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EFFECTS OF UNDERWATER SAND MINING ON THE CARDIOVASCULAR AND LUNG FUNCTION IN PORT HARCOURT CITY WATER FRONTS

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ABSTRACT

There is no documented of information on the effects of sand mining activities on the cardiovascular and lung function of underwater sand miners in various water front in Port Harcourt, Rivers State Nigeria. The focus has always being on the environmental impact. In this study, 100 subjects were studied as the test group while 100 subjects were also studied as the control group making a total of 200 subjects. After obtaining information about their, Age, work duration, any previous respiratory disease condition, Measurements were made to determine height, weight, Blood pressure and peak flow rate. This study was aim at the respiratory rate, peak flow rate, the age ranges, work duration and Body Mass Index (BMI), and blood pressure. Analysis of variance ANOVA single factor was employed for statistical analysis. The summary of the (ANOVA) single factor showed that the respiratory rate was not significant (p=0.16789). But the summary of the peak flow rate was significant (0.006893.)The increases and decreases in any of these variable does not really depend on age and work duration but may be family related history. Further studies are however recommended in groups and in larger number.

Keywords: Underwater Sand Mining; Cardiovascular; Lung Function; Water Fronts

Introduction

Cardiovascular system comprises the heart and its blood vessels. The heart is the central pump and the blood vessels are the series of distributing and collecting tubes. The thinnest blood vessels are in the form of extensive thin walled vascular channels called capillaries through which interactions between cardiovascular system and tissues occurs. The Cardiovascular System constitutes one of the major coordinating and integrating system of the body. The other two systems with such actions are Nervous System and Endocrine System. The function of cardiovascular system is to supply oxygen, nutrients and other essential substances to the tissues of the body and to remove carbon dioxide and other metabolic end product

from the tissues (Sembulingam et al, 2006).

While, respiratory system is divided into a respiratory zone, which is the site of gas exchange between air and blood, and a conducting zone, which conducts the air to the respiratory zone. The exchange of gases between air and blood occurs across the walls of respiratory alveoli. These tiny air sacs, only a single cell layer thick, permit rapid rates of gas diffusion (Cooper, et al 2003).
The term respiration includes three separate but related functions.

(1) Ventilation (breathing);
(2) Gas exchange, which occurs between the air and blood in the lungs and between the blood and other tissue of the body and
(3) Oxygen utilization by the tissue in the energy, liberating reactions of cell respiration. Ventilation and the exchange of gases (oxygen and carbon dioxide) between the air and blood are collectively called external respiration. Gas exchange between the blood and other tissues and oxygen utilization by the tissues are collectively known as internal respiration (Cooper, et al (2004).

Ventilation according to (Castellein, et al 2001) the mechanical process that moves air into and out of the lungs. Since the oxygen concentration of air is higher in the lungs than in the blood, oxygen diffuses from air is blood. Carbon dioxide, conversely, moves from the blood to the air within the lungs by diffusing down it concentration gradient. As a result of this gas exchange, the inspired air contains more oxygen and less carbon dioxide than the expired air. More importantly, blood leaving the lungs (in the pulmonary views) has a higher oxygen and lower carbon dioxide concentration than the blood delivered to the lungs in the pulmonary arteries.

Sand mining in underwater business: This business venture is of two categories, the large scale using mechanized machines and the manual category, which is the focus of this study**.** This is a business that large involved over ninety per cent male subjects because it's involve the use of a large energy. Its involve diving into the underwater most of the time or the use of buckets as haulage devices using long ropes to pull it onto shore or the bank of the river or onto the canoe.

Occupational practices and Health Conditions in Extreme Environments

The ability to perform physical work depends on the ability of the muscle cell to transform chemically bound energy in the food which we eat into mechanical energy for muscular work (AHA, 2024). This in turn depends on the capacity of the service functions that deliver fuel and oxygen to the working muscle fiber, i.e. on the nutritional state, nature and quality of the food ingested,

frequency of meals, oxygen uptake include pulmonary ventilations, cardiac output and oxygen extraction and the nervous and hormonal mechanisms that regulate these functions(Maurizio,G. A, 2022).

