

Prevalence of obesity and the association of overweight with selected factors and anthropometric measures among children attending preschools in MOH areas of Colombo Municipal Districts 4(D4) and 5 (D5)

Perera, KCM¹, Murali, V.

¹Acting Consultant Community Physician in Community Medicine, Epid Unit, Colombo, Sri Lanka.

²Consultant Community Physician, Anti-filarial Campaign, Colombo, Sri-Lanka

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Abstract- Background Childhood obesity increases the risk of obesity in adulthood and is associated with cardiovascular disease risk factors. The roots of the obesity epidemic need to be tracked back as early in life as possible. The objective of the study was to determine the prevalence of obesity and to describe the association of overweight with selected factors and anthropometric measures among children attending preschools.

Method Preschool children (n=431) in MOH areas of Colombo Municipal District 4 and 5 were selected using a multistage stratified cluster sampling technique. Information was collected from the parent/guardian of the study population by using an interviewer-administered questionnaire. Anthropometric measurements were taken from the selected preschool children. Data was entered in IBM-SPSS version 20 and a chi-squared test was used to determine associations

Results Overall prevalence of obesity and overweight (including obesity) among children attending preschools in MOH areas of Colombo Municipal District 4 and 5 were 1.7% and 4.37% respectively. Age of the study population was significantly ($p < 0.01$) associated to the preschool children overweight. Age, birth weight and weight at 6 months were significantly associated at 0.01 level ($p < 0.01$). Waist circumference, hip circumference, mid upper arm circumference, waist to hip ratio, mid upper-arm circumference to height were significantly ($p < 0.001$) associated anthropometric measures to the preschool children overweight.

Conclusions This study was shown the increased prevalence of preschool children overweight, associated factors, and anthropometric measures for overweight in the Colombo Municipal Districts 4 and 5 for early intervention.

Index Terms- Preschool, children, obesity, overweight, factors, anthropometric measures

I. INTRODUCTION

Background Obesity is defined as pathological or excessive fat accumulation on the body (1). Preschool children overweight and obesity were defined as children with weight for height values > 2 Standard Deviations (2SDs) and 3SDs,

respectively, from the World Health Organization Growth Standard Median. Being “at risk of overweight” was defined as children with weight for height values $> 1SD$ and $\leq 2SD$, respectively (2).

Children are most commonly enrolled in preschools between the ages of 3 and 5 years, though those as young as two years can also attend some preschools(3). Overweight and obesity are the fifth leading risk for global deaths(4). It is one of the serious global public health issues of the 21st century(5).

Complications of childhood obesity are based on physical and psychosocial consequences (6). The amount of physical activity is influenced by the competition for higher grades at school, compelling children to attend extra classes, watching television, involvement in computer/video games and the increased use of private transport have also contributed towards to sedentary life style (7). Obesity is the most prevalent nutritional disorder among children in some developed countries (8).

The nutrition transition is one of the major components out of three in health transition. The nutrition transition is a global phenomenon resulting from changing diet patterns towards high fat and highly refined sugars, while more people are adopting sedentary life styles and jobs with less activity (9).

The three indices of physical growth that describe the nutritional status of children according to WHO growth standards (10) are: Height-for-age, Weight-for-Height, and Weight-for-age. The nutritional status indicator is expressed in terms of standard deviations from the median (Z scores) of the reference population.

The global prevalence of preschool children obesity is 6.75%. The overweight and obesity prevalence in the age group of 0-5 years in South Asia is 4.6% in 2010, and is expected to be increased to 6.7% in 2020(11). Over the last 5 year reports from several developing countries have indicated prevalence rates of preschool children obesity inclusive overweight is more than 15%;

Mexico 41.8%, Brazil 22.1%, India 22% and Argentina 19.3% (12).

In Sri Lanka, the prevalence of overweight among children between the age of 36-47 months old is 1.9% and between 48-59 months old is 1.5% according to the national demographic and health survey data 2006/7 (11). The prevalence of overweight among Sri Lankan children between the age of 36-47 months old is 0.9% and between 48-59 months old is 0.8% (13).

