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Product Manual

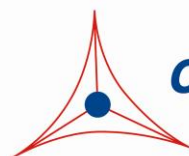
# OxiSelect™ Oxygen Radical Antioxidant Capacity (ORAC) Activity Assay

Catalog Number

STA-345	192 assays
STA-345-5	5 x 192 assays

**FOR RESEARCH USE ONLY**  
Not for use in diagnostic procedures

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**CELL BIOLABS, INC.**  
*Creating Solutions for Life Science Research*

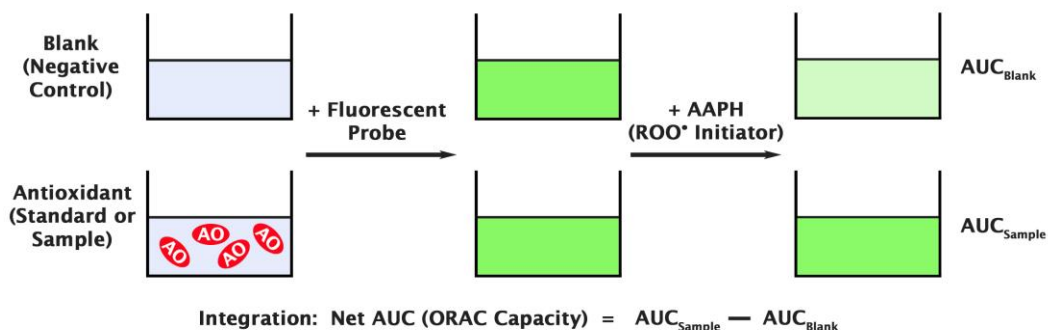
## Introduction

Oxidative stress is a physiological condition where there is an imbalance between concentrations of reactive oxygen species (ROS) and antioxidants. However, excessive ROS accumulation will lead to cellular injury, such as damage to DNA, proteins, and lipid membranes. The cellular damage caused by ROS has been implicated in the development of many disease states, such as cancer, diabetes, cardiovascular disease, atherosclerosis, and neurodegenerative diseases. Under normal physiological conditions, cellular ROS generation is counterbalanced by the action of cellular antioxidant enzymes and other redox molecules. Because of their potential harmful effects, excessive ROS must be promptly eliminated from the cells by this variety of antioxidant defense mechanisms. Antioxidants include both hydrophilic and lipophilic molecules for metabolizing ROS.

Although the products of ROS-induced oxidative stress are extensively used to monitor the effects of oxidative stress, it is also important to evaluate the antioxidant capacity of biological fluids, cells, and extracts. The Oxygen Radical Antioxidant Capacity (ORAC) Assay is a classic tool for measuring the antioxidant capacity of biomolecules from a variety of samples. The ORAC Activity Assay is based on the oxidation of a fluorescent probe by peroxy radicals by way of a hydrogen atom transfer (HAT) process. Peroxyl radicals are produced by a free radical initiator, which quenches the fluorescent probe over time. Antioxidants present in the assay work to block the peroxy radical oxidation of the fluorescent probe until the antioxidant activity in the sample is depleted. The remaining peroxy radicals destroy the fluorescence of the fluorescent probe. This assay continues until completion, which means both the antioxidant's inhibition time and inhibition percentage of free radical damage is a single value. The sample antioxidant capacity correlates to the fluorescence decay curve, which is usually represented as the area under the curve (AUC). The AUC is used to quantify the total peroxy radical antioxidant activity in a sample and is compared to an antioxidant standard curve of the water-soluble vitamin E analog Trolox™ (see Assay Principle below).

Cell Biolabs' OxiSelect™ ORAC Activity Assay is a fast and reliable kit for the direct measurement of ORAC antioxidant capacity from cell lysate, plasma, serum, tissue homogenates, and food extracts. Each kit provides sufficient reagents to perform up to 192 assays, including blanks, antioxidant standards and unknown samples. The assay is designed for use in single plate microplate readers as well as readers with high-throughput capabilities. Please read the complete kit insert prior to performing the assay.

