Nigerian Journal of Health Promotion Vol. 4 , 2011

STRESS TESTING: AN INTERVENTION STRATEGY IN EXERCISE PHYSIOLOGY AND CARDIAC REHABILITATION

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Abstract

Exercise, a common physiological stress, can lead to an abnormal cardiac response not present at rest. It is used to determine the efficiency of cardiovascular function. "Two types of exercise or physical activity can be applied as a stress to the cardiovascular system: isometric or isotonic. Isotonic exercise is preferred for testing because it puts a volume stress rather than a pressure on the heart and it can be graduated. Exercise physiology concerns itself with the improvement of functional capabilities directed to the enhancement of health and physical fitness for the general population and towards optimizing performance in the various types and level of games. Cardiac rehabilitation practice allows for exercise appropriately prescribed and supervised by qualified professionals for patients with cardiovascular disease. Well-trained specialists from the multiple disciplines of medical science contribute greatly to the safety of the programme. In conclusion the paper recommended that for the Nation to reduce the rising wave of hypertension and related cardiac diseases exercise physiology practice should be incorporated into our health care system.

Key word: Exercise, Stress, Testing, Cardiovascular Disease

Introduction

Exercise, a key element in the rehabilitative process, can produce improved musculoskeletal fitness, multiple training adaptations, and salutary changes (Oberman, 1988). Froelicher, Hartley, Haskell and Pollock (1990) stated that exercise is not only one of many stresses to which human can be exposed; therefore, it is more appropriate to call it an "exercise" test, and not a "stress test", as it is popularly known worldwide.

Brooks, Fahey, White and Baldwin (2000) suggested that the exercise training programme should be based on an exercise test that includes measurement of heart rate (HR), blood pressure (BP), rate-pressure product (RPP), also known as Myocardial oxygen uptake (MO_2), and ideally, oxygen consumption (during graded exercise). Patients should be evaluated for ischaemia, arrhythmias, and adequate blood flow to the extremities. Exercise testing should be conducted only by well-trained personnel with a basic knowledge of exercise physiology.

Exercise physiology is a subdivision of general physiology that is concerned with the description and explanation of the functional changes brought on by single or repeated bouts of exercise, with the objective of improving human functional capacities (Igbanugo, 2001). Exercise physiology and physical fitness are related because improvement in physical fitness can be optimally achieved only through application of sound principles of exercise physiology.

Cardiac rehabilitation is a clinical professional area that focuses on assessment of cardiovascular function, determination of effect of exercise programmes in preventing cardiovascular diseases and rehabilitation of individual suffering from cardiovascular disease (Okuneye, 2004). Cardiac rehabilitation should allow patients to attain the best possible physical, mental, and social conditions so that they may lead active and productive lives in the community.

The Concept of Exercise Testing and Prescription

Exercise testing uses the stimulus-response method of inquiry (Brooks, Fahey, White and Baldwin, 2000). A standard exercise stimulus is applied and the response is measured against recognized standards that are themselves based on typical reactions to the exercise stress.

The America College of Sports Medicine (ACSM) [1998] views the benefits of increasing amounts and intensity of exercise as points along a continuum. People get significant benefits from doing low levels of physical activity. They receive additional benefit when they exercise more intensely or more frequently.

Brooks, Fahey, White and Baldwin, (2000) observe that effective exercise prescription (programme design and recommendation) depends on knowledge of the maximum capacity. Many laboratory and field tests have been devised to measure physical fitness. They may be conducted at places such as a running track, a treadmill, bicycle ergometer, stepping bench, arm ergometer, or swimming flume. Fitness tests vary in their safety, accuracy, and specificity.

The ACSM (1995) recommends that males 40 years and older and females 50 years and older, or any person with significant health problems, should get a medical examination and a maximal treadmill test before beginning a vigorous exercise programme, people with significant health problems include those with two or more of the major risk factors of coronary heart disease (CHD). The table following lists symptoms suggestive of cardio-pulmonary or metabolic diseases that could make exercise dangerous.

The examination should include the medical history and appropriate procedures (blood chemistry, blood pressure, resting electrocardiogram, and so on) to identify such conditions. People of any age who experience any unusual symptoms, such as chest pain, viral infections, irregular heartbeats, and shortness of breathe, or severe pain in muscles, joints, or skeleton, should consult a physician before continuing with an exercise programme (Brooks, Fahey, White and Baldwin, 2000).

