

Childhood Overweight: Unexpected Nutritional Outcome by Trained Community Health Workers in a Rural Setting in Kisumu County, Kenya

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Abstract: Globally, an estimated 19 million children are malnourished. The prevalence of child overweight is rising in Low and Middle-Income countries and is no longer associated with socio economic elite in the society. It predisposes children to adulthood obesity, psychological morbidity and increases the prevalence of non-communicable diseases. The potential of using Community Health Workers to implement the Timed and Targeted counselling intervention was evaluated in Kisumu County. Through home visits, trained CHWs targeted children below two years of age and gave their caregivers key nutrition messages that were most relevant during child's growth that enabled them make best possible nutrition choice. Child's overweight status were computed at baseline (before) and endline (after) at areas with and without the intervention. The study assessed the impact of the trained CHWs on 450 children. Child's age in months and weight in kilograms were obtained and overweight status (Weight- for-Age) computed based on WHO Z-scores. The mean age at baseline and endline were 12.35 and 11.85 months respectively and mean weight 9.33 and 8.6 kgs respectively. There was an increase in prevalence of moderate and severe overweight at intervention area to 10.89% from 3.79% and 4.95% from 3.79% respectively ($\chi^2= 21.54, p<0.001$). At comparative area, prevalence of moderate overweight dropped from 6.25% to 3.3% but prevalence of severe overweight increased to 3.3% from 0.78%. Bivariate analysis did not find any factor to be associated with overweight in the study areas. Trained CHWs failed to reduce the prevalence of overweight status of children. It is evident that childhood overweight is increasing even in areas where CHWs are implementing nutrition interventions. It is now a public health issue that needs urgent attention. Overweight interventions should focus on young children so as to avert the negative consequences associated with overweight in later years of life.

Key words: Overweight, Timed and Targeted counselling, Community Health Workers.

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I. INTRODUCTION

Overweight in young children is a worrying trend that is of public concern. It is estimated that 10% of the world's children are carrying surplus fat and are at risk of developing non communicable diseases (NCDs) before or later years of adult life^{1,2}. Studies have shown that the prevalence of childhood overweight has been significantly high in developing countries with the shift now moving towards the urban poor and rural areas thus indicating that it is no longer associated with the social elite in the society^{3,4}. It is evident that LMICs are struggling with its rise⁵⁻⁸. In the past decade, the prevalence has been high in urban areas of developed countries but recent research has shown that more cases are now being witnessed among the African Americans who are usually termed as poor and undernourished in the society⁷. According to World Health Organization(WHO), it is a worrying trend that requires urgent intervention^{7,9}. Traditionally, fat children were viewed as healthy children but excess fat is associated with childhood unhealthy complications¹⁰. In children like in adults, the risk factors associated with increased overweight are family history and bad lifestyle including physical inactivity, poor dietary practices and television watching¹¹⁻¹³. In Africa, childhood overweight could be attributed to the exposure to westernized-diets that is concurring with history of undernutrition¹ It predisposes individuals to adulthood obesity, psychological morbidity and premature mortality and highly associated with increase in prevalence of non-communicable diseases¹⁴. Consequently, it has been proved to be a predictor of adulthood death¹⁵. Most interventions in Sub Saharan Countries focus on undernutrition thus results to too few countries having data on overweight. There is limited information in Kenya even in areas with active nutrition

interventions. There is lack of nationally representative data on the prevalence of childhood overweight with few studies showing an emerging evidence among school aged children predominantly living in urban areas¹⁶. These rising trends have negative effects on health services.

Global trends are showing that 1% of all children in the world are likely to be overweight every year^{1,17}. Consequently, almost 10% of them develop Type 2 diabetes and other NCDs in later years and this is very costly for nations especially from LMICs^{1,18}. The health sectors in these countries are currently facing a lot of challenges with WHO estimating that health professionals account to only 67% of all health care work force in the world¹⁹. With the expanding population, rise in disease burden, escalating cost of training health professionals and low use of health services, health professionals are finding it hard to handle the increased work load in the few busy public facilities²⁰⁻²³. To bridge these gaps, Community Health Workers (CHWs) have been integrated into the health systems and they have been used widely as advocates of community rights and activists of fighting against inequalities^{22,24,25}. With their presence as implementers of interventions, there has been remarkable improvements in delivery of Primary Health Care services in LMICs²⁶⁻²⁸. Despite the challenges that they face such as heavy workloads, unexhausted time use, lack of clearly defined work schedules and formal trainings, they are determined to improve health outcomes of the underserved population in the communities that they serve^{22,29}.