## Assay Principle



## **Related Products**

1. STA-305: OxiSelect™ Nitrotyrosine Protein ELISA Kit
2. STA-310: OxiSelect™ Protein Carbonyl ELISA Kit
3. STA-320: OxiSelect™ Oxidative DNA Damage ELISA Kit (8-OHdG Quantitation)
4. STA-330: OxiSelect™ TBARS Assay Kit (MDA Quantitation)
5. STA-346: OxiSelect™ HORAC Activity Assay

## **Kit Components**

1. 96-well Microtiter Plate (Part No. 234501): Two 96-well clear bottom black plates.
2. Fluorescein Probe (100X) (Part No. 234502): One 0.5 mL vial.
3. Free Radical Initiator (Part No. 234503): One 0.5 g bottle of powder.
4. Antioxidant Standard (Trolox™) (Part No. 234504): One 100 µL vial of a 5 mM solution.
5. Assay Diluent (4X) (Part No. 234505): One 50 mL bottle.

## **Materials Not Supplied**

1. Sample extracts for testing
2. 1X PBS and Deionized water
3. 50% Acetone
4. Bottles, flasks, and conical or microtubes necessary for reagent preparation
5. Reagents and materials necessary for sample extraction and purification

## **Storage**

Upon receipt store the Fluorescent Probe and Antioxidant Standard (Trolox™) frozen at -20°C. Aliquot as necessary to avoid multiple freeze/thaws. Store all remaining components at 4°C.

## **Preparation of Reagents**

- 1X Assay Diluent: Dilute the Assay Diluent 1:4 with deionized water. Mix to homogeneity. Use this for all sample and standard dilutions. Store the 1X Assay Diluent at 4°C.
- 1X Fluorescein Probe: Dilute the Fluorescein Probe 1:100 with 1X Assay Diluent. Mix to homogeneity. Label this as 1X Fluorescein Solution. Use only enough Fluorescein Probe as necessary for immediate applications.

*Note: Do not store diluted Fluorescein Probe solutions.*

- Free Radical Initiator Solution: Freshly prepare 80 mg/mL Free Radical Initiator Solution in 1X PBS. For example, weigh out 160 mg of Free Radical Initiator powder in a conical tube and reconstitute the powder with 2 mL of 1X PBS and mix to homogeneity. Free Radical Initiator Solution is not stable and should be used immediately.

## **Preparation of Samples**

*Note: Samples should be stored at -70°C prior to performing the assay. Sample should be prepared at the discretion of the user. The following recommendations are only guidelines and may be altered to optimize or complement the user's experimental design.*

- **Deproteinized Fractions:** Samples can be deproteinized and have their non-protein fractions assayed. Mix samples with 0.5 M perchloric acid (1:2, v/v), centrifuge at 10,000 x g for 10 minutes at 4°C. Remove the supernatant for measuring the non-protein fraction in the assay.
- **Cell Culture:** Wash cells 3 times with cold PBS prior to lysis. Lyse cells with sonication or homogenization in cold PBS and centrifuge at 10,000 x g for 10 minutes at 4°C. Aliquot and store the supernatant for use in the assay.
- **Lipophilic Fractions:** Dissolve lipophilic samples in 100% acetone and then dilute in 50% acetone. Incubate the mixture for 1 hour at room temperature with mixing. Further dilute samples as necessary prior to testing.
- **Plasma or Serum:** Collect blood with heparin and centrifuge at 4°C for 10 minutes. Remove the plasma and aliquot samples for testing. Blood plasma or serum should be diluted 100-fold or more with Assay Diluent prior to performing the assay.
- **Tissue Lysate:** Sonicate or homogenize tissue sample on cold PBS and centrifuge at 10,000 x g for 10 minutes at 4°C. Aliquot and store the supernatant for use in the assay.
- **Urine:** Test neat or diluted with Assay Diluent if appropriate.
- **Nutrition Samples:** Results may vary depending on sample source and purification. Dilution and preparation of these samples is at the discretion of the user, but use the following guidelines:
  - **Solid or High Protein Samples:** Weigh solid sample and then homogenize after adding deionized water (1:2, w/v). Centrifuge the homogenate at 10-12,000 x g for 10 minutes at 4°C. Recover the supernatant which is the water-soluble fraction. Separately recover the insoluble fraction (pulp) and wash with deionized water. Combine this wash with the supernatant. The pooled supernatant can be diluted with Assay Diluent and used directly in the assay. The pulp is further extracted by adding pure acetone (1:4, w\*(solid pulp)/v) and mixing at room temperature for 30-60 minutes. Centrifuge the extract/solid at 12,000 x g for 10 minutes at 4°C. Recover the acetone extract and dilute with Assay Diluent as necessary prior to running the assay. The total ORAC value is calculated by combining the results from the water-soluble fraction and the acetone extract from the pulp fraction.
  - **Aqueous Samples:** Centrifuge the sample at 5-10,000 x g for 10 minutes at 4°C to remove any particulates. Dilute the supernatant as necessary prior to running the assay. Certain liquids such as juice extracts may be tested without dilution.

