Sri Lakshmi Narayana Institute of Medical Sciences

Osudu, Puducherry-605502

Date:07/05/19

From
V.Senthil kumar
Professor and Head,
Dept.of physiology
SLIMS,
Bharath Institute of Higher Education and Research,
Chennai.

To
The Dean,
SLIMS
Bharath Institute of Higher Education and Research,
Chennai.

Sub: Permission to conduct value-added course: Certificate course in oxidative stress, antioxidants and its mechanism

Dear Sir,

With reference to the subject mentioned above, the department proposes to conduct a value-added course titled: Certificate course in oxidative stress, antioxidants and its mechanism on Sep 2019– Oct 2019. We solicit your kind permission for the same.

Kind Regards

DR.V.Senthil kumar

FOR THE USE OF DEANS OFFICE

Names of Committee members for evaluating the course:

The Dean: DR.Jeyalakshmi

The HOD: DR.V.Senthil kumar

The Expert: DR.S.Latha

The committee has discussed about the course and is approved.

Dean

DEAN
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE,
KOODAPAKKAM POST,
PUDUCHERRY - 605 502

S. Latha
Subject Expert

V.S.K
HOD

PROFESSOR & HOD
DEPARTMENT OF PHYSIOLOGY
Sri Lakshmi Narayana Institute Of Medical Sciences
PONDICHERRY - 605 502.

OFFICE OF THE DEAN

Sri Lakshmi Narayana Institute of Medical Sciences

OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST,
PUDUCHERRY - 605 502.
[Recognised by Medical Council of India, Ministry of Health letter No. U/12012/249/2005-ME (P -II) dt. 11/07/2011]
[Affiliated to Bharath University, Chennai - TN]

Circular

Date : 02/08/19

Sub: Organising Value-added Course: Certificate course in oxidative stress, antioxidants and its mechanism - **reg**

With reference to the above mentioned subject, it is to bring to your notice that **SLIMS, Bharath Institute of Higher Education and Research**, is organizing "oxidative stress, antioxidants and its mechanism ". The course content is enclosed below."

The application must reach the institution along with all the necessary documents as mentioned. The hard copy of the application should be sent to the institution by registered/ speed post only so as to reach on or before 15th Aug 2019. Applications received after the mentioned date shall not be entertained under any circumstances.

Dean

DEAN
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE,
KOODAPAKKAM POST,
PUDUCHERRY - 605 502

Encl: Copy of Course content and Registration form.

VALUE ADDED COURSE

1. Name of the programme & Code

Certificate course in oxidative stress, antioxidants and its mechanism, PHYC12

2. Duration & Period

30 hrs & Sep 2019– Oct 2019

3. Information Brochure and Course Content of Value Added Courses

Enclosed as Annexure- I

4. List of students enrolled

Enclosed as Annexure- II

5. Assessment procedures:

Descriptive questions- *Enclosed as Annexure- III*

6. Certificate model

Enclosed as Annexure- IV

7. No. of times offered during the same year:

1 Sep 2019– Oct 2019

8. Year of discontinuation: 2019

9. Summary report of each program year-wise

Value Added Course Aug 2019– Oct 2019					
Sl. No	**Course Code**	**Course Name**	**Resource Persons**	**Target Students**	**Strength & Year**
1	PHYC12	Certificate course in oxidative stress, antioxidants and its mechanism	Dr. S.Latha	1st MBBS	20 (Sep 2019– Oct 2019)

10. Course Feed Back

Enclosed as Annexure- V

S. Latha

RESOURCE PERSON

VSK

COORDINATOR

PROFESSOR & HOD
DEPARTMENT OF PHYSIOLOGY
Sri Lakshmi Narayana Institute Of Medical Sciences
PONDICHERRY - 605 502.

Annexure -I

COURSE PROPOSAL

Course Title: Certificate course in oxidative stress, antioxidants and its mechanism

Course Objective: The main objective of the course is to enable the students to understand the oxidative stress, antioxidants, types of antioxidants and mechanism of antioxidants.

Course Outcome: On successful completion of the course the students will acquire adequate knowledge on oxidative stress and its complications, antioxidants, types and mechanism of antioxidants.

Course Audience: Ist MBBS students

Course Coordinator: DR.V.Senthil kumar

Course Faculties with Qualification and Designation:

1. **DR.S.Latha, Ph.D, Assoc. Professor**
2. **DR.Premaraja, MD, Assistant professor**
3. **DR.B.Deivanayagame, MD, Assistant professor**

Course Curriculum/Topics with schedule (Min of 30 hours)