The intervention.

Most governments in the world like Kenya have a duty to improve the health and nutritional status of its citizens. The existing CHWs from the Ministry of Health received specialized training on Timed and Targeted counseling (TTc) and implemented this intervention through home visits. The home visits were targeted to a time in early childhood when nutrition messages were most relevant so as to enable caretakers get a better understanding of nutrition issues and make best possible choice for their children who were aged below two years. The key nutrition messages given to caretakers at specific times during child's growth are summarized on Table 1 below. Home visits per household were done at least once a month. In order to assess the effectiveness of the TTc, a comparative area (Migori County) was selected in which they continued receiving services from the CHWs who did not receive TTc training. The two areas were selected and paired because of their similarities in population and community characteristics including socio cultural practices and beliefs. There was no other nutrition intervention in these study areas apart from TTc. This study assessed the impact of trained CHWs on the overweight status of children aged less than two years after the TTc intervention.

Table 1: Timed and Targeted strategy.

| Targeted time of child's age | Key message |
|-------------------------------------|------------------------------------|
| 0-6 months | Exclusive breastfeeding |
| 6 months to 24 months | Appropriate complimentary feedings |
| 6 months | Emphasize on Iron rich foods |
| 6 , 12, 18 months | Vitamin A supplementation |
| 6 to 24 months | Oral rehydration therapy |
| 0-24 months | Full immunization of age |
| 12 to 24 months | Deforming |

II. MATERIAL AND METHODS

The study recruited 450 children aged below two years from two study areas. A total of 258 were recruited at baseline where 132 were from intervention area and 126 from comparative area. At endline, 192 children were recruited with 101 from the intervention area and 91 from comparative area. Data was collected between 2014 and 2016.

Study duration:3 years

Study population: Children aged below two years from Kisumu and Migori Counties in Kenya.

Sample size calculation: This was calculated based on the prevalence of malnutrition in two studies with similar characteristics as those in the study areas. The sample size actually obtained from this study was 88 for each area but the study recruited 258 children at baseline (132 intervention area and 126 comparative area) and 192 at endline (101 intervention area and 91 comparative area). The level of significance was set at P=0.05.

Subjects and selection method: An approximate 20,000 children aged less than two years were in the study areas in the proportion of 2: 3: 3: 2 for ages 1 to 6 months, 6 to 12 months, 12 to 18 months and 18 to 24 months respectively. In each age strata, children were randomly selected into the study as summarized on Table 2 below. This was to ensure that all children got an equal chance of participating in the study.

Table 2: Sampled population per age strata

| Age in months | Baseline | | | Endline | | |
|---------------|-------------------|------------------|------------|-------------------|------------------|------------|
| | Intervention area | Comparative area | Total | Intervention area | Comparative area | Total |
| < 6 | 26 | 25 | 51 | 20 | 19 | 39 |
| 6 to <12 | 40 | 39 | 79 | 30 | 27 | 57 |
| 12 to <18 | 40 | 38 | 78 | 31 | 26 | 57 |
| 18 to <24 | 26 | 24 | 50 | 20 | 19 | 39 |
| Total | 132 | 126 | 258 | 101 | 91 | 192 |

Procedure methodology

Trained Research Assistants explained the purpose of the study to the caretakers of the children and requested them to assent on behalf of their children. Ethical approval and clearance was gotten from Moi University Institutional Research and Ethical Committee Approval number 0001567. A well-designed socio-economic status questionnaire was administered to the caretakers to collect information on mothers' and fathers' level of income and education; mother's marital status, type of housing and total number of house members in child's house. Each of the child's age was obtained from health records cards and weights taken thrice using SECA bathroom scale and mean extrapolated. In instances where children were irritable and or were not able to stand, guardians were weighed holding their children and then their own weights subtracted. Children were weighed with very light clothing and without shoes^{30,31}. Weighing scales were calibrated after every 10th child.

