


Monitoring BMI Trends in a Midwest Regional Head Start Population: The Results of a Healthy Lifestyle Intervention

Journal of Primary Care & Community Health
Volume 11: 1–6
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DOI: 10.1177/2150132720962866
journals.sagepub.com/home/jpc


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Abstract

Background: Childhood obesity represents a public health crisis in the United States. Thus, focusing on early childhood is crucial to modify the consequences associated with obesity. The Food and Fitness Initiative (FFI) is a community-based wellness program implemented in Northeast Iowa since 2009. FFI focuses on healthy eating and physical activity. Our aim is to describe the impact on body mass index (BMI) after implementing FFI in a Northeast Iowa Community Action Head Start (HS) population. **Methods:** Retrospective BMI data was collected from all children attending 14 HS sites from 2012 to 2018. Children with BMI measurements during July to December of the first year in HS were included in the study. Follow-up data the second year in HS was obtained. Overweight and obesity prevalence, as well as, BMI changes between year 1 and 2 in HS were analyzed. **Results:** Data from 1013 children were collected, 850 (84%) had qualifying BMI measurements during their first year in HS and 352 of those children (41%) had follow-up data in their second year. There was a decrease in BMI between years 1 and 2 in HS that approached statistical significance ($t = 1.83$, $P = .07$, $d = .10$). There were no statistically significant changes in the percent of overweight (Wald $\chi^2 = .50$, $P = .48$) or obese (Wald $\chi^2 = 1.71$, $P = .19$) children between the first and second year. **Conclusion:** The FFI wellness program can be feasibly integrated into the HS curriculum and shows promising short-term results in improving BMI, but not to a statistically significant level when evaluated over 1 year.

Keywords

obesity, children, early childhood, head start, community interventions

Date received: 24 July 2020; revised: 2 September 2020; accepted: 4 September 2020

Background

Childhood obesity continues to increase in prevalence and is a public health crisis in the United States.¹ According to the 2015-16 National Center for Health Statistics 13.9% of preschool-aged children in the United States are obese.² Type 2 diabetes, hypertension, hypercholesterolemia, and other chronic health problems are just some of the consequences that occur as a result of obesity, and the prevalence of these conditions is also increasing.^{3,4}

Early childhood is a critical period in a child's life.⁵ The "first 1000 days" is considered the most crucial for the introduction of pathophysiological mechanisms leading to childhood obesity.⁶ Baidal et al⁷ and Blake-Lamb et al⁸ analyzed risk factors in the first 1000 days of life, concluding that healthy infant weight gain and healthy nutrition

recommendations could lead to positive results in prevention programs. Thus, early childhood interventions could be the key to addressing this problem.

Overweight is defined as body mass index (BMI) above the 85th percentile and below the 95th percentile and obesity is defined as BMI at or above the 95th percentile.⁹ Children, who are overweight or obese by preschool age, are likely to be obese in adolescence.¹⁰ In addition, BMI trajectories

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before age 5 years can predict future risk for obesity¹¹; therefore, it is important to target children in Head Start and preschool when considering prevention programs.

Head Start programs promote school readiness of children from birth to age 5 years, from low-income and high-risk families by supporting their development. These programs target education as well as physical and emotional health by utilizing nutrition education, health screenings, and parent involvement with services. These interventions lead to positive parenting practices, health improvement, and improved academic progress.¹²

Community-based, family centered healthy lifestyle programs are effective interventions for preventing or treating child obesity and improving healthy habits, if implemented with high intensity and sufficient duration.^{13,14} While interventions in Head Start and Preschool settings are an important part of the strategy to decrease childhood obesity, little is known about the impact on BMI of integrating healthy lifestyle community interventions into the established programming. The few published studies of obesity interventions in the Head Start settings have shown mixed results. Both Texas Childhood Obesity Demonstration Study and Hip Hop to Health Study showed a decrease in children's BMI after 2 years of intervention.^{15,16} On the contrary, The Growing Healthy Study in rural Michigan failed to improve obesity prevalence or obesity related behavior after a 1 year intervention.¹⁷

Families participating in Northeast Iowa Community Action Head Start Programs (HS) have been the recipients of multiple healthy lifestyle interventions since 2013, introduced by the NE Iowa Food and Fitness Initiative (FFI).¹⁸ This initiative has focused on healthy food intake, increased physical activity and decreased screen time. In 2017 Toussaint et al¹⁹ published findings that showed that after 2 to 6 year of FFI exposure, as compared with 1 year or less; children from kindergarten to fifth grade had a significantly smaller increase in BMI level. There is no published data regarding the impact of the FFI on NE Iowa children participating in Head Start.