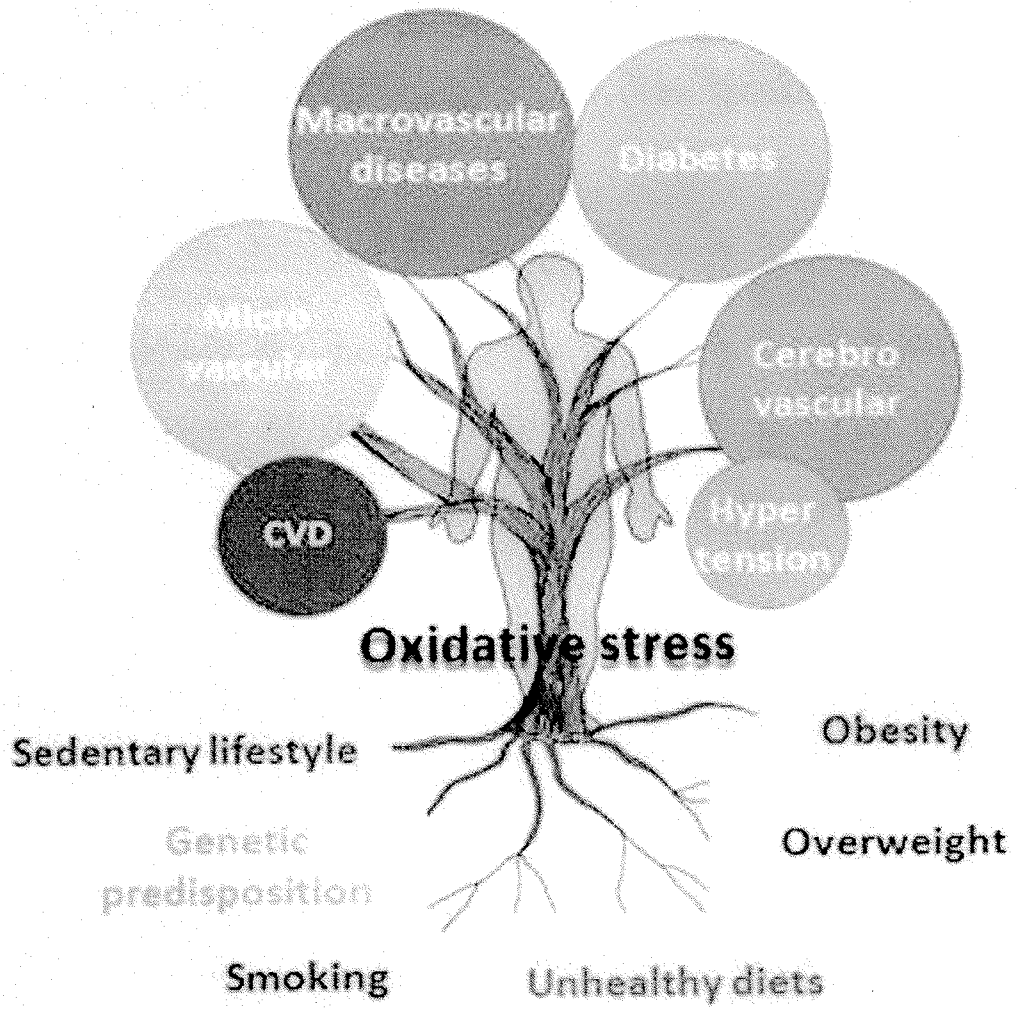
S. No	Date	Topic	Time	Hours
1.	07/09/19	Oxidative stress and Risk factors of oxidative stress	2-5pm	3
2	14/09/19	Free radicals- Formation, Adverse effects	2-5pm	3
3	21/09/19	Antioxidants and its classification	2-5pm	3
4	28/09/19	Food antioxidants and its mechanism	2-5pm	3

5	05/10/19	Antioxidants in our body	2-5pm	3
6	12/10/19	Structure and chemistry of antioxidants	2-5pm	3
7	15/10/19	Medicinal uses of antioxidants	4-7pm	3
8	17/10/19	Oxidative stress in diabetes mellitus	4-7pm	3
9	19/10/19	Managing and preventing oxidative stress	4-7pm	3
10	26/10/19	Assessment	2-5pm	3
			Total Hours	30

REFERENCE BOOKS:

Oxidative Stress-Molecular Mechanisms and Biological Effects-edited by Volodymyr
Oxidative Stress in Health and Disease-Michael Breiten bach and Peter Eckl

CERTIFICATE COURSE IN OXIDATIVE STRESS, ANTIOXIDANTS AND ITS MECHANISM



PARTICIPANT HAND BOOK

COURSE DETAILS

Particulars	Description
Course Title	Certificate course in oxidative stress, antioxidants and its mechanism
Course Code	PHYC12
Key Competencies	1. Oxidative stress and Risk factors of oxidative stress 2. Free radicals- Formation, Adverse effects 3. Antioxidants and its classification 4. Food antioxidants and its mechanism 5. Antioxidants in our body 6. Structure and chemistry of antioxidants 7. Medicinal uses of antioxidants 8. Oxidative stress in diabetes mellitus 9.Managing and preventing oxidative stress
objectives	On successful completion of the course the students will acquire adequate knowledge on management of oxidative stress and its complications
Target Student	1st MBBS Students
Duration	30hrs, Sep 2019– Oct 2019
Assessment Procedure	Descriptive questions-based assessment

Introduction:

The oxidative stress

The oxidative stress means imbalance between the oxidants especially the reactive oxygen and nitrogen species and the level of the antioxidants. Oxidative stress caused by reactive oxygen species (ROS) that formed in excess or insufficient removal plays important role in the damage of cellular DNA, proteins, lipids and late diabetic complications. the proteins, lipids and the DNA make the large part of the body, the damage leads to

1. Diabetes mellitus
2. Atherosclerosis or hardening of the vessel
3. Inflammatory conditions
4. High blood pressure
5. Heart diseases
6. Neurodegenerative diseases such as Parkinson's and
7. Cancer

Risk factors of oxidative stress:

1. ozone
2. certain pesticides and cleaners
3. cigratte smoking
4. radiation
5. pollution
6. a diet high in sugar, fat and alcohol

