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A comparative study on peripheral capillary oxygen saturation between underweight and normal weight preadolescent boys

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Abstract

Background: Peripheral capillary oxygen saturation (SPO₂), is an estimate of the amount of oxygen in the blood. More specifically it is the percentage of oxygenated haemoglobin compared to the total haemoglobin the blood. Normal value of SPO₂ is 95% to 100%.

Aim: The purpose of the present study is to compare the peripheral capillary oxygen saturation (SPO₂) between normal weight and underweight preadolescent boys.

Method: For the purpose of the study 52 preadolescent boys were selected as subject from Kumarpur Parashmoni Sikshabitan, North 24 Parganas (West Bengal). The age of the subject ranges from 11 to 13 years. To divide the subjects into underweight and normal weight category BMI was calculated for 70 students and from there 26 underweight and 26 normal weight boys were selected. Therefore actual number of subjects for the present study were fifty two (N=52). For the computation of BMI height and weight were measured by Stadiometer and digital weighing machine. CDC (Centers for Diseases Control and Prevention) growth chart is used to determine the underweight and normal weight students. The value of SPO₂ was recorded by Fingertip Pulse Oximeter (Dr. Trust : Nureca Inc USA : Model No: SS01, USFDA and CE approved).

Result: t-test was applied to investigate the existence of significant difference of means in peripheral capillary oxygen saturation between underweight and normal weight preadolescent boys. The result of the study showed that there was a significant difference in peripheral capillary oxygen saturation between underweight and normal weight preadolescent boys.

Discussion: Significant difference was found in SPO₂ level between two groups at 0.05 level of confidence. Normal weight students showed better value as compared to underweight students.

Conclusion: This study revealed that underweight preadolescent boys have less peripheral capillary oxygen saturation as compared to normal weight preadolescent boys due to the deficiency of haemoglobin in RBC, occur from malnutrition and stressed the need for more research in this area.

Keywords: Peripheral capillary oxygen saturation, BMI, Pulse Oximetry

Introduction

SPO₂ stands for Peripheral Capillary Oxygen Saturation, an estimate of the amount of oxygen in the blood. More specifically, it is the percentage of oxygenated haemoglobin compared to the total amount of haemoglobin in the blood. Peripheral Capillary Oxygen Saturation (SPO₂) measured by pulse oximeter, is a simple and reliable objective measurement in routine medical practice that approximates the level of oxygen in arterial blood.

The pulse oximeter, based on all digital technology, is intended for non invasive (means it does not involve the introduction of instruments into the body) spot-check measurement of functional oxygen saturation of arterial haemoglobin. (SPO₂) Advanced DSP (Digital Signal Processor) algorithm can minimize the influence of low perfusion. The oximeter can be used to measure human haemoglobin saturation and heart rate through finger.

Healthy individuals at sea level usually exhibit saturation values between 95% to 100%. Good blood oxygenation is necessary to supply the energy to the muscles, which are increases during sports and activity. If SPO₂ value is below 95% that could be a sign of poor blood oxygenation, also called hypoxia.

Underweight status represents depleted body fat and/or less tissue stores. For classifying Underweight based on BMI (Body Mass Index) the WHO defines underweight as a BMI

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below 5th percentile for age and gender. A BMI above 95th percentile is considered obese. Children with BMI between 85th and 95th percentile are considered to be overweight and 5th to 85th percentile considered as normal weight. Based on this, the aim of this study was to compare the Peripheral Capillary Oxygen Saturation (SPO₂) between normal weight and underweight preadolescent boys.

2. Methodology

2.1 Subject

For the purpose of the study 70 preadolescent boys were selected randomly as subject from Kumarpur Parashmoni Sikshabitan, North 24 Parganas (West Bengal). Age of the students ranges from 11 to 13 years. The students suffering from any respiratory diseases are excluded from the study. To divide the subjects into underweight and normal weight category their BMI was calculated, and from there 26 boys were taken for underweight category and 26 boys were taken for normal weight category. Therefore the actual number of subjects for the present study were fiftytwo (N=52).

2.2 Procedure

To divide the subjects into underweight and normal weight groups BMI was calculated. For the calculation of BMI, height and weight was measured using Stadiometer and digital weighing machine. BMI is used differently for children. It is calculated in the same way as for adults using formula weight(kg)/height(m²), but then compared to typical values for other children of same age. Instead of comparison against fixed thresholds for underweight and overweight. So that CDC (Center of Diseases Control and Prevention) growth chart is used to determine the underweight and normal weight category. A BMI that is less than 5th percentile is considered underweight and between 5th to 85th percentile are considered to be normal weight.

2.3 Criterion Measures

Peripheral Capillary Oxygen Saturation (SPO₂) was recorded by using Fingertip Pulse Oximeter manufactured by Dr. Trust (Nureca Inc. USA Model No: SS 01 USFDA and CE approved). SPO₂ values were recorded using dominant hand index finger of all the subjects, when at rest.

2.4 Statistical Procedure

For the analysis of data mean and standard deviation of the variables were calculated. To compare the SPO₂ value between underweight and normal weight students t-test was employed at the level of 0.05 level of significance.

3. Result

Table 1: Representing Mean and Standard Deviation of BMI.

Variable	Mean	S.D
Normal Weight	18.103	2.003
Underweight	14.329	0.689

Table 2: Representing Mean, Standard Deviation and t-test value of SPO₂ between normal weight and underweight student.

Variable	Mean	S.D	Mean difference	t-Ratio
Normal Weight	98.692	1.194	1.692	4.0958
Underweight	97	2.038		

*‘t’ value required to be significant at 0.05 level of confidence with 50 degree of freedom was 2 .000.

The above table showed the significant difference between

under weight and normal weight students in respect of SPO₂ because the calculated ‘t’-value of 4.0958 was greater than the tabulated ‘t’-value of 2.000.

4. Discussion

The analysis of data reveals that normal weight and underweight preadolescent boys differed significantly in relation to Peripheral Capillary Oxygen Saturation (SPO₂). Underweight boys showed the lower SPO₂ value (mean 97%) compared to normal weight (mean 98.692%) at a mean difference of 1.692.

One of the main causes of underweight during preadolescent age is malnutrition. Malnutrition is a condition that results from eating a diet in which nutrients are not enough. Studies in India and Bangladesh have shown deficiencies in the intake of all nutrients, particularly iron, calcium, vitamin-A, and vitamin-C. Iron deficiency is the most common cause of anemia. Iron is necessary for the body to produce haemoglobin, an iron rich protein in red blood cells. Iron has a key function in oxygen transport, either as a part of haemoglobin or as myoglobin. In the decrease in haemoglobin reduces the availability of oxygen to the tissues (Beaton, Corey and Steel 1989). Oxygen Saturation (SO₂) is the blood oxygen binding by the haemoglobin oxygenation (HbO₂). Oxygen saturation is an indicator of the percentage of haemoglobin saturated with oxygen at the time of the measurement. The reading obtained through Pulse Oximetry.

5. Conclusion

On the basis of results and discussion it may conclude that underweight preadolescent boys have significantly lower SPO₂ value compared to normal weight preadolescent boys because of lower oxygen saturation due to iron deficiency in the body, because of malnutrition.

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