The rationale of this study is to evaluate a multi-environment healthy lifestyle intervention on weight status in a high-risk population of children and families in HS. Early childhood is a critical period to combat obesity and it is important to evaluate the effectiveness of community-based healthy lifestyle interventions which could be replicated and spread to other early childhood settings.

Methods

Northeast Iowa Food and Fitness Initiative

Supported by W. K. Kellogg Foundation since 2009, FFI developed strategic wellness plans and policies to promote healthy eating, physical activity and addressed healthy

equity within high risk/low-income families. Advocates, policy-makers, school and community leaders, and parents joined together to create a common vision for this initiative.¹⁸ FFI served more than 100 000 people from rural communities of 6 adjacent counties, to promote access to healthy, locally grown foods; and numerous opportunities for physical activity within the region. During the study time period, the initiative served children in 82 classrooms including school districts, Head Starts and early childhood sites.¹⁷

As part of the strategy, since 2012, HS caregivers were encouraged to provide healthy food and active play, ensuring healthy lifestyle and growing environments. HS curricula included Farm to Early Care and Education (F2ECE), a nutrition education program funded by FFI in 2013. This program used resources from the United States Department of Agriculture Farm to Preschool and National Farm to Preschool²⁰ with the objective of developing healthy eating habits while achieving kindergarten readiness. F2ECE started as a pilot in 5 HS classrooms in 2013 and was implemented in 2014 in 14 HS sites.

During 2013-14, HS new regional wellness policies were implemented to meet national recommendations. These included the following requirements: (1) 60 minutes of physical activity per day, (2) no sugar-sweetened beverages and limited juice, and (3) 30 minutes or less of screen time per day. In 2015 the new F2ECE curriculum, called "Together We Grow Healthy Kids," provided sourcing local food items for snacks and meals, seasonal menus, family resources for cooking, food of the month posters, and teachers toolkits. Later on, in 2016, HS parents were required to complete monthly healthy lifestyle activities at home to ensure more family engagement, including recipes from F2ECE. Finally, monthly family gatherings focused on healthy lifestyle were implemented in 2017. The timeline of these interventions is summarized in Figure 1.

Participants

Data from all children participating at 14 HS in 7 counties exposed to FFI from 2012 to 2018 were collected. No exclusions for sex/gender, race/ethnicity or underlying medical conditions, were made. Six cohorts of children entering HS were analyzed between July 2012 and June 2018. Children from each cohort spent a minimum of 1 and a maximum of 2 years in HS.

Since our study utilized de-identified data, we were not able to directly obtain sociodemographic information on the study population. According to publicly available data for 2018, there were 228 families with children enrolled in HS, 51% of which were single parent families. Parents' education varied from: more than a high-school degree (38%), high school degree (50%), and less than a high school degree (11%). Out of 111, 2 parent families 50% of parents were both employed, 41% had only 1 parent employed, and