FREE RADICALS DAMAGE AND DISEASES

Free radicals contribute to many different diseases. Chemically, a substance is oxidized when electrons are removed and reduced when electrons are added. All chemical reactions involve the transfer of electrons. The body generates energy by gradually oxidizing its food in a controlled manner and storing it in the form of chemical potential energy called ATP (Adenosinetriphosphate). Free radicals are generated largely during the production of ATP in the mitochondria. During this process, radicals coming out from the mitochondria from reactive oxygen species such as superioxide anion ($O2^{-}$) and hydroxyl radicals (HO .) and other reactive oxygen species such as singlet oxygen (O2 1), destroy the body system especially the site where the free radicals is been generated. The ultraviolet light that penetrate the skin and the air pollutant that is high in smog which we inhale generates free radicals too. Food, like lipid in the presence of (Fe 3 , Fe 2) lead to the production of hydrogen peroxide from which further hydroxyl radicals are generated in a reaction that appear to depend on the presence of iron ions. The acceleration of hydroperoxide decomposition to form peroxyl radicals and alkoxyl radical.

$Fe^{3+} + ROOH \rightarrow Fe^{2+} + ROO^{\cdot} + H^{+}$ $Fe^{2+} + ROOH \rightarrow Fe^{3+} + RO^{\cdot} + OH^{-}$

Formations of alkyl free radicals by direct reaction with fats and oils.

$Fe^{3+} + RH \rightarrow Fe^{2+} + R^{\cdot} + H^{+}$

Activation of molecular oxygen for singlet oxygen formation

$Fe^{2+} + O_2 \rightarrow Fe^{3+} + O_2^{-}$

ANTIOXIDANTS :

Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals. Antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals might otherwise cause. Free radical damage may lead to cancer. Examples of antioxidants include beta-carotene, lycopene, vitamins C, E, A and other substances. An antioxidant is a molecule capable of slowing or preventing the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being oxidized themselves.. Plants and animals are the abundant source of naturally producing antioxidants. Alternately, antioxidants can also be synthesized by chemical process as well as from the different kinds of agro-related wastes using biological process. Based on their solubility, antioxidants are broadly categorized into two groups: water soluble and lipid soluble. In general, water-soluble antioxidants, such as ascorbic acid, glutathione, and uric acid, have functions in the cell cytosol and the blood plasma. Ascorbic acid is a redox catalyst which reduces and neutralizes the reactive oxygen species (ROS), glutathione has antioxidant properties as reducing agent and can be reversibly oxidized and reduced, while α-tocopherol, carotenoid, and ubiquinol are the examples of lipid-soluble antioxidants and protect the cell membranes from lipid peroxidation. Another commonly used classification is on the basis of their mechanism of action, i.e., primary or chain-breaking antioxidants and secondary or preventive antioxidants. Antioxidants can also act as prooxidants when these are not present at the right place at the right concentration at the right time. The relative importance of the antioxidant and prooxidant activities of an antioxidant is an area of current research. This chapter discusses the types, sources, synthesis, uses, and protective efficacy of various antioxidants.

CLASSIFICATION OF ANTIOXIDANTS

Antioxidants are grouped into two namely; Primary or natural antioxidants. Secondary or synthetic antioxidants.

Primary or natural antioxidants They are the chain breaking antioxidants which react with lipid radicals and convert them into more stable products. Antioxidants of this group are mainly phenolic in structures and include the following Antioxidants minerals - These are co factor of antioxidants enzymes. Their absence will definitely affect metabolism of many macromolecules such as carbohydrates. Examples include selenium,

copper, iron, zinc and manganese. Anti oxidants vitamins – It is needed for most body metabolic functions. They include-vitamin C , vitamin E, vitamin B. Phytochemicals - These are phenolic compounds that are neither vitamins nor minerals. These include: Flavonoids: These are phenolic compounds that give vegetables fruits, grains, seeds leaves, flowers and bark their colours. Catechins are the most active antioxidants in green and black tea and sesamol. Carotenoids are fat soluble colour in fruits and vegetables. Beta carotene, which is rich in carrot and converted to vitamin A when the body lacks enough of the vitamin. Lycopene, high in tomatoes and zeaxantin is high in spinach and other dark greens. Herbs and spices-source include Diterpene, rosmariquinone, thyme, nutmeg, clove, black pepper, ginger, garlic and curcumin and derivatives.