The objective of the study was to determine the prevalence of obesity and overweight and to describe the association of the overweight with selected factors, anthropometric measures, and anthropometric indices among children attending preschools in MOH areas of Colombo Municipal Districts 4(D4) & 5(D5).

II. METHODS

A community-based descriptive cross-sectional study was conducted from 1st of June 2014 to 30th June 2014. The study population comprised of children at preschool settings in MOH areas of D4 and D5 registered at Western Province Preschool Unit and the preschool list provided by an area MOH along with their one parent preferably mother/guardian.

Diagnosed children with hypothyroidism, Prader-villi syndrome, any other disease or pathological status with enlarged abdominal organs and/or ascites, children on dietary restrictions, parent/guardian not accompanying the selected child, who were absent on the day of the commencement of the study, children who was residing temporarily at MOH areas D4 and D5 \leq 6 months were excluded from the study.

For the calculation of the sample size, we assumed that the expected prevalence of obesity was 5% (14) and the degree of accuracy desired specified as 0.03. Therefore we needed 203 women. To account for the cluster effect, it was necessary to adjust the required sample size having it multiplied by the design effect ($n=406$), which was taken as 2(15).

According to the Western Province Preschool Unit registration and the preschool list provided by an area MOH there were 31 preschools were registered for the year. In that 31 preschools altogether 1615 preschool children registered for the year.

As the first stage, preschool children population in all these 31 preschools were divided into 2 strata according to the 2 MOH areas, D4 & D5. In MOH area D4 there were 20 preschools with 841 preschool children. In MOH area D5 there were 11 preschools with 774 preschool children. Sampling unit was a cluster (classroom $n=31$). Total number of clusters identified in the MOH area D4 and D5 was equal to 27 and 22 respectively.

As the second stage, clusters were selected for the study sample. The number of clusters selected into the sample from each stratum was proportionate to the preschool children population in the MOH area D4 and MOH area D5 (Probability proportional to

size sampling technique). The proportion of preschool children population in MOH area D4 was 51.6%.

The proportion of preschool children population in MOH area D5 was 48.4%.

Clusters selected in MOH area D4 was 16 (Table 1)

Clusters selected in MOH area D5 was 15 (Table 2)

Sixteen clusters from the MOH area D4 and 15 clusters from the MOH area D5 were selected for the study by probability proportional to size sampling technique on a complete sampling frame of all preschools in MOH areas D4 and D5. The number of clusters was randomly selected from each preschool by lottery method in a case of the excess number of clusters than required from the relevant preschool.

As the third stage before the commencement of the study, the first author visited each selected preschool and the selected cluster/s in the relevant preschool was/were divided into two strata from the preschool register according to the sex boys and girls and selected 180 girls and 179 boys respectively in D4 and 186 girls and 150 boys respectively in D5. As the fourth stage from each of two strata in the relevant preschool has been taken all the eligible preschool children to the study sample after applying exclusion criteria, on the day of commencement of the study at each preschool.

The total number of girl preschool children selected to the study sample from the MOH area D4 was equal to 106. The total number of boy preschool children selected for the study sample from the MOH area D4 was equal to 110. The total sample size in the MOH area D4 was 216. The total number of girl preschool children selected for the study sample from the MOH area D5 was equal to 126. The total number of boy preschool children selected to the study sample from the MOH area D5 was equal to 89. The total sample size in the MOH area D5 was 215.

The questionnaire was administered by an interviewer and was designed by the first author. It contained the following information of the preschool children; personal data, socio-demographic characteristics, socioeconomic characteristics, lifestyle factors, developmental history, medical history, daily activities, food-related activities, and parental activities. A total of 431 preschool children were selected for the study. Out of them, anthropometric assessments (weight, height, waist circumference, hip circumference, and mid-upper arm circumference) were carried out in 412 children after discarding non-respondents.