## **Preparation of Antioxidant Standard Curve**

### **I. Hydrophilic (aqueous) Samples**

1. Prepare fresh standards by diluting the 5 mM Antioxidant Standard stock solution to 0.2 mM in Assay Diluent (example: add 10 µL of Antioxidant Standard stock tube to 240 µL of Assay Diluent).

2. Prepare a series of the remaining antioxidant standards according to Table 1.

Tubes	0.2 mM Trolox™ Antioxidant Standard (µL)	Assay Diluent (µL)	Resulting Trolox™ Concentration (µM)
1	50	150	50
2	40	160	40
3	30	170	30
4	20	180	20
5	10	190	10
6	5	195	5
7	2.5	197.5	2.5
8	0	200	0

**Table 1. Preparation of Standards for use when testing Hydrophilic Samples.**

*Note: Do not store diluted Antioxidant Standard solutions.*

## II. Lipophilic Samples

1. Prepare fresh standards by diluting the 5 mM Antioxidant Standard stock solution to 0.2 mM in 50% acetone (example: add 10 µL of Antioxidant Standard stock tube to 240 µL of acetone).
2. Prepare a series of the remaining antioxidant standards according to Table 2.

Tubes	0.2 mM Trolox™ Antioxidant Standard (µL)	50% Acetone (µL)	Resulting Trolox™ Concentration (µM)
1	50	150	50
2	40	160	40
3	30	170	30
4	20	180	20
5	10	190	10
6	5	195	5
7	2.5	197.5	2.5
8	0	200	0

**Table 2. Preparation of Standards for use when testing Lipophilic Samples.**

*Note: Do not store diluted Antioxidant Standard solutions.*

## Assay Protocol

*Note: Each Antioxidant Standard and sample should be assayed in duplicate or triplicate. A freshly prepared standard curve should be used each time the assay is performed.*