Statistical analysis

Using STATA version 13, data was summarized using descriptive statistics. Nutritional status was measured by overweight indice (Weight-for-Age) which was computed based on the Z-Scores derived from WHO reference standards³². A Z-score above ≥ 3 was categorized as severely overweight, between ≥ 2 and ≥ 3 moderate overweight and below < 2 were as normal³². The study compared the overweight status before and after the intervention in the study areas and used Chi- square tests to analyze the association between the overweight and independent variables while multinomial logistic regression determined the effect of overweight status on the independent variables within the two study areas. The level of significance was set at $P < 0.05$.

III. RESULT

The descriptive characteristics of 192 children (101 intervention and 91 comparative area) after the intervention were summarized on table 3 below. Children whose mothers were married recorded a frequency of 78.2% and 57% in the intervention and comparative areas respectively compared to the unmarried who accounted to 21.78% and 42.86% respectively. At the intervention area, 79.21% of women and 64.4% of fathers were earning less than Kenyan Shillings (Ksh.) 3,000 per month while 71.4% of mothers and 37 40.66% of fathers in comparative area were earning more than Ksh.3,000.00 per month. With the mother's level of education, 54.5% of them from intervention area had attained primary level whereas only 49.5% had attained secondary education from comparative area. A total of 61.4% of the families were living in permanent houses in intervention area with 72.5% reporting to be living in semi-permanent house in comparative area. The frequency of those living in rental houses, 60% and 28% were paying less than Ksh. 3000.00 per month in the intervention and comparative area respectively. A total of 45.05% and 21.78% were living in their own houses in comparative and intervention areas. The mean number of people in a household was 6 with 4 adults and 7 children in intervention area and 5 with 4 adults and 6 children in comparative area.

Table 3: Demographic Characteristics

| Characteristic | Study area | | Statistics | |
|----------------------|-----------------------------|---------------------------|-------------------------|---------|
| | Intervention (%) (N=101) | Comparative (%) (N=91) | chi ² -value | P-value |
| Marital status | | | | |
| Single/divorce/widow | 21.78 | 42.86) | 9.8084 | 0.002 |
| Married | 78.22 | 57.14) | | |
| Mother income(Ksh) | | | | |
| <2,999 | 79.21 | 28.57 | 49.6349 | <0.001 |
| >3,000 | 20.79 | 71.43 | | |
| Father income(Ksh) | | | | |
| <2,999 | 64.36 | 59.34 | 0.5111 | 0.475 |
| >3,000 | 35.64 | 40.66 | | |
| Mother Education | | | | |
| ≤Primary | 54.46 | 15.3 | 32.6580 | <0.001 |
| Secondary | 30.69 | 49.45 | | |
| Tertiary | 14.85 | 34.16 | | |
| Type of housing | | | | |
| Semi-permanent | 38.61 | 72.53 | 22.2179 | <0.001 |
| Permanent | 61.39 | 27.47 | | |
| Size of housing | | | | |
| Single | 1.10 | 29.70 | 28.9301 | <0.001 |
| Double | 40.66 | 28.71 | | |
| ≥3 rooms | 58.24 | 41.58 | | |
| Rent amount (Ksh) | | | | |
| None | 21.78 | 45.05 | 20.2017 | <0.001 |
| <3000 | 60.40 | 28.57 | | |
| >3001 | 17.82 | 26.37 | | |
| Mother own phone | | | | |
| Yes | 92.08 | 98.9 | 4.9863 | 0.026 |
| No | 7.92 | 1.1 | | |

Table 4: Indicates the mean age and weight at the baseline and endline both at intervention and comparative areas. At baseline, mean age in months and weight in kilograms for 132 children at intervention area was found to be 12.35 (11.15, 13.46) and 9.33 (8.78, 9.89) respectively. The youngest child was 0.46 months while the oldest was 23.59 months. At comparative area where 126 children were recruited, mean age in months and weight in kilograms were 11.67 (10.59, 12.76) and 8.68 (8.29, 8.75) respectively. The youngest child was 0.53 months while the oldest was 23.56 months. Their weights ranged from 3.08 to 14.00 kilograms