Secondary or synthetic antioxidants These are phenolic compounds that perform the function of capturing free radicals and stopping the chain reactions, the compound include : i. Butylated hydroxyl anisole (BHA). ii. Butylated hydroxyrotoluene (BHT). iii. Propyl gallate (PG) and metal chelating agent (EDTA). iv. Tertiary butyl hydroquinone (TBHQ). v. Nordihydro guaretic acid (NDGA). Ascorbic acid Ascorbic acid or "vitamin C" is a monosaccharide antioxidant found in both animals and plants. As one of the enzymes needed to make ascorbic acid has been lost by mutation during human evolution, it must be obtained from the diet and is a vitamin. Most other animals are able to produce this compound in their bodies and do not require it in their diets. In cells, it is maintained in its reduced form by reaction with glutathione, which can be catalyzed by protein disulfide isomerase and glutaredoxins. Ascorbic acid is a reducing agent and can reduce and thereby neutralize, reactive oxygen species such as hydrogen peroxide . Glutathione The free radical mechanism of lipid peroxidation: Glutathione is a cysteine-containing peptide found in most forms of aerobic life. It is not required in the diet and is instead synthesized in cells from its constituent amino acids. Glutathione has antioxidant properties since the thiol group in its cysteine moiety is a reducing agent and can be reversibly oxidized and reduced. In cells, glutathione is maintained in the reduced form by the enzyme glutathione reductase and in turn reduces other metabolites and enzyme systems, such as ascorbate in the glutathione-ascorbate cycle, glutathione peroxidases and glutaredoxins, as well as reacting directly with oxidants. Due to its high concentration and its central role in maintaining the cell's redox state, glutathione is one of the most important cellular antioxidants. In some organisms glutathione is replaced by other thiols, such as mycothiol in the Actinomycetes, or by trypanothione in the Kinetoplastids . Melatonin Melatonin is a powerful antioxidant that can easily cross cell membranes and the blood-brain barrier. Unlike other antioxidants, melatonin does not undergo redox cycling, which is the ability of a molecule to undergo repeated reduction and oxidation. Redox cycling may allow other antioxidants (such as vitamin C) to act as pro-oxidants and promote free radical formation. Melatonin, once oxidized, cannot be reduced to its former state because it forms several stable end-products upon reacting with free radicals. Therefore, it has been referred to as a terminal (or suicidal) antioxidant Tocopherols and tocotrienols (vitamin E) Vitamin E is the collective name for a set of eight related tocopherols and tocotrienols, which are fat-soluble vitamins with antioxidant properties. Of these, - tocopherol (Figure 1) has been most

studied as it has the highest bioavailability, with the body preferentially absorbing and metabolizing this form . It has been claimed that the -tocopherol form is the most important lipid-soluble antioxidant and that it protects membranes from oxidation by reacting with lipid radicals produced in the lipid peroxidation chain reaction. This removes the free radical intermediates and prevents the propagation reaction from continuing. This reaction produces oxidized -tocopheroxyl radicals that can be recycled back to the active reduced form through reduction by other antioxidants, such as ascorbate, retinol. This is in line with findings showing that -tocopherol, but not water-soluble antioxidants, efficiently protects glutathione peroxidase (GPX4)-deficient cells from cell death. GPX4 is the only known enzyme that efficiently reduces lipid-hydro peroxides within biological membranes

FOOD ANTIOXIDANTS AND REACTION MECHANISMS

Food antioxidants include substances that keep edible fats and oils from becoming rancid and prevent fruit and vegetables from turning brown. Examples include butylated hydroxyanisole (BHA) and butylated hydrogenoxytoluene (BHT) , ascorbic acid (Vit.C), -tocophenol (Vit. E) (Figure 1). Hence, vitamins containing aromatic ring which reacts and destroys the most reactive forms of oxygen radicals, protecting the most unsaturated fatty acids from oxidation and preventing oxidative damage to the membrane . It is very stable even when it loses its H + from OH - group to the free radicals in PUFA and hence become oxidized. The antioxidant activity of flavonoid has been received by many scientists. They concluded that food possesses the potential to scavenge and quench various reactive oxygen species (ROS). This antioxidant reacts with lipid (fats and oil) and prevents lipid peroxidation that usually occurs in fatty foods at the initial stage by free radical scavengers. The chain breaking antioxidant action of flavonoid (FL-OH) can be represented as shown below: $LOO^{\cdot}$ + FL - OH LOOH + FL - $O^{\cdot}$ Flavonoid phenonyl radical Termination of lipid radical ($L^{\cdot}$), lipid peroxy radical ($LOO^{\cdot}$) and alkoxyl radicals ($RO^{\cdot}$) formed by re-initiation of lipid peroxidation induced by metal ions by flavonoids is shown below: $LOO^{\cdot}/L^{\cdot}/LO^{\cdot}$ + FL – OH LOOH/LH/LOH = FL - $O^{\cdot}$ Flavonoid protects the memberane phospholipids PUFA by donating the hydrogen atom (H) to quench lipid peroxyl radicals generated as s result of hydroxyl radical attack on the unsaturated carbon chain of PUFA (poly unsaturated fatty acids).

ANTIOXIDANTS SYSTEM IN OUR BODY

The body has developed several endogenous antioxidant systems to deal with the production of ROI. These systems can be divided into enzymatic and nonenzymatic groups. The enzymatic antioxidants include superoxide dismutase (SOD), which catalyses the conversion of O2˙O to H2O2 and H2O; Catalyse, which then conver H2O and O2; and glutathione peroxidase, which reduces H2O2 to H2O. The non-enzymatic antioxidants include the lipidsoluble vitamins, vitamin E and vitamin A or provitamin A (beta-carotene) and the water-soluble vitamin C. Vitamin E has been described as the major chain-breaking antioxidant in humans. It is located within the membranes, where it interrupts lipid peroxidation and may play a role in modulating intracellular signaling pathways that rely on ROI. Vitamin E can also directly quench. The present study