Data was entered and analyzed by using the statistical package SPSS version 20. World Health Organization growth charts were used to assess the corresponded weight for height for preschool children to get the percentile rank. Non-parametric association and correlation with selected factors to the overweight were measured using a chi-square test.

III. RESULTS

Overall response rate was 95.6% (412/431x100). Majority of the study population were between the age category of >35-70 in months (96.8%). More female children have participated in the study (53.9%). The majority of the study population were Buddhist (75%) (Table 3). The majority of the study population were Sinhalese (85%) and participants were more from the MOH area D5 (51%) (Table 4).

The overall prevalence of obesity was 1.7% (95%CI: 1.69%-1.71%). The prevalence of obesity in MOH area 4 was 1.46%, while the prevalence of obesity in MOH area5 was 1.93%. The overall prevalence of overweight including obesity was 4.37% (95%CI: 4.36%-4.38%). The prevalence of overweight in MOH area 4 was 4.9%, while the prevalence of overweight in MOH area 5 was 3.9% (Table 5).

Prevalence of the overweight was higher among preschool children in the age category between 24-35 month old (23.1%) than in the age category between >35-70 month old (3.8%). There was a significant association ($p < 0.01$) between the overweight and the age of the study population. Prevalence of the overweight was higher among female preschool children (5.0%) than in male children (3.7%). There was no significant association ($p > 0.05$) between the overweight and the sex of the study population. Prevalence of overweight was higher among preschool children in MOH area D4 (4.9%) than MOH area D5 (3.9%). There was no significant association ($p > 0.05$) between the overweight and the permanent residence of the study population (Table 6).

The mean of the birth weight was 3.0 ± 0.1 kg. There was a significant association ($p < 0.01$) between the overweight and the birth weight of the study population. The mean weight at 6 months was 7.1 ± 0.1 kg. There was a significant association ($p < 0.01$) between the overweight and the weight at 6 months of the study population. The mean weight at 12 months was 9.0 ± 0.1 kg. There was no significant association ($p > 0.05$) between the overweight and the weight at 12 months of the study population (Table 7).

There was a significant association ($p < 0.001$) of the overweight with the WC, HC, and MUAC anthropometric measures of the study population. There was a significant association ($p < 0.001$) of the overweight with the weight to hip circumference ratio (WHR) and MUAC to height anthropometric indices of the study population. There was no significant association ($p > 0.05$) of the overweight with the weight circumference to height ratio (WHtR), Body Mass Index (BMI), and MUAC to the age of the study population.

IV. DISCUSSION

Recent studies have established that childhood obesity is an emerging global health problem (5). Childhood obesity would persist to adulthood obesity and are higher risk of developing NCDs at a younger age and premature death in life.

An alarming increase in preschool children obesity was noticed in South Asian countries in the recent past (12). In Sri Lanka, there are very few studies on the prevalence and the risk factors associated with preschoolers overweight and obesity.

The present study assess the magnitude of preschool children obesity and overweight in a defined community within a defined period of time. The magnitude was assessed by the identification of preschool children with their descriptive characteristics of overweight and obesity. To achieve such an objective, a cross-sectional study design was appropriate as it provided opportunities to obtain information by two approaches: 1. Descriptive in which the prevalence of a single variable was assessed. 2. Analytical in which its strengths of associations with other variables were tested by using a chi-square test. This data is useful for healthcare providers in assessing the importance of preschool children obesity and overweight as a public health problem. Moreover, it assessed the association of the overweight with anthropometric measures and anthropometric indices to determine the suitability of them to detect obesity and overweight in Sri Lankan preschool children. What had been assessed in the present study is the prevalence of obesity and overweight and the association of overweight among preschoolers (age between 2 and 5), but the critical period for the development of obesity and overweight was in gestational and in early infancy period (16), which was not attempted and thus the true associations may remain concealed.