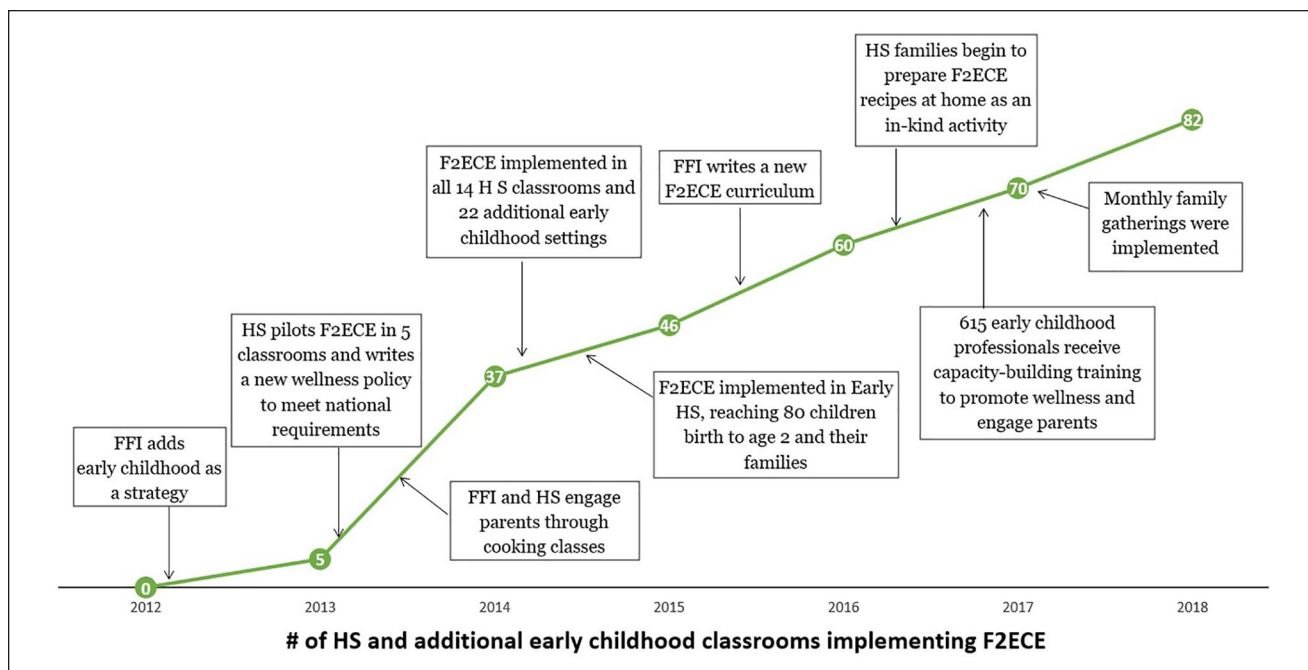


Figure 1. Timeline of NE Iowa Head Start healthy lifestyle interventions.

Abbreviations: FFI: Northeast Iowa Food and Fitness Initiative; F2ECE: Farm to Early Care and Education; HS: Northeast Iowa Community Action Head Start.

9% were both unemployed. In 117 single parent families, 63% were employed. All families received federal or other assistance, the majority from Supplemental Nutrition Assistance Program and Special Supplemental Nutrition Program for Women, Infants, and Children. Children aged 2 to 5 years could participate, but 85% of involved children were aged 3- or 4-years. The race of participating children was 70% Caucasian, 10% biracial, 4% African-American, and 16% other. The primary language was English in 90% and Spanish in 9% of families.²¹

Measurements

A majority of height and weight measurements were obtained by HS staff using portable stadiometers and digital scales. Some children had height and weight measurements from previous medical appointments. The BMI (kg/m^2) and BMI percentiles were calculated by HS staff using ChildPlus software.²²

Retrospective data were collected and collated by a research assistant (CH), supervised by HS staff and FFI staff onsite, and included: (1) Head Start site location, (2) sex, (3) academic year of both entering and exiting Head Start (4) date and age (in days) for every height and weight measurement throughout both years.

Data were manually entered in a secure password protected excel datasheet and then de-identified for the research team. This study was determined to be exempt under 45 CFR

46.101(b) (4) by the Luther College Institutional Review Board.²³ The Human Ethics Approval number was 2019_14.

Procedures

The BMI for each child was obtained between July and December of their first year in Head Start. If a child did not have a BMI measurement during this time period, they were excluded from the study. For all children included in the study, investigators obtained follow-up BMI data between July and December of their second year in HS. If children did not have follow-up BMI data measured during this time period, then they were not included in the follow-up cohort. If more than 1 BMI measurement was available during either the first- or second-year measurement period, then the first measurement obtained was utilized for the study.

Analysis

Data were manually entered, into a password protected Excel file. Statistical Package for the Social Science (SPSS) version 25 was used to conduct statistical comparisons. Mixed model analyses of variance were used to examine continuous raw BMI scores and generalized estimating equations were used to examine overweight and obesity outcomes. In both cases the effects of time on outcomes were examined first and then the effects of cohort year were examined to determine if it moderated the

Table 1. BMI Change Between Year 1 and 2 Across Head Start Population.

Year	Total new subjects to HS	Mean age of initial BMI (yr.)	Mean initial BMI	Mean age for F/U* BMI (yr.)	Mean F/U* BMI
2012-13	26	3.43	16.52	4.56	16.40
2013-14	51	3.72	16.67	4.66	16.51
2014-15	64	3.61	16.69	4.57	16.85
2015-16	66	3.64	16.67	4.60	16.48
2016-17	70	3.58	16.55	4.54	16.25
2017-18	75	3.52	16.96	4.53	16.73
Total	352	3.59	16.70	4.57	16.55

*F/U data refers to BMI data the second year in HS.

changes across time. Data met assumptions for statistical tests and statistical significance was set at $P < .05$.

Results

Data was obtained from all 14 HS sites exposed to FFI. There were a total of 1013 children in HS between 2012 and 2018. There were 850 (84%) children who had at least 1 BMI assessment between July and December of their first year in HS. Of these children, 352 children (41%) had follow up data during their second year in the program. For many children follow-up data was not available as they were no longer in the program. In children who had follow-up, there was a decrease in BMI the second year in Head Start that approached statistical significance ($t=1.83$, $P=.07$, $d=.10$) (Table 1). Changes in BMI between the initial and follow-up measurements did not vary by year ($F=.45$, $P=.85$, $\eta_p^2=.01$).

