Supplementary Information 4. Detection of different antioxidant activity indexes

T-AOC: The tissue homogenization in ice bath was performed at a ratio of 1:5 ~10 (tissue mass: g to extraction liquid volume: mL). Subsequently, the resulting mixture was centrifuged at 4 ℃ for 10 minutes with a force of 10000 g. The supernatant was collected and kept on ice for further analysis. Prior to testing, the spectrophotometer/enzyme marker was preheated for 30 minutes and set to a wavelength of 593 nm, while distilled water served as the zero reference. Following the addition of reagents according to instructions, thorough mixing and subsequent reaction for 20 minutes took place. Finally, the absorbance value at 593 nm was determined using microquartz colorimetric plates.

SOD: The SOD method involves homogenizing tissue at a ratio of 1:5 to 10 (tissue mass in grams: extract liquid volume in mL) using an ice bath. Subsequently, the resulting mixture is centrifuged at 8000 g and 4 ℃ for 10 minutes, followed by collection of the supernatant as samples on ice. Thoroughly mix and vortex each sample, allowing them to incubate at room temperature for 30 minutes before measuring the absorbance value at 450 nm for each tube A.

ROS: The ROS probe DCFH-DA was diluted in serum-free medium at a ratio of 1:1000 to achieve a final concentration of 10 μmol/L. After sample collection, they were suspended in the diluted DCFH-DA and incubated in a cell incubator at 37 ℃ for 20 minutes with regular inversion and mixing every 3-5 minutes to ensure optimal interaction between the probe and the sample. Stimulation of cells for 20-30 minutes with an active oxygen positive control can significantly enhance the level of reactive

oxygen species. Real-time detection of fluorescence intensity before and after stimulation is performed using an excitation wavelength of 488 nm and an emission wavelength of 525 nm.

MDA: The ice bath homogenization is performed at a ratio of 1:5 ~10 (tissue mass in grams: extract liquid volume in milliliters). After centrifugation at 4 ℃ for 10 minutes with a force of 8000 g, the supernatant is collected and kept on ice for measurement. Serum samples are directly detected. Reagent (0.3 mL) is absorbed into a 1.5 mL centrifuge tube, followed by the addition of sample (0.1 mL) and thorough mixing. The mixture is then heated in a water bath at 95 ℃ for 30 minutes, cooled in an ice bath, and finally subjected to centrifugation at 10000 g and 25 ℃ for another 10 minutes. Superant (200 μL) is absorbed into either a microquartz cuphor or a well plate with 96 wells, and the absorbance at wavelengths of both 532 nm and 600 nm (A532 and A600 respectively) are determined to calculate ΔA = A532 - A600.