The overall prevalence of preschool children overweight was 4.73% (including obesity) observed in the present study is higher than the prevalence rate of overweight reported by the Demographic Health Survey in 2006/2007 (1.3%), Jayatissa and Hossaine in 2009 (0.9%) and Jayatissa et al 2012 (0.7%) in their studies. However in the study done by Jayatissa et al 2012, the sample had consisted of a study population ($n=300$) from all 25 administrative districts of Sri Lanka and the study done by Jayatissa and Hossaine in 2009, the sample had consisted of a large study population ($n=2865$) from 9 districts from each of Sri Lanka's nine provinces and in the Demographic Health Survey 2006/2007, the sample too had consisted of a large study population ($n=6857$) from 20 administrative districts of Sri Lanka excluding 5 districts (Jaffna, Mannar, Vavuniya, Mullaitivu and Killinochchi) in Northern Province which may have had an impact on the findings. The other possible reasons for higher prevalence in this study was, since the study was done at preschool settings and the study sample may reflect a more affluent group and the trend of the increasing prevalence of overweight among preschool children is observed in developing countries.

The overall prevalence of preschool children obesity was 1.7% observed in the present study is lower than the annual rate reported by Mercedes et al 2010 (6.75%). Branca et al 2007, had been reported 16%-18% rates in their studies, where Gupta et al 2013, had been reported that the prevalence rates of preschool children obesity inclusive overweight is more than 15%.

In the present study inter-observer variation of anthropometric measurements were not assessed by taking repeated anthropometric measurements of the children due to limited time factor. Measurement errors with instruments, interviewer, and recall were too not assessed. Waist circumference and MUAC can be used as a single and simple screening tool for childhood obesity. Non-availability of the Sri Lankan cut-off values for preschool -aged children prevent its use in full length. Developing valid cut-off values would require a separate study.

V. CONCLUSIONS AND RECOMMENDATIONS

As a result of the health transition taking place in Sri Lanka, some risk factors and risk behaviors have clustered among the urban population, where the prevalence of overweight among preschoolers was relatively high. This study was showed the prevalence of preschool children overweight and associated factors to the overweight in the Colombo Municipal District 4 and 5, to make decisions regarding early intervention.

Abbreviations

CI: Confidence Interval,
MOH: Medical Officer of Health
OR: Odds Ratio PHMM: Public Health Midwives,
PHMM: Public Health Midwives,
RA: Research Assistant
WHR- Waist to hip circumference ratio
WHtR- Waist circumference to height ratio

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AVAILABILITY OF DATA AND MATERIALS

The datasets used to analyze in this study are available at the corresponding author on reasonable request.

AUTHORS CONTRIBUTION

KCMP has participated in the design of the study, coordinated data collection performed the statistical analysis, and drafted the version of the manuscript. MV has participated in the design of the study. MV has performed the statistical analysis and interpreted data. MV was helped to draft the manuscript. All two authors were read and approved the final manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance was obtained from the Ethics Review Committee (ERC), Faculty of Medicine, University of Colombo (Reference: EC-13-117). Informed written consent was obtained from each of the selected participants in the field during the study. Confidentiality was highly maintained, while handing over individual information. Administrative clearance was obtained from the Chief MOH of the Colombo Municipal Council and Director Western Province Preschool Unit. In addition, heads of the preschools were contacted and their concurrence was taken.

CONSENT FOR PUBLICATION

Not applicable

COMPETING INTERESTS

The authors were declared that they have no competing interests

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Second Author – Murali, V, Consultant Community Physician, Anti-filarial Campaign, Colombo, Sri-Lanka

Corresponding author: KCM Perera, Acting Consultant Community Physician, Epid Unit, Colombo, Sri Lanka.
 Email – chithranganieperea@yahoo.com

AUTHORS

First Author – Perera, KCM, Acting Consultant Community Physician in Community Medicine, Epid Unit, Colombo, Sri Lanka.

