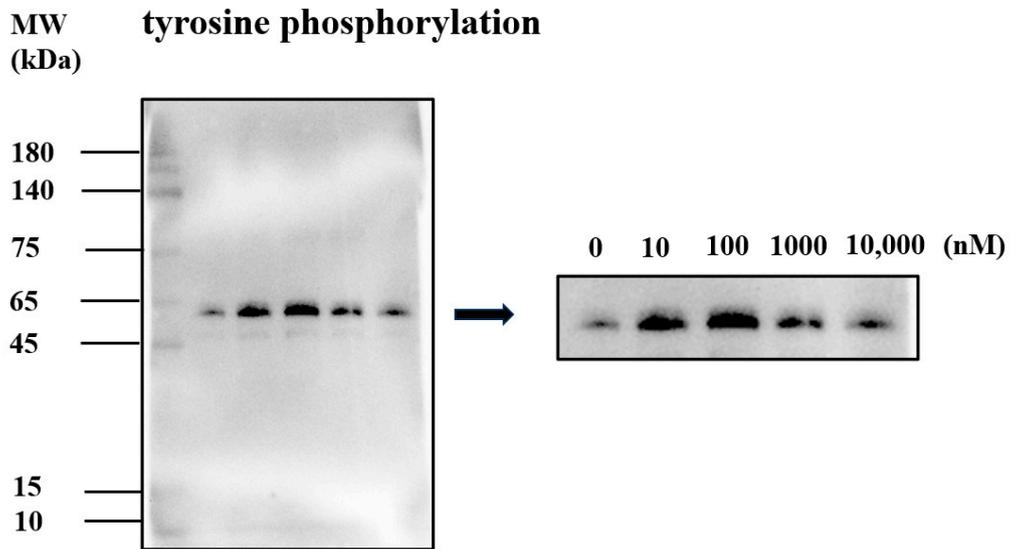


Supplementary Figure S2. PQQ decreased the ROS damage of mitochondrial proteins (MT-ND1 and MT-ND6).

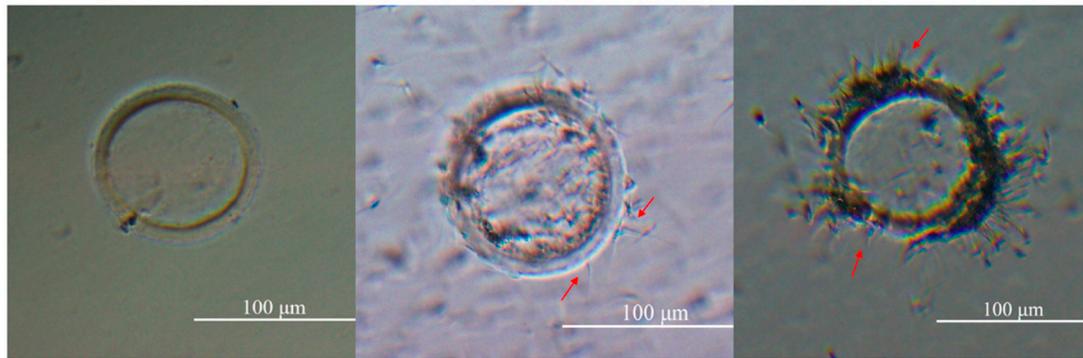




Supplementary Figure S3. Different concentrations of PQQ on the expression of tyrosine phosphorylation proteins in ram sperm stored at 4°C



Supplementary Figure S4. Effect of PQQ on sperm-zona pellucida (ZP) binding capacity after sperm treated with PQQ. (A) zona pellucida. (B) Control group sperm-zona pellucida complex, (C) 100 nM PQQ group sperm-zona pellucida complexes, red arrow indicate the sperm tightly bound to zona pellucida. Bars=100 μm .



A Original appearance of zona pellucida

B 0 nM PQQ group

C 100 nM PQQ group