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A Critical Analysis of Location as a Correlate of Body Mass Index of Children Aged 1-5 Years in Akwa Ibom State

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ABSTRACT

The study critically analyzed location as a correlate of body mass index of children aged 1-5 years in Akwa Ibom State. Infants and children under 5 years old were used. Apparently, assessment of growth is the single most important measurement of nutritional status. The presence of under nutrition in children is assessed using weight for age, height for age, weight for height and body mass index. Weight for age can be used to diagnose underweight children in the form of wasting, underweight or stunting. Height for age shows linear growth and can be used to measure long-term growth faltering or stunting. Weight for height shows proper body proportion and harmony of growth. The target population of this study comprised schoolchildren registered in government-approved nursery and primary schools aged 1-2 years and 3-5 years in Akwa Ibom State. A multi-stage sampling procedure was used to draw 1440 pupils from urban and rural nursery and primary schools in Akwa Ibom State Senatorial districts. The instrument used for data collection was a standardized instrument for anthropometric assessment. Face and content validation of the instrument was carried out by an expert in testing, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. The reliability coefficient obtained was 0.83, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical techniques. The test for significance was done at 0.05 alpha levels. It was concluded that very few pupils (3.6%) out of the population of the children aged 1-2 years in Akwa Ibom State has Body Mass Index in line with WHO recommended standard, while (96.4%) of them have their body mass index below standards. It was also concluded that very few pupils (12.5%) out of the population of the children aged 3-5 years in Akwa Ibom State had Body Mass Index in line with WHO recommended standard, while (87.5%) of them had their body mass index below standards. One of the recommendations made was that since the goal of every health practitioner is to maintain a high level of nutritional health status for the population, the hospitality industry should always go for regular checkup using anthropometric indicators such as weight for height (W/H), weight for age (W/A) and height for age (H/A) to characterize the nutritional status of populations.

Introduction

A critical aspect of nutritional practices that significantly determines nutritional health status is the use of anthropometric methods. Anthropometry refers to the measurement of the human individual. It is seen as an early tool of physical anthropology used for identification, and for the purpose of understanding human physical variation. WHO (2016b) asserted that anthropometry is a science that defines physical measurement of a person's size, form and functional capacities.

It forms a key component of nutritional health assessment in children and adults, which encompass a variety of human body measurements such as weight, height, skin fold thickness, mid-upper arm and head circumferences. Generally, anthropometry may be in the form of horizontal or vertical measurements. Horizontal anthropometric measurement is the repeated measurements of certain parameters of the human body, such as weight, height, mid-upper arm circumference, skin fold thickness, and body mass index, in a specific age range over a specified period of time. Vertical anthropometric measurement which is the concern of this study involves measurements of weight, height, skin fold thickness, and mid-upper arm circumference (MUAC), head circumference, and body mass index of different age groups at a particular point in time (Orji, 2014). Anthropometric data on the physical development of individuals is widely used to determine the degree and duration of nutritional deprivation. The reference standards most commonly used to standardize the measurements were developed by the US National Centre for Health Statistics (NCHS) and are recommended for international use by the World Health Organization (WHO). Available evidence suggests that children from well-nourished and healthy families throughout the world grow at approximately the same rate and attain the same height and weight as children from industrialized countries (Center Disease Control and Prevention, 2021). The National Centre for Health Statistics (NCHS)/WHO reference standards can therefore be used for standardizing anthropometric data from around the world. So, for this particular study, vertical anthropometric measurements of children in Akwa Ibom State will be the key to understanding their nutritional health status in relation to their growth and development.

Anthropometric indices are the main criteria for determining the adequacy of growth and optimal nutritional health status in infancy and childhood. In infants and children under 5 years old, assessment of growth is the single most important measurement of nutritional status. The presence of under nutrition in children is assessed using weight for age, height for age, weight for height and body mass index. Weight for age can be used to diagnose underweight children in the form of wasting, underweight or stunting. Height for age shows linear growth and can be used to measure long-term growth faltering or stunting. Weight for height shows proper body proportion and harmony of growth. It is sensitive to acute growth disturbances and detects wasting. Skin fold thickness measures the relationship between subcutaneous fat and total body fat. It is done by pinching a fold of skin with the thumb 2cm away from the measuring site or midpoint of right upper arm to obtain the measurement (Raval & Mehta, 2022). Body mass index is calculated by dividing weight (in kilograms) by height (in meters squared). It reflects body fat storage and is an important way of classifying subjects into weight categories which correlate with risks.