Table 1: Selection of clusters in each preschool in MOH area D4

| | Name of the preschool in MOH area D4 | Total number of children in each preschool | Total number of clusters in each preschool | Number of children in cluster 1 | Number of children in cluster 2 | Number of children in cluster 3 | Number of clusters selected to the study sample |
|----|---|---|---|--|--|--|--|
| 1 | Anula | 153 | 03 | 50 | 52 | 51 | 03 |
| 2 | A,B,C, school of early learning | 124 | 03 | 41 | 44 | 39 | 02 |
| 3 | Asian international | 121 | 03 | 40 | 39 | 42 | 02 |
| 4 | Texas international & daycare center | 62 | 02 | 32 | 30 | N.A. | 01 |
| 5 | Visaka | 32 | 01 | 32 | N.A. | N.A. | 01 |
| 6 | Kiddles | 30 | 01 | 30 | N.A. | N.A. | 01 |
| 7 | Sumudu | 30 | 01 | 30 | N.A. | N.A. | 01 |
| 8 | Sigithi-1 | 12 | 01 | 12 | N.A. | N.A. | 00 |
| 9 | Rose buds | 28 | 01 | 28 | N.A. | N.A. | 01 |
| 10 | Sri Bodhi raja | 20 | 01 | 20 | N.A. | N.A. | 00 |
| 11 | Pettles | 25 | 01 | 24 | N.A. | N.A. | 01 |
| 12 | Vidumina | 26 | 01 | 26 | N.A. | N.A. | 01 |

| | | | | | | | |
|----|-------------------------------|------------|-----------|----|------|------|-----------|
| 13 | Darmadutha | 17 | 01 | 17 | N.A. | N.A. | 00 |
| 14 | Star kids | 27 | 01 | 17 | N.A. | N.A. | 01 |
| 15 | Bright kids | 23 | 01 | 23 | N.A. | N.A. | 00 |
| 16 | Sigithi-2 | 25 | 01 | 24 | N.A. | N.A. | 01 |
| 17 | Bright spark | 22 | 01 | 14 | N.A. | N.A. | 00 |
| 18 | Shailo seventh day advents | 22 | 01 | 14 | N.A. | N.A. | 00 |
| 19 | Less on phone | 19 | 01 | 19 | N.A. | N.A. | 00 |
| 20 | Vasana | 23 | 01 | 24 | N.A. | N.A. | 00 |
| | Total | 841 | 27 | | | | 16 |

*N.A.-Not Applicable

Table 2: Selection of clusters in each preschool in MOH area D5

| Name of the preschool in MOH area D5 | Total number of children in each preschool | Total number of clusters in preschool | Number of children in cluster 1 | Number of children in cluster 2 | Number of children in cluster 3 | Number of children in cluster 4 | Number of children in cluster 5 | Number of clusters selected to the study sample |
|--------------------------------------|--|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---|
| 1 Visaka | 230 | 05 | 47 | 44 | 45 | 46 | 48 | 5 |
| 2 St.Lawrance | 206 | 05 | 43 | 40 | 41 | 40 | 42 | 4 |
| 3 Holy Family | 164 | 04 | 42 | 40 | 40 | 42 | N.A. | 03 |
| 4 Monart Internationala | 37 | 01 | 37 | N.A. | N.A. | N.A. | N.A. | 01 |

| I | | | | | | | | | |
|--------------|----------------------|------------|-----------|----|------|------|------|------|-----------|
| 5 | Havelock Gardinen | 30 | 01 | 30 | N.A. | N.A. | N.A. | N.A. | 01 |
| 6 | Shanthi | 25 | 01 | 25 | N.A. | N.A. | N.A. | N.A. | 01 |
| 7 | Pubudu | 19 | 01 | 19 | N.A. | N.A. | N.A. | N.A. | 00 |
| 8 | Isipathanara ma | 18 | 01 | 18 | N.A. | N.A. | N.A. | N.A. | 00 |
| 9 | Minobusang | 21 | 01 | 21 | N.A. | N.A. | N.A. | N.A. | 00 |
| 10 | Wonderkids | 16 | 01 | 16 | N.A. | N.A. | N.A. | N.A. | 00 |
| 11 | Sneha | 08 | 01 | 08 | N.A. | N.A. | N.A. | N.A. | 00 |
| Total | | 774 | 22 | | | | | | 15 |