assessed the antioxidant properties of -tocopherol, -tocotrienol, which contained 45% tocopherols and 55% tocotrienols. When Vitamin E-deficient rats were fed either -tocopherol- or -tocotrienol-enrich diets, -tocotrienol accumulated in the hearts and liver more slowly than -tocopherol. The rate of lipid peroxidation induced in vitro in heart homogenate from rats supplemented with -tocotrienol was approximately two-thirds as high as that of -tocopherol. Thus palm oil vitamin E may be more efficient than –tocopherol alone in protecting the heart against injury from ischaemia and reperfusion. In addition, supplementation with –tocopherol or -tocotrienol protects skeletal muscles against exercise induced increases in protein oxidation thus palm oil vitamin E protects against biological systems against both lipid and protein oxidation. The pathogenesis of many diseases can involve free radical-medicated lipid peroxidation in biological membranes. Vitamin E is the major chain- breaking antioxidant in membrane; although it is present in extremely low concentration, it is very efficient in inhibiting the development of conditions such as heart disease, cancer, cataracts, neuropathies and myopathies and other related diseases. The consumption of berries has been implicated with diverse health benefits such as prevention of stroke, of age-related degenerative diseases and cancer. Some berry constituents have cancer suppressive effects in these were attributed to certain berry phytochemicals with high antioxidative potentials that could contribute to, or enhance by induction, the endogenous antioxidant properties of living cells or organisms.

THE CHEMISTRY OF ANTIOXIDANTS

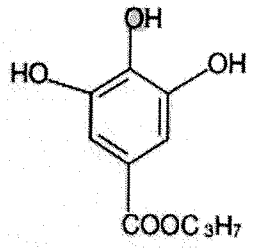
It involves the mechanism of action of antioxidant. Two principle mechanisms of action have been proposed for antioxidants. The first is a chain-breaking mechanism by which the primary antioxidants donate electrons to the free radicals present in the system, example lipid radicals. The second mechanism involves removal of ROS (reactive oxygen species) and RNS (reactive nitrogen species) initiator by quenching chain initiator catalyst.

Chain reactions of free radicals Initiation stage (1) RH R˙+ H˙ (2) R˙ R˙ + O2 ROO˙ (3) 2ROOH ROO˙ + RO˙ + H2O

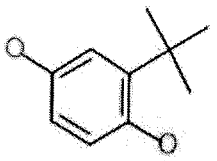
Propagation stage (1) R˙ + O2 ROO˙ (2) ROO˙ + RH ROOH + R˙ (3) RO˙ + RH ROH + R˙

Termination stage (1) R˙ + R˙ R – R (2) R˙ + ROO˙ ROOR (3) ROO˙ + ROO˙ ROOR + O2 (4) Antioxidants + O2 oxidized antioxidants

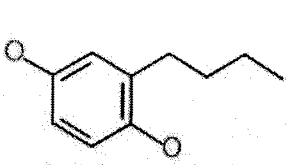
STRUCTURES OF ANTI OXIDANTS:



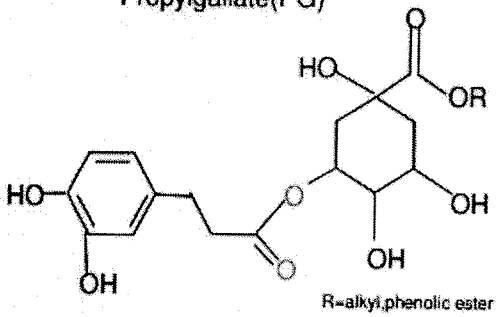
Propylgallate(PG)



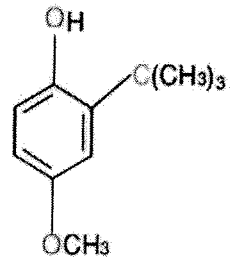
t-butylhydroquinone



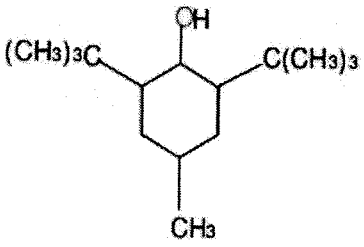
butylhydroquinone



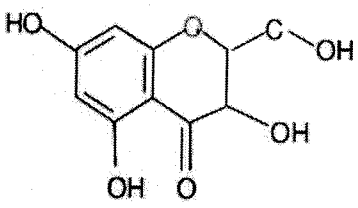
Phenolic acid and ester



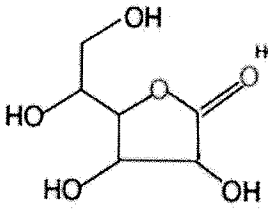
Phenolic acid



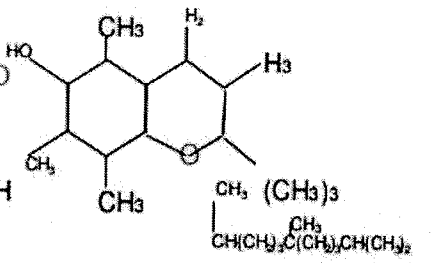
Butylated hydroxytoluene(BHT



Flavonoids



Ascorbate



α-tocopherol(Vit. E)