According to the Federal Republic of Nigeria (2023), children aged 1-2 years are meant for early childhood and children aged 3-5 years are for pre-primary school education and are generally termed "preschool children." The categorization of school children in Nigeria by the National Policy on Education serves as the guiding principle for this present study (Utomi, 2022). At this age, it is said that the physical attributes of these age groups at this stage of life include rapid growth in stature, muscle mass and fat mass which gear them optimally into achievable adolescence. It is, however clear that; their nutritional status during this period is an important determinant of their health status. Thus, the nutritional health status of children in this age bracket determines, to a large extent, their growth rate and development.

The NCHS/WHO reference standards are available for children up to the age of 18 years, but this study will focus on children aged 1 to 5years. The international reference standards can therefore be used for standardizing anthropometric data from around the world. As part of a public health programme, it is important to monitor the weight and height measurements of school children. It is with this background that this study is designed to determine the nutritional health status of

early childhood and preschool children in Akwa Ibom State using vertical anthropometric methods of growth monitoring. The variables considered include age, gender, and location of the early childhood children aged 1-2 years and preschool children aged 3-5 years.

Statement of Problem

It is very common that early childhood and preschool children have been much influenced by the nutrient they consume. Research shows that early childhood and preschool ages are the most turbulent and confusing stages of life where children dislike and refuse eating food regularly. Even in the presence of adequate food items, inadequate food intake and incorrect feeding practices invariably lead to severe physical, cognitive and biological changes. Sometimes the general disliking of food during the brain's most formative years and long bone development brings about health-related issues. At this time, children generally are expected to grow and develop well-formed muscle mass and thick bones for future growth into healthy adolescence and adulthood. Unfortunately, many early childhood and preschool children develop low resistance to infection and become sickly. It is quite obvious that the effects are reflected in the body mass index of these children. The problem of this study is on the premise of body mass index of children aged 1-5 years as to whether it depends remarkably on their location.

Purpose of the Study

1. To determine what percentages of children aged 1-2 years with body mass index are in line with WHO/NOHS recommended standard?
2. To determine what percentage of children aged 3-5 years with body mass index are in line with WHO/NCHS recommended standard?

Research Questions

1. What percentages of children aged 1-2 years with body mass index are in line with WHO/NCHS recommended standard?
2. What percentages of pre-school children aged 3-5 years with body mass index are in line with WHO/NCHS recommended standard?

Research Hypotheses

1. Body mass index of children aged 1-2 years does not depend significantly on their location.
2. Body mass index of preschool children aged 3-5 years does not depend significantly on their location.

LITERATURE REVIEW

Vertical Anthropometric Methods

Nejedly, (2020) identified anthropometry as a tool used to assess and predict performance, health and survival of individuals and reflect the economic and social wellbeing of a population. It may be in the form of horizontal or vertical measurements. Horizontal anthropometry is the repeated measurements of certain parameters of the human body, such as weight, height, mid-upper arm circumference, skin fold thickness, and body mass index over a specific period of time. Vertical anthropometry involves measurements of weight, height, skin fold thickness, mid-upper arm and head circumferences, and body mass index of different age groups at a particular point in time (Orji, 2014). WHO (2016b) defined anthropometry as the branch of anthropology concerned with comparative measurement of human beings. It is a science that defines physical measures of a person’s size, form, and functional capacities. Utkualp and Ercan (2015) asserted that it has served to study body measurements, including size, shape, strength, and working capabilities.

According to the Centers for Disease Control and Prevention (CDC) (2021), anthropometry

provides a valuable assessment of nutritional status in children and adults. Typically, they are used in the pediatric population to evaluate the general health status, nutritional adequacy, and the growth and developmental pattern of the child. Growth measurements and normal growth patterns are the gold standards by which clinicians assess the health and well-being of a child. It highlighted the four indicators used to undertake anthropometric assessment as age, sex, height and weight. Each of these variables provides a particular piece of information about a person. When two of these variables are used together, they are called indexes, such as body mass index. Sleet and Delinger (2021) asserted that when the variables are used together, they can provide important information about a person's nutritional health status. Furthermore, Adam (2020) and the Center for Disease Control and Prevention (CDC, 2022) identified body mass index as a tool used to measure excess weight rather than excess body fat and changes with age. Additionally, weight for age, height for age, weight for height, and body mass index were identified as the four indices commonly used in determining the nutritional health status of children. Others relevant to this study include mid upper arm and head circumferences.

Prevalence and number of preschool (under five years old) children who are stunted, underweight and wasted.