*N.A.-Not Applicable

Table 3: Characteristics of frequency distribution by age, sex and religion of the study population

| Characteristics | Frequency | Percentage% |
|-------------------------|-----------|-------------|
| Age (in months) | | |
| 24-35 | 13 | 3.2 |
| >35-70 | 399 | 96.8 |
| Sex | | |
| Female | 222 | 53.9 |
| Male | 190 | 46.1 |

| Religion | | |
|-----------------|------------|--------------|
| Buddhist | 309 | 75.0 |
| Catholic | 57 | 12.8 |
| Hindu | 30 | 7.3 |
| Islam | 20 | 4.9 |
| Total | 412 | 100.0 |

Table 4: Characteristics of a frequency distribution by ethnicity and permanent residence of the study population

| Characteristics | Frequency | Percentage% |
|----------------------------|------------------|--------------------|
| Ethnicity | | |
| Sinhala | 350 | 85.0 |
| Tamil | 38 | 9.2 |
| Muslim | 16 | 3.9 |
| Other* | 08 | 1.9 |
| Permanent residence | | |
| MOH area D5 | 210 | 51.0 |
| MOH area D4 | 202 | 49.0 |
| Total | 412 | 100.0 |

*Includes Burgher and Colombo Chetty

Table 5: Prevalence of obesity and overweight among preschool children in Colombo Municipal District 4 and 5

| | Overweight including obesity % | Obesity% |
|--|---------------------------------------|-----------------------|
| Overall Prevalence | 4.37 (95% CI:4.36-4.38) | 1.7(95% CI:4.36-4.38) |
| Prevalence of Colombo Municipal District 4 | 4.9 | 1.46 |
| Prevalence of Colombo Municipal District 5 | 3.9 | 1.93 |

Table 6: The association between the overweight and the age, sex of the study population

| Characteristics | Overweight | % Non-overweight | % | Total | % | |
|----------------------------|------------|------------------|------------|-------------|------------|---|
| Age (in months) | | | | | | |
| | 03 | 23.1 | 10 | 76.9 | 13 | 100 |
| 24-35 | 15 | 3.8 | 384 | 96.2 | 399 | 100 |
| >35-70 | | | | | | |
| | | | | | | p=0.001 (OR)=7.7 95CI%: (1.9-30.8) |
| Sex | | | | | | |
| Female | 11 | 5.0 | 211 | 95.0 | 222 | 100 |
| Male | 07 | 3.7 | 183 | 96.3 | 190 | 100 |
| | | | | | | p=0.53 OR=0.7 95%CI: (0.3-1.9) |
| Permanent residence | | | | | | |
| MOH area D4 | 10 | 4.9 | 195 | 95.1 | 205 | 100 |
| MOH area D5 | 08 | 3.9 | 199 | 96.1 | 207 | 100 |
| Total | 18 | 4.4 | 394 | 95.6 | 412 | 100 |

Table 7: Characteristics of frequency distribution of the birth weight, the weight at 6 months and the weight at 12 months among the study population (in kg)

| Characteristics | Birth weight | Weight at6 months | Weight at 12months |
|-----------------|-------------------|---------------------|---------------------|
| Mean | 9.0 | 7.1 | 9.0 |
| SE | 0.1 $\chi^2=50.1$ | 0.1 $\chi^2=74.656$ | 0.1 $\chi^2=42.978$ |
| Median | 2.9 df=29 | 6.9 df=45 | 8.9 df=49 |
| Mode | 2.9 p=0.009 | 6.8 p=0.004 | 8.9 p=0.715 |
| SD | 0.4 | 0.9 | 0.8 |
| Skewness | 0.3 | 0.5 | 0.1 |
| Minimum | 1.3 | 4.3 | 5.1 |
| Maximum | 4.3 | 10.5 | 13.5 |
| Range | 3.0 | 6.2 | 8.4 |