At endline, mean age in months and weight in kilograms for 101 children at intervention area were 11.67 (10.59, 12.76) and 8.68 (8.29, 8.75) respectively. The youngest child was aged 0.53 months while the oldest was 23.59 months. At the comparative area with 91 children, mean age in months and weight in kilograms were 12.33 (10.06, 13.60) and 11.78 (11.05, 12.50) respectively. The youngest child was aged 1.58 months while the oldest was 23.89 months. The weights ranged from 4.80 and 18.00 kilograms

Table1 : Mean estimation of anthropometric measurements at baseline and endline.

| Baseline | | | | | | | | | | | | |
|--------------|---------------------------|-----|--------|----------------|-----|------|--------------------------|-----|--------|----------------|-----|------|
| Variable | Intervention area (n=132) | | | | | | Comparative area (n=128) | | | | | |
| | Mean | SD | StdErr | CI | Min | Max | Mean | SD | StdErr | CI | Min | Max |
| Age (Months) | 12.3 | 7.0 | 0.61 | 11.15 13.56 | 0.4 | 23.5 | 11.6 | 6.2 | 0.55 | 10.59 12.76 | 0.5 | 23.5 |
| Weight (kg) | 9.33 | 3.2 | 0.28 | 8.78 9.89 | 2.7 | 16.4 | 8.6 | 2.2 | 0.20 | 8.29 8.75 | 3.0 | 14.0 |
| Endline | | | | | | | | | | | | |
| Variable | Intervention area (n=101) | | | | | | Comparative area (n=91) | | | | | |
| | Mean | SD | StdErr | CI | Min | Max | Mean | SD | StdErr | CI | Min | Max |
| Age (Months) | 11.6 | 6.2 | 0.55 | 10.59 12.76 | 0.5 | 23.5 | 12.3 | 6.1 | 0.64 | 11.06 13.60 | 1.5 | 23.8 |
| Weight (kg) | 8. | 2.2 | 0.20 | 8.29 8.75 | 3.0 | 14.0 | 11.7 | 3.4 | 0.36 | 11.05 12.50 | 4.8 | 18.0 |

Prevalence of overweight at baseline in study areas

The prevalence of moderate and severe overweight children at baseline at intervention area as indicated on table 5 below were equal at 3.8% compared to those at the comparative area that were 6.3% for moderately and 0.8% for severe overweight. There was no significant difference between the two study areas at baseline [$\chi^2=8.726$, $P=0.068$].

Table 5: Prevalence of overweight at baseline in both areas

| Overweight status | Nutritional status at baseline (%) | | Statistics | |
|---------------------|------------------------------------|---------------------|------------|---------|
| | Intervention (n=132) | Comparative (n=128) | Chi | p-value |
| Normal | 92.42 | 92.97 | 8.7263 | 0.068 |
| Moderate Overweight | 3.79 | 6.25 | | |
| Severe Overweight | 3.79 | 0.78 | | |
| Total | 100.00 | 100.00 | | |

Prevalence of overweight at Endline

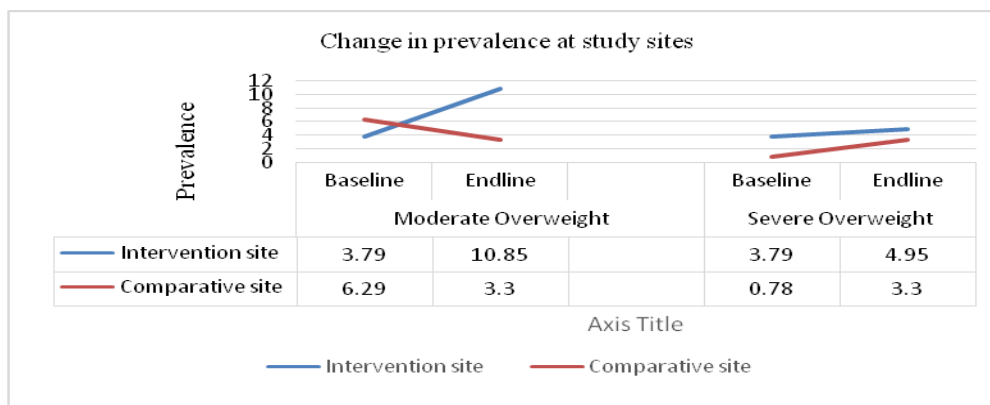
After implementation of TTc by CHWs, the prevalence of severe and moderate overweight among the children whose caregivers received the key nutrition messages were 4.95% and 10.89% respectively while those who did not receive the intervention recorded a prevalence of 3.3% each. This is as shown on table 6 below. There was significant difference between the two study areas after the intervention [χ^2 13.26, $p=0.01$].