Growth assessment serves as a means of evaluating the health and nutritional status of children, just as it also provides an indirect measurement of the quality of life for the entire population. Kiernan and Mascerenhas (2023) posited that growth assessment is the interpretation of anthropometric growth measurements including height, weight, head circumference, weight for length and body mass index. The internationally recommended way to assess the nutritional status (malnutrition) of a population at large is to take anthropometric measures. The three most commonly used anthropometric indices are height for age, weight for age, and weight for height. It is the anthropometric index of height-for-age that will reflect linear growth during pre and postnatal periods, with its deficits indicating long-term effects of inadequate nutrition and/or health (ACC/SCN/IFPRI, 2021). Shortness in height refers to low height for age that may reflect either normal variation in growth or a deficit in growth. Stunting refers to shortness that is a deficit in growth that has failed to reach generic potential as a result of poor diet and disease (ACC/SCN, 2001). Stunting can also be defined as low weight for age at <-2 standard deviations (SD) of the median value of the reference population. (National Center for Health Statistics / World Health Organization).

According to WHO (2022), weight for height measurement is one of the methods used to determine the nutritional health status of a child. The weight of a child has to be related to his height in order to obtain an objective measurement of that child's degree of thinness and growth. WHO (2021) asserted that weight for height is more specific than the measurement of weight alone, which does not distinguish between tall, thin, and short children. This is the reason why weight for height will be used in this present study. For height measurement, the child must be over 2 years of age for an accurate result (Norton, 2019). Weight for height indices are used for children over the age of two to indicate wasting or acute undernutrition, whereas weight for length indices are used for children under the age of two. Weight for height measurements are sensitive to acute growth disturbances like wasting or thinness and indicate recent severe processes of weight loss associated with unfavorable conditions. The height of an individual is measured in centimeters. After taking both weight and height, the values are calculated to obtain the body mass index to determine whether the value is desirable or not.

Nuttall (2015) opined that body mass index is a metric currently in use for defining anthropometric height and weight characteristics in adult and for classifying them into groups. It implies a measure used to determine the level of wellness enjoyed by people in terms of their nutritional status following calculations of weight and height. The index is used to determine

those who are underweight, normal or overweight among the respondents. According to WHO (2017a) classification, a person exhibiting weight for height is considered overweight and is an indicator of obesity. This has to be confirmed by using calipers, otherwise called skin fold thickness. The formula for calculating BMI is written-thus

Weight in kilogram (kg)

Height in square meter (M^2)

A cross-sectional comparative survey study was carried out by Illo, Agbapuonwu, Ogbonnaya, Obai, Makata, Chinweuba, and Okeke, (2015) to determine the nutritional status, growth, and body mass index of school children aged 3-17 years using vertical anthropometric measurements in Anambra State. Sixteen research questions and six hypotheses were developed to guide the study. The research design adopted for the study was a cross-sectional comparative survey design. The area of study was Anambra State. The target populations of the study comprised all school children in the nursery, primary and secondary schools in the approved public schools. The estimated population of children in all the schools based on Anambra State Ministry of Education report was 82,118 which were as follows: Nursery pupils 6,980, Primary school 23,904 and Secondary school 51,234. The sample size consisted of 1280 nursery school children, 1288 primary school children, and 1600 secondary school children, making a total of 4168 school children drawn from the population. A multi-stage sampling procedure was used to select the sample for the study. In the first stage, six educational zones in Anambra were identified, namely Aguata, Awka, Nnewi, Sogidi, Onitsha, and Otuocha. A simple random sampling procedure was used to draw the three zones, namely the Awka, Nnewi, and Ogidi educational zones. In the second stage, two Local Government Areas were drawn from each educational zone. The schools selected were already stratified into urban and rural schools by the State Ministry of Education. In the third stage, schools were listed according to nursery, primary, and secondary categories in the urban and rural locations in the six Local Government Areas selected.

Method

The research design adopted for this study was the cross-sectional survey design. The research was conducted in Akwa Ibom State, Nigeria. The target population of this study comprised school children registered in government approved nursery and primary schools aged 1-2 years and 3-5 years in Akwa Ibom State. Multi stage sampling procedure was used to draw 1440 pupils from urban and rural nursery/primary schools in Akwa Ibom State Senatorial districts. The instrument used for data collection was a standardized instruments and performa for anthropometric assessment. The performa is a standardized and validated instrument whose quality was ensured by the validating experts in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. No reliability test was done since the instruments were standardized. The researcher subjected the data generated for this study to appropriate statistical techniques The test for significance was done at 0.05 alpha levels.

Results and Discussions

Research questions

Research Question One

What percentages of children aged 1-2 years with body mass index are in line with WHO/NCHS recommended standard?