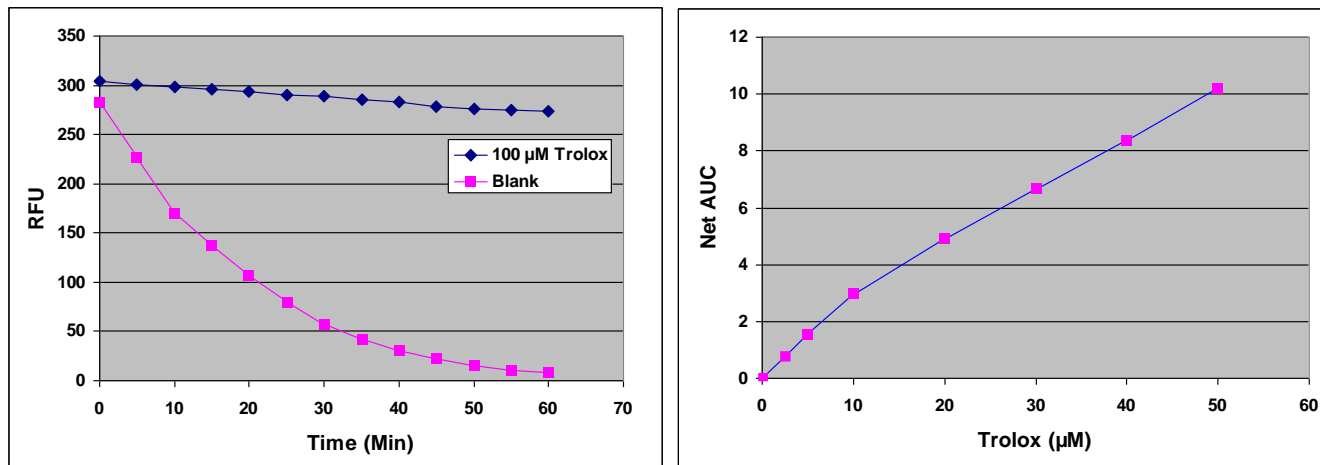
1. Add 25 µL of the diluted Antioxidant Standard or samples to the 96-well Microtiter Plate.
2. Add 150 µL of the 1X Fluorescein Solution to each well. Mix thoroughly. Incubate the plate for 30 minutes at 37°C.
3. Add 25 µL of the Free Radical Initiator Solution into each well using either a multichannel pipette or a plate reader liquid handling system.
4. Mix the reaction mixture thoroughly by pipetting to ensure homogeneity.
5. Immediately begin reading sample and standard wells with a fluorescent microplate reader at 37°C with an excitation wavelength of 480nm and an emission wavelength of 520nm. Read the wells in

increments between 1 and 5 minutes for a total of 60 minutes. Save values for Calculation of Results below.

*Note: The final assay values of blank control should be less than 10% of the initial values in order for the assay to be completed.*

### **Example of Results**

The following figure demonstrates typical OxiSelect™ ORAC Activity Assay results. One should use the data below for reference only. This data should not be used to interpret or calculate actual sample results.



**Figure 1: ORAC Activity Assay Standard Curve.**

### **Calculation of Results**

*Note: A spreadsheet application or plate reader software can be used to perform the calculations.*

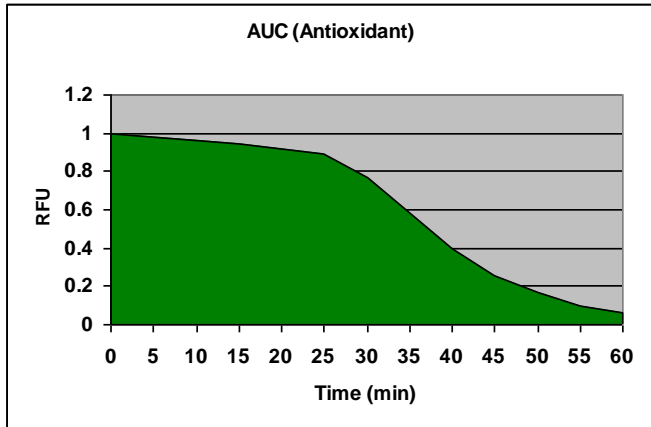
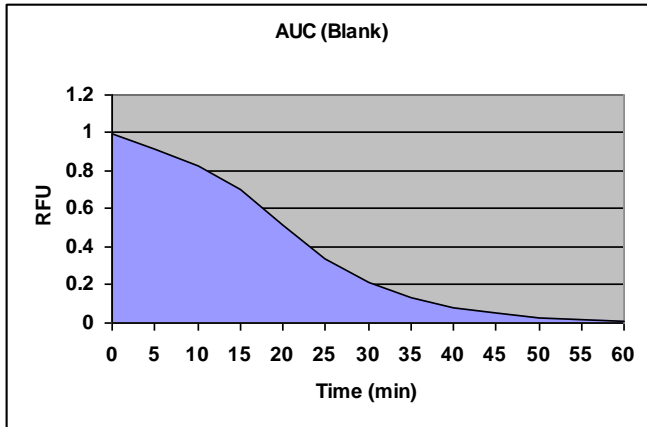
1. Calculate the area under the curve (AUC) for each sample and standard using the final assay values and the linear regression formula below.