Table6: Prevalence of overweight at Endline

| Overweight status | Nutritional status at Endline (%) | | Statistics | |
|---------------------|-----------------------------------|--------------------|------------|---------|
| | Intervention (n=101) | Comparative (n=91) | Chi | p-value |
| Nutritional status | | | | |
| Normal | 84.16 | 93.4 | 13.26 | 0.010 |
| Moderate Overweight | 10.89 | 3.3 | | |
| Severe Overweight | 4.95 | 3.3 | | |
| Total | 100.00 | 100.00 | | |

Change in prevalence of overweight in study areas

There was an increase in severe and moderate overweight status among the children who received the TTc intervention from 3.79% to 10.89% and 3.79% to 4.95% respectively as shown in Figure 1 while at the comparative area, the prevalence of moderate overweight dropped from 6.25% to 3.3% and that of severe overweight increased from 0.78% to 3.3%. There was significant difference between the two study areas before and after TTc intervention [χ^2 33.38, $p=0.001$].



Chi=33.38 p=0.001

Figure 1: Change in prevalence of overweight at study areas

Bivariate analysis

Bivariate analysis with Chi-square statistics was performed to test the independence of distribution between overweight status and the independent variables at the intervention and comparative areas respectively are shown in table 7 below. None of the independent variable was found to be associated with overweight status in either of the areas as all the p value were all greater than 0.05. The associations between the variables and overweight was to be considered statistically significant if $p < 0.05$.

Table 7: Relationship between overweight status and independent variables in intervention area

| Variable | Overweight status at Intervention area (n=101) | | | Statistics | | Overweight status at Comparative area (n=91) | | | Statistics | |
|-----------------------------------|--|--------------|-------------|------------------|---------|--|--------------|-------------|------------------|---------|
| | Normal (%) | Moderate (%) | Severe (%) | Chi ² | P-value | Normal (%) | Moderate (%) | Severe (%) | Chi ² | P-value |
| Sex | | | | | | | | | | |
| Female | 82.35 | 9.8 | 3.92 | 1.48 | 0.83 | 71.74 | 6.52 | 4.35 | 5.33 | 0.25 |
| male | 76.00 | 12.00 | 6.00 | | | 75.56 | 0.00 | 2.22 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |
| Age group (months) | | | | | | | | | | |
| < 6 | 95.00 | 5.00 | 0.00 | 14.29 | 0.28 | 78.95 | 0.00 | 5.26 | 15.37 | 0.22 |
| 6-12 | 66.67 | 10.00 | 10.00 | | | 81.48 | 0.00 | 0.00 | | |
| 13-18 | 83.87 | 12.9 | 0.00 | | | 61.54 | 3.85 | 7.69 | | |
| 19-24 | 75.00 | 15.00 | 10.00 | | | 73.68 | 10.53 | 0.00 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |
| Mother's marital status | | | | | | | | | | |
| Single | 86.36 | 4.55 | 9.09 | 3.58 | 0.46 | 87.18 | 0.00 | 2.56 | 7.64 | 0.10 |
| Married | 77.22 | 12.66 | 3.8 | | | 63.46 | 5.77 | 3.85 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |
| Mother's education | | | | | | | | | | |
| ≤ Primary | 78.18 | 10.91 | 5.45 | 6.59 | 0.58 | 78.57 | 0.00 | 0.00 | 10.38 | 0.23 |
| Secondary | 83.87 | 9.68 | 6.45 | | | 68.89 | 0.00 | 4.44 | | |
| Tertiary | 73.33 | 13.33 | 0.00 | | | 78.13 | 9.38 | 3.13 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |
| Mother's Income level(Ksh) | | | | | | | | | | |
| <3000 | 80.0 | 12.5 | 5.00 | 6.82 | 0.14 | 84.62 | 0.00 | 3.85 | 4.30 | 0.36 |
| >3001 | 76.1 | 4.76 | 4.76 | | | 69.23 | 4.62 | 3.08 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |
| Father's Income level | | | | | | | | | | |
| <3000 | 76.92 | 12.31 | 6.15 | 1.90 | 0.75 | 79.63 | 0.00 | 3.7 | 8.07 | 0.08 |
| >3001 | 83.33 | 8.33 | 2.78 | | | 64.86 | 8.11 | 2.7 | | |
| Total | 79.21 | 10.89 | 4.95 | | | 93.40 | 3.33 | 3.33 | | |