THE MEDICINAL EFFICACY OF ANTIOXIDANTS

Some tumour cells can actually use antioxidants to protect themselves from natural cellular defense mechanisms, enabling them to survive and proliferate. The study provides insight into altered metabolism of tumour forming cells and could help improve current treatments. Joan brugge and her group from Harvard Medical School in Boston, US were investigating changes in breast cancer cells that allow them to survive without being attached to the normal extracellular matrix. They found that treating cells with vitamin E like antioxidants blocked the usual programmed cell death cycles, allowing the cells to survive free from their usual scaffolding by switching their metabolism to use fatty acids rather than glucose as fuel. Normal cells need to be attached to a matrix to function properly and even survive. They went further that as a potential tumour cells start to proliferate rapidly and they quickly run of space to stay attached to the matrix, so have to find ways to dodge the normal mechanisms by which detached cells programme to die. One of the most common mechanism of cell death is apoptosis (a kind of programmed cell suicide), but the team found that when they blocked the apoptosis pathways, the detached cells still died, which hinted at a major change in the metabolism of cells. They found that there was several reduction in ATP [adenosine triphosphate] in cells within 24 h of attachment. Cell use ATP as an energy source, so it seemed that part of the reason detached cells is metabolism of glucose and the teams found that detached cell lose the ability to transport glucose through their cell membranes. 'We found that expressing a cancer-causing gene called ErbB2, which is altered in many human tumor, allows the cells to transport glucose even when they are not attached'(Rietveld and Wiseman, 2003). Glucose is not just used for energy

generation; it is also the source of natural cellular antioxidants. When they looked at detached cells, they found raised levels of highly oxidising reactive oxygen species, which they reasoned could be a second line of defence against tumour generation in detached cells. 'We were curious what would happen if we neutralised the reactive oxygen species [without using ErbB2 to restore glucose transport], and that is when we got this really surprising result.' The researchers checked to see if the antioxidants were also promoting glucose uptake, but they were not, so the team reasoned that the cells must be getting energy from another source. 'Other labs have shown that matrix-attached cells can use fatty acid oxidation as a source of energy when they are deprived of glucose. That suggested that perhaps the detached cells were not able to exploit that pathway because the

Diabetes mellitus and oxidative stress

The enzymatic and non enzymatic antioxidants protect our body cells from oxidative stress. In the case of any pathological conditions that cause excess formation of free radicals, the level of the both enzymatic and non enzymatic antioxidants has been altered. Hence the level of the antioxidants in the body provide useful index of the oxidative stress.

The impaired metabolic events and sustained hyperglycemia in the diabetes mellitus are the main cause of oxidative stress. It is believed that the negative regulation on insulin signaling and interpretation caused by ROS and RNS will be the main reason to develop insulin resistance in Type II diabetes mellitus The evidences showed that the decreased insulin level in diabetic rats increases the activity of the enzymes like fatty acyl coenzyme A which initiates auto oxidation of fatty acids and generate oxygen free radical. and lipid peroxidation. The increased lipid level in the diabetes mellitus also causes the cells more susceptible to lipid peroxidation. This affects the membrane function by altering the membrane fluidity and changing the activity of membrane bound enzymes. The enzymatic and non enzymatic antioxidants which includes, SOD, CAT GPx, GST, GSH, Vitamin C and Vitamin E are fight against. ROS. The suproxide dismutase catalyses the suproxide ions into molecular oxygen and peroxide and play first line of defence in the free radical mediated cell injury.26 The catalase which acts on hydrogen peroxide and converted into water and oxygen thus neutralizes it. The vitamins C and E are act as antioxidants by detoxifying the free radicals and these vitamins levels were altered in oxidative stress. The enzymes Glutathione Peroxidase and Glutathione Reductase present in the cell metabolizes peroxide to water. The alterations in these enzymatic and non enzymatic antioxidant level in the diabetes mellitus are the important biomarkers of oxidative stress.

Managing and preventing oxidative stress:

It is impossible to completely eliminate the oxidative stress and free radical exposure but we can minimize the effects by increasing the antioxidant level in our body. eating fruits and vegetables increases the anti oxidant levels

Fruits and vegetables:

Berries

Cherries

Citrus fruits

Broccoli,

green leafy vegetables

carrot

olive

other antioxidants:

fish and nuts

vitamin E

vitamin C

turmeric

green tea

onion

garlic

cinnamon

life style choices that prevent oxidative stress

regular moderate exercise

avoid smoking

avoid over eating

use of sunscreen

decrease alcohol intake

get plenty of sleep

Assessment Procedure

Descriptive questions-based assessment after successful completion of theory sessions

Bharath Institute of Higher Education and Research

Annexure -II

SLIMS Participant list of Value-added course: Certificate course in oxidative stress, antioxidants and its mechanism

Sep 2019– Oct 2019

Sl.No	Reg.No	Name of the candidate	Signature
1	U19MB311	KARTHIKA M	
2	U19MB312	KAVYA RADHAKRISHNAN	
3	U19MB313	KEERTHANA S	
4	U19MB314	KENDRE LAXMIKANT BALAJI	
5	U19MB315	KIRAN S	
6	U19MB316	KIRUTHI NITHIN N	
7	U19MB317	KUMAVAT AKSHADA SHRIKRISHNA	
8	U19MB318	LASYA S M	
9	U19MB319	LOKESH R	
10	U19MB320	MADHUMITHA S	
11	U19MB321	MALAVIKA NAIR	
12	U19MB322	MALAY KUMAR BEHERA	
13	U19MB323	MANISHA R	
14	U19MB324	MANOJ BALA B	
15	U19MB325	MARIA VENNILA A	
16	U19MB326	MATLI KAREEM KHAN	
17	U19MB327	MINU VASANTHINI P S	
18	U19MB328	MOHAMED MUZZAMIL T	
19	U19MB329	MOHAN PRASATH L	
20	U19MB330	MONICA K	

SRI LAKSHMI NARAYANA INSTITUE OF HIGHER EDUCATON AND RESEARCH

Annexure -III

Certificate course in Certificate course in oxidative stress, antioxidants and its mechanism