The American College of Cardiology and the America Heart Association – ACC/ AHA (2004) noted that exercise testing after ST-Elevation Myocardial infarction (STEMI) may be performed to;

i. assess functional capacity and the patients ability to perform tasks at home and at work;
ii. establish exercise parameters for cardiac rehabilitation;
iii. evaluate the efficiency of the patients current medical regimen;

iv. risk-stratify the post-STEMI patient according to the likelihood of a subsequent cardiac event. (Theroux, Waters and Halphen, 1979; DeBusk, Kraemer and Nash 1983; Krone, Gillespie and Weld 1985, Valentine; Frew and Mashford 1974, Ross; Gilpin and Madsen, 1989)..

v. evaluate chest pain symptoms after STEMI; and

vi. provide reassurance to patients regarding their functional capacity after STEMI as a guide to returning to work.

For most people, exercise training will be safe and enjoyable. However, for those medical conditions, exercise may be dangerous. Medical conditions that significantly limit the body's ability to adapt to physiological challenges make exercise dangerous. Although exercise training is beneficial for most people, it is not for everyone.

Table 1: Major symptoms or signs suggestive of cardiopulmonary or metabolic disease

Pain or discomfort in your chest (pain may radiate to surrounding areas, such as the neck or arms)
Unaccustomed shortness of breath or shortness of breath with mild exercise fainting
Dizziness or fainting
Distressed breathing while lying in bed at night; swelling in the ankles
Skipped or racing heartbeats.
Leg pains that increase in severity with increased exercise intensity.
Known heart murmur

Source: Adapted from Brooks GA, Fahey TD, White TP, Baldwin KM: Exercise physiology: Human Bioenergetics and its Applications, ed 3 Boston McGraw Hill Higher Educ, 2000, P. 641

Testing strategies in Exercise physiology

Okuneye and Danladi (2004) opine that exercise physiology is the study of the effects of exercise on the body. It is concerned with the body's adaptations to exercise, ranging from the subcellular level to the systematic level. From an applied perspective, exercise physiology divides into two areas of study; the enhancement of health and fitness, and prevention of debilitating diseases and the improvement of motor performance, most typical in sport. It is also considered as a disciplinary field of study that provides the main focus for academic programmes in exercise science.

The two areas of study that have dominated exercise physiology are:

i. how oxygen is utilized in the cardiovascular system based on the knowledge that oxygen utilization largely determine performance in exercise that last longer than 1 minute; and

ii. what metabolic responses to exercise and training which focuses on assessing the balance between aerobic and anaerobic metabolism under a variety of exercise conditions.

Physiologists, cardiologists, and other members of the medical profession have accepted the concept of physical work capacity (PWC) or Test of functional capacity as an indication of a person's level of physical fitness. Functional capacity tests can be subdivided into laboratory and field tests. It is measured by a technique that determines maximum oxygen uptake (VO_2 max).

Verducci (1980) defined VO_2 max as the highest oxygen consumption the individual can attain during physical work or exercise while breathing air at sea level. It can be predicted from submaximal HR tests and, to a lesser degree, from distance running tests.

The advantages of submaximal tests are that they are physically less demanding on the subjects, take less time, and may be safer, maximal tests are more accurate, provide a better physiological profit of the subject, and can produce diagnostic changes in the electrocardiogram that may be missed during submaximal tests.

In laboratory tests, VO_2 max is measured while subjects exercise on devices such as a treadmill, bicycle ergometer, arm ergometer, or swimming flume. Field tests

estimate VO_2 max from established formula based on performance in running, bench stepping, cycling, or swimming.

There are several protocols used in estimating VO_2 max from maximal and submaximal tests. VO_2 max represents the amount of oxygen transported and used in cellular metabolism. It is convenient to express oxygen uptake in sitting, resting requirements.

The metabolic equivalent (MET) is a unit of sitting, resting oxygen uptake (3.5ml O_2 per kilogram of body weight per minute (ml. kg-^{1} min^1). Rather than determine each person's true resting oxygen uptake a MET is taken as this average. See table II below

Table II. Clinically Significant Key Metabolic Equivalent for Maximum Exercise

1 MET =	resting
2METs =	level walking at 2mph
4METs =	level walking at 4mph
<5METs =	poor prognosis, usual limit immediately after MI; peak cost of basic activities of daily living.
10METs=	excellent prognosis regardless of other exercise responses
18METs =	elite endurance athletes
20METs =	world class athletes

MET, metabolic equivalent or a sitting, resting oxygen uptake, IMET = 3.5ml. kg-^{1} min-^{1} oxygen uptake Source: Fletcher et al (1990). AHA Medical Scientific Statement Circulation; 82(6): 2236-2300

It is difficult to accurately predict VO_2mass from its relation to exercise habits and age because of considerable scatter and correlations that are generally low. VO_2max is equal to maximum cardiac output times maximum arteriovenous (aVO_2) difference. Since cardiac output is equal to product of stroke volume and HR, VO_2 is directly related to HR. The maximum a VO_2

difference during exercise has a physiological limit of 15-17 volumes percent; hence, if maximum effort is achieved, VO_2max can be used to estimate maximum cardiac output.

