Current knowledge regarding the biochemical methods for assessing oxidative stress in human serum.

Delimaris I*

Center for Instruction, Research, and Technology (C.I.R.T), Metropolitan College, Athens, Greece

Abstract

This editorial summarizes the information available currently regarding the different biochemical techniques for assessing the level of oxidative stress in human serum. The methods include the determination of the concentration of Reactive Oxygen Species (ROS) (direct measurement), the antioxidant enzyme activity, and the concentration of antioxidant molecules (non-enzymatic antioxidants), the concentration of oxidative damage biomarkers, the Total Antioxidant Capacity (TAC), and Oxidative Stress Index (OSI). Each approach has advantages and disadvantages, and the optimal strategy may change based on the specific research question or biomedical application. Therefore, it is essential to carefully consider the benefits and weaknesses of each method before selecting the optimal one for identifying oxidative stress in human serum. Moreover, combining various methods can provide a more accurate assessment of the oxidative stress level in the human organism.

Keywords: Oxidative stress, Human serum, Oxidants, Antioxidants.

Introduction

Oxidative stress is defined as a disturbance in the balance between the production of reactive oxygen species (ROS) and antioxidant defences. This imbalance has been connected to numerous chronic illnesses, including cancer, cardiovascular disease, and neurological disorders, as it can cause cellular damage. Smoking, alcohol consumption, adequate or inappropriate diet, exercise, training or untrained condition, contribute to oxidative stress [1]. Thus, it is essential to determine oxidative stress accurately in human serum in order to comprehend the disease progression and create efficient treatment strategies. The different techniques for determining the level of oxidative stress in human serum will be covered in this editorial.

Biochemical methods for assessing oxidative stress in human serum

Direct measurement of the concentration of ROS is one approach to determine oxidative stress conditions in human serum. Several methods can be used, including fluorescence, Chemilumniscence, and electron spin resonance spectroscopy. These techniques make use of particular probes that react with ROS and generate a detectable signal. However, these methods have the disadvantage of not being able to distinguish between various ROS types, and they could also be impacted by other factors as sample preparation and storage conditions [2].

Also, the human body uses antioxidant enzymes like Glutathione Peroxidase (GPx), catalase, and Super Oxide Dismutase (SOD) to fight oxidative stress. As a result, assessing their levels of activity in human serum can yield important insights into the antioxidant defence mechanism. The rate at which these enzymes react with particular substrates can be measured using spectrophotometric or fluorometric assays. However, it should be mentioned that other factors like enzyme expression and inhibition can also affect the results, so enzyme activity may not always reflect the body's true antioxidant capacity [3].

In addition to enzymes, the body contains a number of non-enzymatic antioxidants, including uric acid, glutathione, and vitamins C and E. These compounds have the ability to directly scavenge ROS and shield cells from oxidative damage. As a result, determining their concentrations in human serum can act as a heuristic for oxidative stress. These molecules can be quantified in serum samples using methods like Enzyme-Linked Immunosorbent Assay (ELISA) or High-Performance Liquid Chromatography (HPLC) [4].

Moreover, several biomolecules in the body, such as lipids, proteins, and DNA, can be damaged by oxidative stress. Therefore, an indirect assessment of oxidative stress can be obtained by measuring the levels of oxidative damage products in human serum. As an example, colorimetric or HPLC-based assays can be used to measure the levels of lipid peroxidation products like malondialdehyde (MDA) and 4-hydroxynonenal (4-HNE). Comparably, 8-hydroxy-2'-deoxyguanosine (8-OHdG) and protein carbonyls are frequently used biomarkers for evaluating oxidative damage to DNA and proteins, respectively [5].

***Correspondence to:** Delimaris I, Center for Instruction, Research, and Technology (C.I.R.T), Metropolitan College, Athens, Greece, E-mail: dr.i.delimaris@gmail.com

***Received:** 24-Jan-2024, Manuscript No. AACPLM-24-126468; **Editor assigned:** 27-Jan-2024, PreQC No. AACPLM-24-126468(PQ); **Reviewed:** 10-Feb-2024, QC No. AACPLM-24-126468; Revised: 15-Feb-2024, Manuscript No. AACPLM-24-126468(R); Published: 22-Feb-2024, DOI:10.35841/aacplm-6.1.186*

***Citation:** Delimaris I. Current knowledge regarding the biochemical methods for assessing oxidative stress in human serum. J Clin Path Lab Med. 2024;6(1):186*

On the other hand, the determination of Total Antioxidant Capacity (TAC) is well established in human biochemical studies. TAC measures the total antioxidant content in the body, including both enzymatic and non-enzymatic biomolecules with antioxidant function. Consequently, quantifying TAC in human serum can offer a thorough evaluation of the whole antioxidant defence mechanism via colorimetric assays, which estimate a sample's capacity to scavenge a given concentration of ROS. Three commonly used measures of overall antioxidant capacity are the ORAC assay (Oxygen Radical Absorbance Capacity), the FRAP assay (Ferric Reducing Ability of Plasma), and the anti-oxidative activity assay. However, variables like sample preparation and storage conditions may also have an impact on TAC measurements [6].

Another important analytical method that is widely used in serum biochemistry is the determination of Oxidative Stress Index (OSI). The OSI measures the proportion (ratio) of oxidant molecules to antioxidant molecules in a particular human serum sample expressed as a percentage (%). It estimates how well the body is balancing its levels of oxidants and antioxidants. The theoretical advantage of using OSI is that it may provide a more reliable assessment of oxidative stress levels in human serum compared to quantitative assays of individual ROS or antioxidant molecules. The levels of ROS and TAC acquired from various tests can be used to calculate OSI. However, the interpretation of OSI results can be challenging because different studies have employed various biomarkers and computation techniques [7].

Conclusion

In conclusion, oxidative stress can be determined using a variety of analytical techniques in human serum. Every method has benefits and disadvantages, and the best approach may vary depending on the particular biomedical application or research question. Therefore, before deciding which approach is the best for estimating oxidative stress in human serum, it is crucial to carefully weigh the advantages and disadvantages of each method. Furthermore, combining different techniques can offer a more thorough estimation of the human body's state of oxidative stress.

References

1. Sharifi-Rad M, Anil Kumar NV, Zucca P, et al. Lifestyle, oxidative stress, and antioxidants: Back and forth in the pathophysiology of chronic diseases. Front physiol. 2020;11:694.
2. Hardy M, Zielonka J, Karoui H, et al. Detection and characterization of reactive oxygen and nitrogen species in biological systems by monitoring species-specific products. Antioxid Redox Signal. 2018;28(15):1416-32.
3. Cecerska-Heryc E, Krauze K, Szczesniak A, et al. Activity of erythrocyte antioxidant enzymes in healthy women depends on age, BMI, physical activity, and diet. J Health Popul Nutr. 2022;41(1):1-4.
4. Mironczuk-Chodakowska I, Witkowska AM, Zujko ME. Endogenous non-enzymatic antioxidants in the human body. Adv Med Sci. 2018;63(1):68-78.
5. Li J, Pan L, Pan W, et al. Recent progress of oxidative stress associated biomarker detection. Chem Com. 2023.
6. Brainina K, Stozhko N, Vidrevich M. Antioxidants: Terminology, methods, and future considerations. Antioxidants. 2019;8(8):297.
7. Sanchez-Rodríguez MA, Mendoza-Nunez VM. Oxidative stress indexes for diagnosis of health or disease in humans. Oxidative Med Cell Longev. 2019.

Citation: *Delimaris I. Current knowledge regarding the biochemical methods for assessing oxidative stress in human serum. J Clin Path Lab Med. 2024;6(1):186*