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Estimation of Age in Childhood using the Armspan

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Summary

Lawoyin TO. Estimation of Age in Childhood using the Armspan. *Nigerian Journal of Paediatrics* **1999; 26: 7.** Decades ago, in the absence of date of birth, any child who was able to touch the earlobe on the opposite side of the body by carrying the arm over the highest part of the head, was deemed old enough to start school. In order to verify this screening test, 567 children from two randomly selected schools in an urban, inner city community were enrolled into the study. Weight and armspan measurements were obtained. Results showed that the test had a high specificity of 95.5 percent and was able to exclude most of the children who were not yet six years old. As age increased, specificity was reduced and sensitivity increased. By the age of nine years, all the children were able to touch the ear. Furthermore, armspan was found to be highly correlated with chronological age ($R < 0.90$). Using this method, undernourished children were at a disadvantage, as they had shorter armspans than well-nourished children of the same age; consequently, the age at which they were allowed school entry was likely to be delayed. For accurate age determination, registration of children at birth should be made mandatory.

KEYWORDS: Chronological Age, Undernourished, School Age, Specificity, Sensitivity, Birth Registration.

Introduction

DETERMINING chronological age in the absence of date of birth can be problematic and errors are bound to occur. Various methods for estimating chronological age of the child have been investigated[1-6] and some of these have not been very useful.[5] Knowledge of exact age is of importance for demographic surveys, forensic studies and in many instances, for admission into schools. During the colonial era in Nigeria, the early missionaries and teachers had some difficulty identifying which children were six years old and therefore, admissible to school. At that time, many deliveries took place at home and in rural areas where the majority of the people lived; consequently, most of such births were not registered. In an attempt to solve this problem, District Officers (DOs) devised a method which was used to screen prospective pupils for admission into primary schools. As far as the author is aware, there has been no scientific study to determine the accuracy of such empirical method of determining age. This study was, therefore, carried out in order to validate the screening test to which a large number of adults who are now over the age of 50 years were subjected , before being admitted into schools.

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Subjects and Methods

The subjects consisted of primary school pupils from the Idikan community, a homogenous slum with an estimated population of over 7600 inhabitants. Over 97 percent of al. children of school age attend primary schools in this zone (Idikan census). These schools are either government, or privately owned. Using a two-stage stratified sampling technique, all the 567 children in the Nursery, Primary one and Primary two classes from two randomly selected schools were included in the study; one government owned and one privately owned school were selected by simple random sampling technique for the study. Each child was screened by a single investigator and the age was verified by inspection of birth certificates which all of them had to have before being enrolled into the study. Age at last birthday was used for analysis. After age verification, the child was made to stand, eyes looking straight ahead, then to raise the right arm over the highest part of the head to touch the left ear lobe while the head was held in a vertical position. All children who succeeded in touching the ear lobe were deemed as having reached the minimum required school age of six years.

The following anthropometric measurements were carried out and these included the armspan measured with the arm fully extended sideways, 90 degrees away from the body. The distance from the acromium process to the tip of the longest finger was

measured; the weight was measured with a standard portable scale which was checked daily for accuracy, against known weights. Permission was obtained from the school authorities and also from parents. Data obtained was entered into a computer, using EPI INFO version 6 programme and correlation matrix was determined for armspan and age. Weight measurements were compared with the National Center for Health Statistics (NCHS)[7] standards. Using EPINUT analysis of EPI INFO version 6, a child with weight-for-age less than two standard deviations of median value of the standard was considered malnourished. Student's t-test was used to compare differences in mean values. Specificity, which is the ability of the test to detect children who have not yet attained the age of six years and sensitivity which is the ability to detect those who have reached six years, were also determined.