Many of these functions according to Falilu et al (2018)) depend on sex, age, body dimensions and state of health. In addition physical performance is to a significant extent, a function of psychological factors, notably motivation, attitude to work and the will to mobilize one's resources for the accomplishment of the task in question(). Several of these factors, may be affected by training and adaption. Physical performance may also, directly or indirectly, be greatly influenced by factors in the external environment. Thus, air pollution may affect physical performance directly by increasing airway resistance and thereby pulmonary ventilation and indirectly by causing ill health (Julian, L 2020). The same applies to cigarette smoking. Alcohol may also have a negative effect on performance (Price and Hicks, 1979; Kahn and Cooper, 1990). Noise is a stress, which may not only damage hearing but also cause an elevation of heart rate and affect other physiological parameters that reduce physical performance. Cold weather, if severe, may in itself reduce physical performance because of numbness of the hands of lowered body temperature (The opposite effect of a warm-up prior to an athletic competition). But it may also involve the hobbling effect bulky clotting and the slowing down of ordinary simple functions because of snow and ice (Lombordo, 2024). Heat if intense, may greatly reduce endurance because of the reed for more of the circulating blood volume to be the effect of dehydration often accompanying heat exposure as a result of loss of body fluids (sweating). High gas pressures, encountered in underwater operations in connection with modem offshore oil exploration, present now and rather unique problems for work physiologists (AHA, 2024). The drastic reduction in physical work capacity at high altitudes is one of the best studied problems concerning environmental effects on physical work capacity. In fact, significant muscle fibre atrophy has been noted after only 5 days in space (Booth and Criswell, 1997).

The nature of the work to be performed, apart from intensity and duration is of decisive importance when considering an individual's capacity to endure prolonged work stress. Since all life functions generally consist of rhythmic, dynamic muscular work in which work and rest muscle contraction and relaxation are interspersed at more or less regular fairly short intervals, the ideal way to perform physical work period interrupted by brief pauses. This routine will provide some rest during the actual work period, so the worker may avoid fatigue and exhaustion. Similarly, the work position is also important in that working in a standing position, which

will permit the worker to more about and there by vary the load on individual muscle groups and facilitate circulation, may at times be preferable. The working technique may be of major importance in conserving energy and in providing varied use of different muscle group (Ohaeri, et al, 2021).

Physiologically speaking, working in the cold is primarily a matter of maintaining thermal balance, since both energy metabolism and neuromuscular functions are temperature dependent (Tiina, 2018). Body temperature is also subject to variations due to circadian rhythms. While local acclimatization to cold is well established, and may be of considerable practical benefit, general acclimatization to cold, if in fact a reality, at best of limited practical valve compared to know how, experience and environmental protection(CIS, 2021).

Cold injury may be inflicted in common winter sports such as skiing and skating and in long distance runners competing in cold, windy conditions. Local cold injury may occur in the exposed parts of the body such as the face, hands and feet, either due to the freezing of tissue and formation of ice crystals, i.e. frostbite, or by vasoconstriction causing deprivation of the blood circulation to the exposed parts, leading to ischemic cold injury (Tiina, 2018). The pathological consequences of the freezing may, to some extent, depend on the speed of the cooling. In rapid cooling, the ice crystals formed may break the cells and cause tissue destruction and necrosis. In slow cooling, ice crystals are formed in the tissues, but since solutes are excluded in the freezing process, the osmotic pressure in the extra-cellular fluid increases, pulling fluid out of the cell, with exudates formation as a result. This in itself will cause cell damage, augmented by the concomitant (Jauneaau,2021).Cold temperatures have mark effects on the cardiovascular system and are associated with an increase in cardiac symptoms, such as angina and arrhythmias, as well as an increased incidence of myocardial infarction(AHA,2024).

Research Method

Standardized materials for weight and height measurement, blood pressure and peak expiratory rate were utilized for the study. The study was conducted in various waterfronts among underwater sand miners in Port Harcourt, Rivers State of Nigeria. Two hundred (200) adults' male subjects volunteered for the study, out of which 100 subjects were studied as test group and 100 subjects were studied as control group of the research work. The 200 subjects that participated in the study were administered the questionnaires based on a study preformat. **Procedures:** This test requires a peak expiratory flow monitor: a small handheld device with a mouth piece at one end and a scale with a moveable indicator (usually a small plastic arrow). It was ensured

that the mouth piece was cleaned with cotton wood dipped in methylated spirit after each readings.