DESCRIPTIVE QUESTIONS

Course Code: PHYC12

ANSWER ALL THE QUESTIONS **10x5=50**

1. Define oxidative stress
2. What are the risk factors of oxidative stress
3. write a note on antioxidants
4. Write the classification of antioxidants
5. Whart are the food antioxidants
6. Draw the structure of flavonoids, BHT and ascorbic acid
7. Suggest the life style modifications that prevent oxidative stress
8. Mention the method of managing and preventing oxidative stress
9. Give a note on diabetes mellitus and oxidative stress
10. Give the medicinal uses of antioxidants

Annexure -V

Course/Training Feedback Form

Course: Certificate course in oxidative stress, antioxidants and its mechanism

Date: Sep 2019– Oct 2019
Name: MANISHA R
Reg NO. U19MB323
Department: Physiology

Q 1: Please rate your overall satisfaction with the format of the course:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 2: Please rate course notes:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 3: The lecture sequence was well planned

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 4: The lectures were clear and easy to understand

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 5: Please rate the quality of pre-course administration and information:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 6: Any other suggestions:

Comments:

Thank you for taking the time to complete this survey, your comments are much appreciated.

***OPTIONAL Section*:** Name _____
Signature Manisha R Date _____

Date:29-10-19

From
DR.V.Senthil kumar
Dept.of physiology
SLIMS
Bharath Institute of Higher Education and Research,
Chennai.

Through Proper Channel

To
The Dean,
SLIMS
Bharath Institute of Higher Education and Research,
Chennai.

Sub: Completion of value-added course: Certificate course in oxidative stress, antioxidants and its mechanism

Dear Sir,

With reference to the subject mentioned above, the department has conducted the value-added course titled: Certificate course in Oxidative stress-a secondary complication to diabetes mellitus on Sep 2019– Oct 2019. We solicit your kind action to send certificates for the participants, that is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.

Kind Regards

VSlc

DR.V.Senthil kumar

PROFESSOR & HOD
DEPARTMENT OF PHYSIOLOGY
Sri Lakshmi Narayana Institute Of Medical Sciences
PONDICHERRY - 605 502

Encl: Certificates

Photographs

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that MANISHA. R has actively participated in the Value Added Course on Certificate course in oxidative stress, antioxidants and its mechanism held during Sep 2019– Oct 2019 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

S. Latha

Dr. S.Latha

RESOURCE PERSON

Dr. V.Senthil kumar

COORDINATOR

COURSE: CERTIFICATE COURSE IN OXIDATIVE STRESS, ANTIOXIDANTS AND ITS MECHANISM

CODE: PHYC12

D. NO.	

FOR OFFICE USE ONLY

Total Number of pages written including additional sheets

BHARATH UNIVERSITY

(Declared under Section 3 of the UGC Act 1956)

CHENNAI - 600 073

MAIN ANSWER BOOK

NAME OF THE EXAMINATION : Value added Courses

SUBJECT OF THE EXAMINATION : VAC - Physiology

SECTION (Circle) : PHYC12

DATE OF THE EXAMINATION : 26/10/19

QUESTION NUMBERS / MARKS

Section						Sub Total
A	1	2				
B	a	b	c	d	e	
	4	3	4	4	4	20
	f	g	h	i	j	
	5	3	4	4	1	18
C	a	b	c	d	e	
	f	g	h	i	j	
					TOTAL	38

77/100

Total Marks in words ..... SEVENTY SEVEN .....

OFFICE USE

BUNDLE No.

Signature of the Examiner .....

CANDIDATES TO FILL THIS COLUMN CAREFULLY

REG NO.	V19MB323

FOR OFFICE USE ONLY

D. NO.	

PAGE No.

oxidative Stress

The oxidative stress means imbalance between the oxidants especially the reactive oxygen and nitrogen species and the level of antioxidants. oxidative stress caused by reactive oxygen species that formed in excess or insufficient removal plays important role in damage of cellular DNA, proteins lipids and diabetic complication The protein, lipids and DNA make the large part of the body. the damage leads to

1) Diabetes mellitus
2) Atherosclerosis
3) Inflammatory condition
4) High blood pressure
5) Heart disease

PAGE No.

6) Neurodegenerative diseases such as Parkinson's and

7) Cancer.

2) Risk factors of oxidative stress

→ Ozone
→ pesticids and cleaners
→ cigratte smoking
→ Radiation
→ pollution
→ a diet high in sugar, fat and alcohol.

Ozone:

Ozone is composed of O_3 molecules. protect the human from the harmful UV radiations. many pollutions such as air pollution caused due to the excess usage of the refrigerator

that releases the gas chlorofluoro carbon (CSF) that damages the oxone causes splitting of O_3 into O_2 and O, the O is the O_2 free radical that causes oxidative stress and cancer.

Radiation:

Certain radiations like uv rays than damages the oxone and releases the O_2 free radicals.

3) Antioxidants:

Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals.

The antioxidants includes β carotene, lycopene, vit C and E and other substances

PAGE No.

Antioxidants terminate free radical formation reaction and inhibit further oxidation reaction.

plants and animals are the abundant source of naturally producing antioxidants.

There are two types of antioxidants.

(1) water soluble:

ascorbic acid, glutathione and uric acid

ascorbic acid is a redox catalyst which reduces and neutralizes the reactive oxygen species (ROS)

Glutathione has antioxidant propertie as reducing agent and can be reversibly oxidised and reduced.

2) lipid soluble antioxidants.