The AUC can be calculated from the equation below:

$$\text{AUC} = 1 + \text{RFU}_1/\text{RFU}_0 + \text{RFU}_2/\text{RFU}_0 + \text{RFU}_3/\text{RFU}_0 + \dots + \text{RFU}_{59}/\text{RFU}_0 + \text{RFU}_{60}/\text{RFU}_0$$

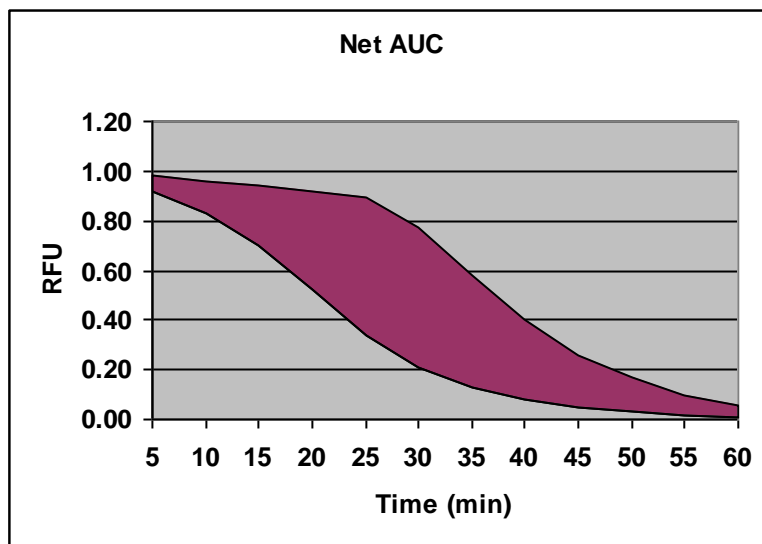
**RFU<sub>0</sub>** = relative fluorescence value of time point zero.

**RFU<sub>x</sub>** = relative fluorescence value of time points (eg. RFU<sub>5</sub> is relative fluorescence value at minute five)



- Calculate the Net AUC by subtracting the Blank AUC from the AUC of each sample and standard.

$$\text{Net AUC} = \text{AUC (Antioxidant)} - \text{AUC (blank)}$$



- Graph the Net AUC on the y-axis against the Trolox™ Antioxidant Standard concentration on the x-axis (see Figure 1)
- Calculate the  $\mu\text{Mole}$  Trolox™ Equivalents (TE) of unknown sample by comparing the standard curve. Results (ORAC value) may be expressed as TE per L or g of sample.

#### Calculation Example:

25  $\mu\text{L}$  of 10-fold diluted sample is assayed along with 25  $\mu\text{L}$  of each Trolox™ antioxidant standard including blank as described in Assay Protocol. The average AUC is 4.3 for blank and 9.1 for sample.

$$\text{Net AUC} = \text{AUC (Antioxidant)} - \text{AUC (blank)} = 9.1 - 4.3 = 4.8$$

Based on the Trolox™ antioxidant standard curve, the equivalent Trolox concentration is 20  $\mu\text{M}$ , therefore: ORAC value (Sample) = 20  $\mu\text{M}$  x 10 (dilution factor) = 200  $\mu\text{M}$  TE = 200  $\mu\text{Mole}$  TE/L

#### References

- Ames, B.N., Shigenaga, M.K., and Hagen, T.M. (1993) Proc. Natl. Acad. Sci. USA 90: 7915-7922.
- Cao, G., and Prior, R. (1999) Methods Enzymol. 299: 50-62.

3. Huang, D., Ou, B., Hampsch-Woodill, M., Flanagan, J., and Prior, R. (2002) *J. Agric. Food Chem.* 50: 4437- 4444.
4. Huang, D., Ou, B., & Prior, R. (2005) *J. Agric. Food Chem.* 53: 1841-1856.
5. Ou, B., Hampsch-Woodill, M., and Prior, R. (2001) *J. Agric. Food Chem.* 49: 4619-4626.
6. Rice-Evans, C., and Miller, NJ. (1994) *Methods Enzymol.* 234: 279-293.