Table I

Validity of Armspan Screening Test in 567 Children

	Six Years & above	*Below Six Years*	*Total*
Screening Test Positive	281	2	283
Screening Test Negative	242	42	284
Total	523	44	567

Specificity = (42/44) 95.5%
Sensitivity = (281/523) 53.7%
Predictive value of Positive Test = (281/283) 99.3%
Predictive value of Negative Test = (42/284) 14.8%
False Negative = (242/284) 85.2%
False Positive = (2/283) 0.7%

Results

Results showed that the D0s test in the community had a very high specificity of 95.5 percent but a much lower sensitivity of 53.7 percent. The test was therefore, able to pick out with precision, children who were not yet six years old, but was not as precise in picking out those children who had attained the age of six years but were of small stature. False negatives were therefore very high, while false positives were very low (Table I). At age four years, no child was able to reach the ear and specificity was 100 percent. As the age increased, the specificity of the test declined while the sensitivity increased. By the age of nine years, all the subjects regardless of their sizes, were able to touch the ear and sensitivity of the test at this age was 100 percent. In addition, armspan was found to correlate highly with the chronological age ($r = 0.89$, 95% CI = $0.80 < R < 0.90$). However, as shown in Table II, all malnourished children, that is, those less than two standard deviations of the median value NCHS[7] had significantly shorter armspans than their better nourished mates at ages five to eight years ($p<0.01$, $p<0.001$, $p<0.0001$, $p<0.02$, respectively).

Discussion

The method devised by the DOs although quite unique, is not documented in literature. Even though weight and height of school age children are correlated with age, in our environment, between 46-48 percent of pre-school children are already stunted and have low heights for age[8] and about 38 percent are underweight,[9] with low weight for age. These variables are therefore, not sufficiently objective to decide age which is perhaps, one of the most important demographic variables that may have life-long consequences if wrongly determined. The method devised by the DOs is still used in some parts of the country today. Specificity, that is, the ability to detect those who are not yet six years must be high as it is in this case, or the schools will be overwhelmed with underage children who may not benefit much from the teaching. With this method however, malnourished children, many of whom come from the low socio-economic strata would be at a disadvantage, as malnutrition significantly reduces armspan. Thus, malnourished children are likely to fail the screening test, and thus enter school later than their better-nourished age mates. This observation was largely responsible for the many false negatives in the present study. The two children who were falsely positive were 'overnourished' and were still under six years of age. Overnourished under-aged children are likely to come from the middle and top socio-economic classes and are also more likely to have records of births which can be used to determine their age for admission into schools.

In the absence of an alternative method for assessing age in childhood, the DO's test that is easy to perform, highly specific and easily reproducible, is recommended; it is however, not sensitive enough for screening populations with a large number of undernourished children. In retrospect, many children

may have been prevented from attending school at the right age on account of undernutrition. It is advantageous for parents, particularly those from the low socio-economic class, to register their children at birth so that they can have accurate records of their ages. It is a relief to find that many deliveries today which occur in urban areas are registered and the majority of parents are able to provide the schools with accurate information on the ages of their children.

Table II

Mean Armspan and Nutritional Status of 567 Primary School Children

Age	*Nutritional Status*		*t*	*p-value*
(years)	*Malnourished*	*Well-nourished*		
4 (n=10)	nil	43.1±1.54		
5 (n=34)	45.0±2.0	47.6±3.2	3.08	<0.01
6 (n=189)	46.6±2.5	50.1±3.0	4.01	<0.001
7 (n=139)	47.9±3.2	53.2±2.6	5.74	<0.0001
8 (n=99)	51.0±3.4	55.1±4.4	3.29	<0.02
9 (n=46)	52.3±2.8	53.0±2.8	0.7	>0.05
10 (n=34)	51.7±3.03	53.8±1.14	1.85	>0.05
11 (n=7)	56.0±2.4	58.1±1.98	1.06	>0.05
12 (n=4)	56.5±4.9	58.0±4.2	0.32	>0.05
13 (n=3)	62.0±7.1	nil		
14 (n=2)	64.0±1.4	nil		

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post operatively as has been done in this study.

Claims such as the adequacy of rotation advancement technique in the anatomical assembly of the components of cleft of upper lip[5] require substantiation. Therefore, objective assessment of the size of the lip[12] and evaluation of correction of lip and nose anomalies based on measurements, is recommended.

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