IV. DISCUSSION

TTC intervention implemented by CHWs through home visits had several key messages that targeted early childhood with an aim of improving child nutritional status including reducing the rates of overweight. Studies have proofed that home-based intervention including use of CHWs have resulted to improved nutrition knowledge thus enabling caretakers make best choices on nutrition issues thus leading to weight loss among children^{33,34}. Findings from this study however showed an increase in prevalence of both moderate and severe overweight to 11% from 4% and 5% from 4% respectively in the area with trained CHWs while the comparative area recorded a drop in prevalence of moderate overweight to 3% from 6% but an increase in severe overweight was observed from 1% to 3%. CHWs gave key nutrition messages at different stages of growth as steps to reducing overweight but the results found were negative thus challenging to attribute to the intervention. Other studies have documented that challenges like communication between the CHWs and the caregivers could be some of the barriers that might resulted to failure by CHWs in such interventions³⁵. As much as the children aged below were used in this study, their rapid growth may have also dominated the effect of TTC and that none of the key messages except exclusive breastfeeding has ever been assessed either alone or with other interventions on effectiveness of weight reduction³⁶. Prevalence in these two study areas were generally low thus concurring with other study findings indicating that prevalence of overweight children in African countries being low compared to those from developed countries whose prevalence have been as high as between 18%

and 20%^{37,38}. Latest survey from KDHS 2014 had indicated that only 11% of Kenyan children of ages below two years were overweight³⁹. The 1998 WHO report predicted an accelerated increase in overweight as endemic in both developed and developing countries. It also had further warned that in future years overweight would substitute common illnesses, undernutrition and other infectious diseases⁴⁰. True to this, children from these countries are showing declining trends in undernutrition with drastic increase in overweight with Africa prediction rising from 8.5% in 2010 to 13% by 2020⁴¹⁻⁴³. A study in England on households from low socio economic status that employed education as strategy of reducing junk food and increasing physical activity among the young and adolescent children resulted to an increase in overweight by almost 18%⁴⁴. Another study in the USA showed an increase of childhood overweight from 14.9% to 17% after 9 years of follow up⁴⁵. Comparisons in childhood overweight have shown that those living in rural areas in countries like Latin America have recorded a prevalence of 4.4% followed by Africa at 3.9% and Asia at 2.9%⁴⁶. It is therefore evident that childhood overweight is still high in developed countries but there is an accelerated rise of the same in developing countries and the trend is even being observed among the rural poor^{5,44,47}. It is also apparent in research studies where nutrition interventions are being implemented. Follow up studies conducted in LMIC found a rise in childhood overweight from 8.1% in 1980 to 12.9% in 2013⁴⁸ and the survey by KDHS also documented an increase in overweight among the similar population from 6% in the 2008/09 to 11% in 2014^{48,39,49}. Most nutrition intervention in developing countries have been focusing on undernutrition and have overlooked overweight and this might be the main contributor to the rapid increase. Overweight children are likely to be overweight later in life and chances of developing non-communicable disease at a young age are also very high. It is associated with obesity, early death and disability and research have found that overweight before 10 years of age might likely lead to severe obesity at later life³³.

V. CONCLUSION

It was evident that there was an increase in childhood overweight in Kisumu county, a rural setting in Kenya. A county where CHWs were implementing a nutrition intervention. This study therefore recommends future research studies that focus on overweight that target young children as is the window period of opportunity to prevent complications associated with overweight later in life.

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