*Trolox™ is a trademark of Hoffman-LaRoche*

### **Recent Product Citations**

1. Eldahshan, O. A. et al. (2023). Evaluation of Antioxidant Activity of Cinnamomum glanduliferum Leaf Oil Using Several In-vitro Assays. *Arch. Pharm. Sci. Ain Shams Univ.* **7**(1):200–207. doi: 10.21608/aps.2023.209218.1120.
2. Arellano-García, L. et al. (2023). Beneficial Effects of Viable and Heat-Inactivated Lactobacillus rhamnosus GG Administration on Oxidative Stress and Inflammation in Diet-Induced NAFLD in Rats. *Antioxidants (Basel)*. **12**(3):717. doi: 10.3390/antiox12030717.
3. Acito, M. et al. (2023). Effect of Cooking and Domestic Storage on the Antioxidant Activity of Lenticchia di Castelluccio di Norcia, an Italian PGI Lentil Landrace. *Int J Environ Res Public Health*. **20**(3):2585. doi: 10.3390/ijerph20032585.
4. Chiu, Y.J. et al. (2023). Investigating Therapeutic Effects of Indole Derivatives Targeting Inflammation and Oxidative Stress in Neurotoxin-Induced Cell and Mouse Models of Parkinson's Disease. *Int J Mol Sci*. **24**(3):2642. doi: 10.3390/ijms24032642.
5. Weng, Z.K. et al. (2023). Using ΔK280 TauRD Folding Reporter Cells to Screen TRKB Agonists as Alzheimer's Disease Treatment Strategy. *Biomolecules*. **13**(2):219. doi: 10.3390/biom13020219.
6. Yuasa, M. et al. (2022). Taste characteristics, volatile components, sensory properties, and antioxidant activity of fresh onion (*Allium cepa* L.) leaves. *Bull Natl Res Cent.* doi: 10.1186/s42269-022-00958-y.
7. Tedesco, E. et al. (2022). Prostatic Therapeutic Efficacy of LENILUTS®, a Novel Formulation with Multi-Active Principles. *Pharmaceutics*. **14**(9):1866. doi: 10.3390/pharmaceutics14091866.
8. Acito, M. et al. (2022). Fagiolina del Trasimeno, an Italian cowpea landrace: effect of different cooking techniques and domestic storage on chemical and biological features. *Int J Food Sci Technol*. doi: 10.1111/ijfs.15998.
9. Yang, Y. et al. (2022). Separation and identification of an abundant trigalloylglucose from special tea genetic resources. *Beverage Plant Research*. doi: 10.48130/BPR-2022-0011.
10. Suruga, K. et al. (2022). Medicinal Mushroom Mycelia: Characteristics, Benefits, and Utility in Soybean Fermentation. *IntechOpen*. doi: 10.5772/intechopen.102522.
11. Kassem, S. et al. (2022). In vivo study of dose-dependent antioxidant efficacy of functionalized core-shell yttrium oxide nanoparticles. *Naunyn Schmiedebergs Arch Pharmacol*. doi: 10.1007/s00210-022-02219-1.
12. von Weissenberg, E. et al. (2022). Copepod reproductive effort and oxidative status as responses to warming in the marine environment. *Ecol Evol*. **12**(2): e8594. doi: 10.1002/ece3.8594.
13. Knowles, S.L. et al. (2022). Color Protection from UV irradiation of artificial dyes with grape seed (*Vitis vinifera*) extract. *J Photochem Photobiol*. doi: 10.1016/j.jpap.2022.100113.
14. Sandilands, E.A. et al. (2022). Acetylcysteine has No Mechanistic Effect in Patients at Risk of Contrast-Induced Nephropathy - A Failure of Academic Clinical Science. *Clin Pharmacol Ther.* doi: 10.1002/cpt.2541.