Table 1: Percentage of Children Aged 1-2 years with Body Mass Index in line with WHO/NCHS Recommended Standard

Body Mass Index (WHO/NCHS Standard = 18.5kg/m^2 -24.9kg/m^2)	f	%
Percentage of children in line with WHO/NCHS recommended standard	8	3.6
Percentage of children not in line with WHO/NCHS recommended standard	216	96.4
TOTAL	**224**	**100%**

The results in Table 1 show that out of the 224 pupils aged 1-2years, 8 of them representing a proportion of 3.6 percent had Body Mass Index in line with WHO recommended standard, while 216 (96.4) of them had their body mass index below standards.

Research Question Two

What percentages of pre-school children aged 3-5 years with body mass index are in line with WHO/NCHS recommended standard?

Table 2: Percentage of Pre-school Children Aged 3-5 years with Body Mass Index in line with WHO/NCHS Recommended Standard

Body Mass Index (WHO/NCHS Standard = 18.5kg/m-24.9kg/m	f	%
Percentage of the children in line with WHO/NCHS recommended standard	152	12.5
Percentage of the children not in line with WHO/NCHS recommended standard	1064	87.5
TOTAL	**1216**	**100%**

The results in Table 2 show that out of the 1216 pupils aged 3-5 years, 152 (12.5%) of them had their body mass Index in line with WHO recommended standard, while 1064(87.5%) had body mass index were not in line with WHO recommended standard.

Hypothesis Testing

Hypothesis One

Body mass index of children aged 1-2 years do not depend significantly on their location.

Table 1: Summary of t-test Analysis of Body Mass Index of Children Aged 1-2 years in the Urban and Rural Areas.

Location	n	$\overline{X}$	SD	df	t-cal.	p-value	DECI
Urban	124	18.89	.19	222	10.22	.000	S
Rural	100	19.17	.22				

S Signifies P<0.05; and Significant

The result in Table 4.11 shows that the calculated t-value of 10.22 for body mass index of children aged 1-2 years in line with WHO recommended standard based on location was significant since the p-value of .000 is less than .05 levels of significance. The result therefore means that the body mass index of children of the study aged 1-2 years depended significantly on their location. The finding of this study was therefore in disagreement with the research findings of WHO (2021), which stated that the weight of a child has to be related to his height in order to obtain an objective measurement of that child's degree of thinness and growth.

Hypothesis Two

Body mass index of preschool children aged 3-5 years does not depend significantly on their location.

Table 2: Summary of t-test Analysis of Body Mass Index of Preschool Children Aged 3-5 years in the Urban and Rural Areas.

Location	n	$\overline{X}$	SD	df	t-cal.	P-value	DECI
Urban	594	20.22	1.57	1214	1.24^	.216	NS
Rural	622	20.11	1.53				

NS Signifies P>0.05; and Not-Significant

The result in Table 2 shows that the calculated t-value of 1.24 for body mass index of children aged 3-5 years based on location is significant since the p-value of .216 is greater than .05 levels of significance. The result therefore means that the body mass index of children aged 3-5 years depended significantly on their individual locations. The finding of this study was therefore in disagreement with the research findings of Kiernan and Mascerenhas (2023) who posited that growth assessment is the interpretation of anthropometric growth measurements including height, weight, head circumference, weight for length and body mass index.

Conclusion

It was concluded that very few pupils (3.6%) out of the population of the children aged 1-2 years in Akwa Ibom State has Body Mass Index in line with WHO recommended standard, while (96.4%) of them have their body mass index below standards. It was also concluded that very few pupils (12.5%) out of the population of the children aged 3-5 years in Akwa Ibom State had Body Mass Index in line with WHO recommended standard, while (87.5%) of them had their body mass index below standards. Furthermore, it was concluded that the body mass index of children aged 1-2 years depended significantly on their location. That same goes to the children aged 3-5 years which also proved that the body mass index of children aged 3-5 years depended significantly on their individual locations.

Recommendations

1. Since the goal of every health practitioner is to maintain a high level of nutritional health status for the population, the hospitality industry should always go for regular checkup using anthropometric indicators such as weight for height (W/H), weight for age (W/A) and height for age (H/A) to characterize the nutritional status of populations.
2. Guardians or caregivers should not deprive children of relevant information they should have known in childhood. For example, if caregivers are consistent, sources of food, comfort, and affection, an infant learns to trust that others are dependable and reliable. If they are neglectful or abusive, the infant instead learns mistrust that the world is an undependable, unpredictable, and possibly dangerous place.

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