Presentation of Result and Statistical Analysis

Results were analyzed using ANOVA; single factor. All results were expressed as mean and standard deviations. The 200 subjects that volunteered for the study, out of which 100 subjects were studied as test and 100 subjects were studied as control of the research work. These subjects were classified" in to 3 age ranges, 20-30, 30-40, 41-54 and work duration 1-2 yrs., 3-10yrs, ll-19yrs. The tables and Histograms shown below where the results obtained in the study conducted in various waterfront, among underwater sand miners in Port Harcourt, River State.

Control

Table 1

Variables	Mean	STD
Age	36.7	21.695
Duration	6.15	5.914
RR	17.12	2.53
PEFR	320.29	86.092

Table shows the mean and STD value, 36.7±21.695, 6.15±21.695, 6.15±5.914, 17.12±2.53, 320.29±86.092.

Table 2 According to Age <= 30yrs

Table 3

Variables	Mean	STD
RR	17.27	2.753
PEFR	326.09	102.557
H+	1.61	0.079
W+	72.67	10.614
BMI	28.022	4.507

Table shows the mean and STD, values 17.27±2.753, 326.09±102.557, 1.61±0.0 79, 72.67±10.614, 28.022±4.507, of age.

Table 4 31-40 yrs

Variables	Mean	STD
RR	16.77	2.438
PEFR	329.49	82.968
H+	1.59	0.058
W+	74.95	8.664
BMI	29.84	3.664

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Table shows t le mean and STD value, 16.77±2.438, 329.49±82.968, 1.59 ±0.058, 74.95±8.37, 29.84±3.664.

Table 5. 40-49 yrs, 40-59yrs

Variables	Mean	STD
RR	17.54	2.395
PEFR	295.83	62.2
H+	1.56	0.058
W+	76.54	9.046
BMI	31.38	3.079

Table shows the means and STD values, 17.54±2.395, 295.83±62.2, 1.56±0.058, 76.54±9.046, 31.38±3.079.

Table 6 ANOVA: Single Factor Respiratory Rate

Source of variation	SS	Df	MS	F	P-value	F crit
Between groups	14.80611	1	14.80611	1.915487	0.16789	3.888139
Within Groups	1553.667	201	7.729686			
Total	1568.473	202				

Table 6 shows that the single factor for respiratory rate was not significant.

Table 7 ANOVA: Single Factor Respiratory Rate

Source of variation	SS	Df	MS	F	P-value	F crit
between groups	40496.17	1	40496.17	7.453634	0.006893	3.888139
Within Groups	1092048	201	5433.077			
Total	1132545	202				

Table 7 shows that single peak flow rate was significant.

Discussion and Conclusion

The aim of this research study was to evaluate the effects of sand mining on the cardiovascular and lung function of underwater sand miners in various waterfronts in Port Harcourt Rivers State, Nigeria. Also to access the level of respiratory rate or problem among under water sand miners and amongst variables like age, family history of cardiovascular Heart

diseases peak flow rate, body mass index and hypertension.

It was observed that the mean values for the test group and the control group where similar in term of age.

It was also observed that the mean values for work duration in the test group were higher than that of the control group.

In an earlier study, Anthonen and Virokannas (1994), Falilu et al (2018), Combordo et al (2024), showed that in outdoor work in the winter, cold stress frequently reduced working ability by some 70%, at least for a short period. They also stated that, the most common problem during light outdoor work in the cold is cooling of the extremities and the face. The frequent diving into the deep of the waters was observed to have remarkable effect on the workers.

The 100 subjects that were study as the test had their respiratory rate as 17.66±3.002, which was greater than that of the control group. It was also observed that the mean values of the duration of work of the respiratory rate and peak flow rate between 1-2, 3-10 and 11-19 years, the PEFR mean values where significantly higher than the respiratory rate.

Conclusion

This study had shown that sand mining has significant effects on the cardiovascular and lung function of underwater sand miners, the mean values for most of the variable varies from individual and also in groups, either in the test group or the control group. The duration of work they do, does not really affect or cause some of these problems but could be that, they might have these problems in their family lineage. Some of the subjects had fast breathe, breath cessation and chest pains.

Recommendations

1. Strongly recommend that more research be done, in greater duration, and with a larger amount of subjects.
2. The study of the electrocardiographic (ECG) recordings of underwater sand miners should cover other details beside the one in this study.

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