Cardiac Rehabilitation, Health and Fitness

There is hardly a country in the developing world in which one or more of the common cardiovascular disorders does not constitute a major or emerging public health problem. However, the profile of morbidity and mortality varies from one place to another (Akinkugbe and Falase, 1987). Akinkugbe and Falase (1987) also noted that most studies in cardiovascular disease undertaken in developing countries have drawn copiously, and almost exclusively, from hospital clinical and autopsy records. Epidemiological surveys have been few, and even then many of these have been characterized by inadequate methodology and different data.

The treatment of cardiac patients and related cardiac ailment in Nigeria clinics is basically by medication, bed rest, and in very few cases by surgery for those who can afford it (Emeahara, 2000). Cardiac rehabilitation in US, Canada and Europe is usually applied to cardiac patients who are recovering from myocardial infarction (MI), revascularization and those who have had a transplant.

In the 70s, the known cases of cardiac disease in Nigeria were mainly hypertension, cardiomyopathy, rheumatic and congenital heart diseases. Ischaemic heart disease formed about 2% of the cardiac disease population (Akinkugbe and Falase, 1987). The present record of the population of cardiac patients in LUTH may be an implication of the rise of ischaemic heart disease in the country (Emeahara, 2000). Amao (2007) also note that there is an epidemic of hypertension and other related cases of cardiovascular disease. This may necessitate an elaborate practice of cardiac rehabilitation in Nigeria.

Rehabilitation is a process whereby patients are restored to their optimal physical, medical, psychological, social, emotional, vocational, and economic status (Shanfield, 1990). Lion, Cruz and Albanesi Filho (1997) state that the beneficial effects of rehabilitation include a reduction in the rate of death from cardiovascular disease, improved exercise tolerance, fewer cardiac

symptoms, improved lipid levels, decreased cigarette smoking, improvement in psychosocial well-being and increased likelihood of return to work.

Rehabilitation involves a multidisciplinary team that focuses on education, individually tailored exercise, risk-factor modification and the optimization of functional status and mental health. In general, the need for cardiac rehabilitation programmes and the supervision of cardiac patients in their training programmes is apparent (ACC, 1986). Exercise, a key element in the rehabilitative process, can produce musculoskeletal fitness, multiple training adaptations, and salutary psychological and attitudinal changes.

Conclusion and Recommendation

There is no gainsaying the fact there is a serious problem with our present health care system. This has made the treatment of many ailments for the common man extremely cumbersome. It is only those who have the means that can have assess to private doctors, and even treatment abroad.

In conclusion, it is pertinent to note that an exercise test is often used to evaluate the safety of an exercise training programme and is useful in formulating an exercise prescription. Also, an exercise test can be used in adult exercise or cardiac rehabilitation programmes to safety advance an individual to a higher intensity. From the foregoing the following recommendations are made:

Every individual is encouraged to form a positive lifestyle habit of exercise, consuming a balanced diet and managing their stress level in order to guard against stroke, myocardial infarction, and heart attack.

Researchers in the health care discipline of medicine, nursing, health education/ promotion, and exercise physiology/ physical therapy should collaborate to develop a cardiac rehabilitation practice in Nigeria.

Finally, the Federal Government 7-point agenda should seek to increase the budget on health and education so as to improve the general well-being of our population.

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TEACHERS' AWARENESS OF DANGERS POSED BY INHALANTS TO HEALTH: IMPLICATIONS FOR CHILD DEVELOPMENT

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Abstract

The study investigated teachers' awareness of the products called inhalants and the dangers they pose to health. The design of the study was descriptive survey. The area of the study was Anambra State. Two research questions and two hypotheses guided the study. All the primary school teachers in Anambra State constituted the population. Simple random sampling technique was used to select 1050 (145 males and 905 females) teachers. A thirty item researchers-developed instrument was used to collect data for the study. Reliability values of 0.79 and 0.81 using Cronbach Alpha were established. Mean values were used to analyse the research questions while t-test statistics was used to test the hypotheses. Result of the study revealed that teachers' awareness of the products called inhalants and the dangers they pose to health is not encouraging. The implication of the study was highlighted. The researchers amongst others recommended that government should mount awareness campaigns on what inhalants are and the dangers they pose to health.

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