15. Chung, H.K. et al. (2022). Antioxidant-Rich Dietary Intervention Improves Cardiometabolic Profiles and Arterial Stiffness in Elderly Koreans with Metabolic Syndrome. *Yonsei Med J.* **63**(1):26-33. doi: 10.3349/ymj.2022.63.1.26.
16. Tanaka, Y. et al. (2022). Hydrogen-rich bath with nano-sized bubbles improves antioxidant capacity based on oxygen radical absorbing and inflammation levels in human serum. *Med Gas Res.* **12**(3):91-99. doi: 10.4103/2045-9912.330692.
17. Koyama, R. et al. (2021). Enzymatic Activities and Gene Transcript Levels Associated with the Augmentation of Antioxidant Constituents during Drought Stress in Lettuce. *Horticulturae.* **7**(11):444. doi: 10.3390/horticulturae7110444.
18. Lehtiniemi, M. et al. (2021). Exposure to leachates from post-consumer plastic and recycled rubber causes stress responses and mortality in a copepod *Limnocalanus macrurus*. *Mar Pollut Bull.* **173**(Pt B):113103. doi: 10.1016/j.marpolbul.2021.113103.
19. Xiao, Li. et al. (2021). Ren Shen Yang Rong Tang and other traditional Chinese medicines exhibit antioxidant and anti-inflammatory capacities and suppress acetylcholinesterase activity in PC12 neuronal cells. *Longhua Chin Med.* **4**:13. doi: 10.21037/lcm-21-12.
20. Chen, L.G. et al. (2021). Hydrolysable Tannins Exhibit Acetylcholinesterase Inhibitory and Anti-Glycation Activities In Vitro and Learning and Memory Function Improvements in Scopolamine-Induced Amnesiac Mice. *Biomedicines.* **9**(8):1066. doi: 10.3390/biomedicines9081066.
21. Davis, S.L. et al. (2021). Protection of hair from damage induced by ultraviolet irradiation using tea (*Camellia sinensis*) extracts. *J Cosmet Dermatol.* doi: 10.1111/jocd.14387.
22. Ishihara, K. et al. (2021). Isolation of Balenine from Opah (*Lampris megalopsis*) Muscle and Comparison of Antioxidant and Iron-chelating Activities with Other Major Imidazole Dipeptides. *Food Chem.* doi: 10.1016/j.foodchem.2021.130343.
23. Rolnik, A. et al. (2021). Antioxidant and hemostatic properties of preparations from Asteraceae family and their chemical composition - Comparative studies. *Biomed Pharmacother.* **142**:111982. doi: 10.1016/j.biopha.2021.111982.
24. Xiao, L. et al. (2021). Hydrogen-Generating Silica Material Prevents UVA-ray-Induced Cellular Oxidative Stress, Cell Death, Collagen Loss and Melanogenesis in Human Cells and 3D Skin Equivalents. *Antioxidants (Basel).* **10**(1): E76. doi: 10.3390/antiox10010076.
25. Yuasa, M. et al. (2020). Antioxidant Activities and Taste Qualities of Fresh Onions Produced in Minamishimabara City, Nagasaki, Japan. *J Food Sci Technol.* doi: 10.3136/fstr.26.167.
26. Gómez-Zorita, S. et al. (2020). Comparative Effects of Pterostilbene and Its Parent Compound Resveratrol on Oxidative Stress and Inflammation in Steatohepatitis Induced by High-Fat High-Fructose Feeding. *Antioxidants (Basel).* **9**(11): E1042. doi: 10.3390/antiox9111042.
27. Yuasa, M. et al. (2020). Antioxidant and taste properties of fresh onion (*Allium cepa* L.) leaves. *J. Food Meas. Charact.* doi: 10.1007/s11694-020-00704-w.
28. Wake, H. et al. (2020). Histidine-rich glycoprotein possesses anti-oxidant activity through self-oxidation and inhibition of hydroxyl radical production via chelating divalent metal ions in Fenton's reaction. *Free Radic Res.* doi: 10.1080/10715762.2020.1825703.
29. Suruga, K. et al. (2020). Soybean fermentation with basidiomycetes (medicinal mushroom mycelia). *Chem. Biol. Technol. Agric.* **7**:23. doi: 10.1186/s40538-020-00189-1.
30. Cheng, H.S. et al. (2020). Pleiotropic ameliorative effects of ellagitannin geraniin against metabolic syndrome induced by high-fat diet in rats. *Nutrition.* doi: 10.1016/j.nut.2020.110973.

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