α tocopherol, carotenoid and ubiquinol

4) Classification of Antioxidants.

→ primary or Natural antioxidants

→ Secondary or synthetic antioxidants

Primary antioxidants

They are the chain breaking antioxidants which react with lipid radicals and convert them into stable products. Antioxidants of this group are mainly phenolic in structures that include the following.

eg: selenium, copper, iron, zinc and manganese and antioxidant- vitamins (vit C, E and vitamin B). Phytochemicals — Flavonoids These are phenolic compounds that give vegetables, fruits, grains, seeds leaves flower and bark. Catechin are the most active antioxidants in green and black tea.

PAGE No.

Secondary or synthetic antioxidants:

These are phenolic compounds that perform the function of capturing free radicals and stopping the chain reactions.

eg: Butylated hydroxy anisole (BH)

Butylated hydroxy toluene (BHT), propyl galla and metal chelating agent (EDTA)

Ascorbic acid is a monosaccharide antioxidant found in both animals and plants

Ascorbic acid is a reducing agent that reduce and neutralize reactive oxygen species such as hydrogen peroxide.

Melatonin is a powerful antioxidant that can easily cross cell membrane and the blood brain barrier.

Food antioxidants

Food antioxidants include substances that keep edible fats and oils from becoming rancid and prevent fruit and vegetables from turning brown.

eg: butylated hydroxy anisole (BHA) Butylated hydroxytoluene (BHT), ascorbic acid

The antioxidant activity of flavonoid has been received by many scientists. They concluded that food possess the potential to scavenge and quench various reactive oxygen species. The antioxidant reacts with lipids and prevent lipid peroxidation that usually occurs in fatty food at the initial stage by free radical scavengers. The chain breaking antioxidant action of flavonoid can be represented as shown below

$$COO^{\cdot} + FL\text{-}OH \longrightarrow COOH + FL\text{-}O^{\cdot}$$

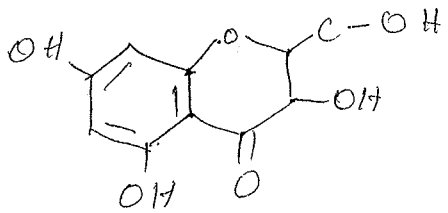
PAGE No.

Flavonoid phenonyl. radical Termination of lipid radical, lipid perexy radical (LOO·) and alkoxyl radical (RO·) formed by re initiation of lipid peroxidation induced by metal ions by flavoid.

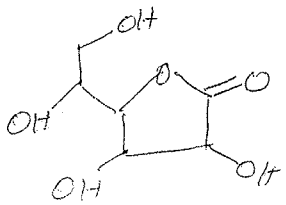
Flavonoid protects membrane phospho lepids PUFA by donating the hydrogen ion to quench lipid peroxy radical generated as a result of hydroxyl radic

b. Str. of flavonoids, BHT and ascorbate.

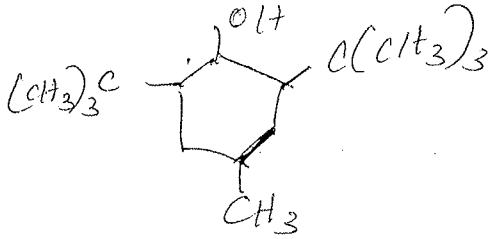
Flavonoids



Ascorbate



BHT



7. life style modification to prevent oxidative stress

The life style modifications that prevent oxidative stress are

→ regular moderate exercise
→ avoidance of smoking
→ avoidance of over eating
→ usage of sunscreen
→ Decrease alcohol intake
→ plenty of sleep

→ The regular moderate exercise is necessary to decrease the oxidative stress because it increase the breathing rate and heart rate. The feed heart rate increases the blood flow.

→ usage of sunscreen prevents the effect of uv radiation and

PAGE No.

Prevent- oxidative stress

→ increasing the duration of sleep decreases the oxidative stress and reduce free radical formation

8. Method of Managing and preventing oxida. stress.

Complete elimination of oxidative stress is not possible. We can minimize the effects by increasing the antioxidants level.

Many fruits and vegetables also contain many antioxidants that plays important role in managing and prevention of oxidative stress.

The fruits and vegetables that are rich in antioxidants are

→ Berries
→ cherries
→ citrus fruits
→ Broccoli

→ green leafy vegetables
→ carrot
→ olive.

The other antioxidants present in

→ fish and nuts
→ vitamin E and C

→ Turmeric
→ green tea
→ onion
→ garlic
→ cinnamon

9. Diabetes Mellitus and oxidative stress

The enzymatic and non enzymatic antioxidants protect our body cells from oxidative stress. In case of any pathological condition the level of antioxidants has been altered. Hence the level of antioxidants provide useful index of the oxidative stress.

The impaired metabolic events and sustained hyperglycemia in the diabetes Mellitus are the main cause of the oxidative stress. It is beleived that negative regulation on insulin signalling and interpretable caused by ROS and RNS will be main reason to develop insulin resistan in Type II diabetes Mellitus. Decreased insulin level in diabetes increases the activity of enzymes like fatty acyl coenzyme A which initiates auto oxidation of fatty acids and generate oxygen free radicals and lipid peroxida tion this affects the membrane function by altering the membrane fluidity and changing the activity of membrane bound enzyme.

10. Medicinal uses of Antioxidants:

→ Some tumour cells can actually use antioxidants to protect themselves from natural cellular defense mechanisms enabling them to survive and proliferate