Overweight and obesity prevalence were analyzed in HS population at the beginning of each school year. The prevalence of overweight and obesity status for the 352 children with follow up data are shown in Table 2. There were no statistically significant changes in the percent of overweight (Wald $\chi^2=.50$, $P=.48$) or obese (Wald $\chi^2=1.71$, $P=.19$) in all children in the study between years 1 and 2 in HS. Changes in percentage of children categorized as overweight (Wald $\chi^2=1.98$, $P=.85$) or obese (Wald $\chi^2=2.18$, $P=.82$) between the initial and follow-up measurements did not vary significantly by study year.

Discussion

We analyzed the impact of FFI, a community-based wellness policy integrated into the HS curricula, on BMI and found a trend for improvement, but not to a statistically significant level between the first and second year in children enrolled in HS. The percentage of children who were overweight or obese was also stable. Neither of these outcomes was moderated by the year of participation in the HS program. Hence, longer term follow-up may be necessary to evaluate the impact of this intervention.

Interventions in critical moments of growth and development can reduce the risk for chronic conditions like obesity. However, most current efforts only focus on diet and behavioral changes at the individual level.⁸ High intensity, family centered and long-term interventions are the most effective in combatting obesity,^{12,13} however only a few published studies have evaluated Head Start initiatives. The Texas Childhood Obesity Research Demonstration Study¹⁵ showed that children across Head Start centers in Austin improved their BMI z-scores after receiving Coordinated Approach to Child Health Early Childhood (CATCH EC)²⁴ a 2-year program with nutritional and behavior modifications in both the home and Head Start settings. CATCH EC curriculum included weekly interactive lessons, stories, games and songs; and activities linking multiple areas of learning like language, math and science. Thirty minutes of daily physical activities were implemented with indoor and outdoor activities; and parent health tips were sent monthly. Similarly, F2ECE-curriculum includes activities related to Science, Technology, Engineering, Art and Math; however, it is integrated into the regular HS curriculum, The Creative Curriculum²⁵; and implemented daily. F2ECE integrates learning across domains and promotes hands on exploration and discovery while drawing on children's interests. Sixty minutes of daily physical activity, monthly parent tips, local food celebrations and family cooking nights, are also part of the strategy. On the other hand, a 2-year study in Chicago,¹⁴ Illinois of the 14 week Hip-Hop to Health Program at 12 Head Starts also demonstrated that the intervention group BMI rate increase was less than the control group at 1 and 2 year follow up. This program involved 40-minute interventions (20 minutes of physical activity and 20 minutes of a lesson that introduced healthy eating) 3 times a week. The F2ECE curriculum in HS differed from Hip Hop to Health curriculum in that it was implemented over a longer time period and was embedded into the regular curriculum, but showed no changes in BMI in children after 1 year follow up.

Similar to the results of this study, the Rural Healthy Study¹⁶ in rural Michigan Head Start programs failed to improve obesity prevalence or obesity related behaviors after 1 year follow up. The study compared the use of

Table 2. Overweight and Obesity Prevalence Among Head Start Population Enrolled 2 Years.

Years	Total subjects	Overweight initial	Obesity initial	Overweight F/U	Obesity F/U
		Y 1	Y 1	F/U	F/U
2012-2013	26	1 (4%)	4 (15%)	4 (15%)	3 (12%)
2013-2014	51	11 (22%)	9 (18%)	8 (16%)	9 (18%)
2014-2015	64	8 (13%)	17 (27%)	9 (14%)	14 (22%)
2015-2016	66	13 (20%)	14 (21%)	11 (17%)	12 (18%)
2016-2017	70	12 (17%)	12 (17%)	14 (20%)	8 (11%)
2017-2018	75	9 (12%)	17 (23%)	9 (12%)	16 (21%)
Total	352	54 (15%)	73 (21%)	55 (16%)	62 (18%)

evidence-based obesity prevention behaviors in Head Start along with adding Preschool Obesity Prevention Series²⁶ and the Incredible Years Series.²⁷ Even though some of these previous studies of obesity interventions in Head Start populations show positive results in decreasing BMI, the study periods were typically longer than 1 year and none of these programs were integrated into the regular Head Start curriculums. Another difference is that these previous studies were in minority populations, with more than 50% participants were Hispanic or African American; as opposed to our population which was predominately Caucasian. Toussaint et al¹⁸ also showed positive results after 2 years, but not 1 year, of exposure to FFI curriculum, in elementary school-aged children in NE Iowa. These findings support the idea that for long term interventions, like FFI, BMI levels need to be tracked for multiple years to understand their level of effectiveness. Our study only analyzed BMI changes after 1 year of exposure to F2ECE curriculum as children only participated in the program for 2 years with BMI measurements occurring 1 year apart; thus, lack of significant changes could be explained by the short time period of the assessment. The trend may be due to random variations or to small changes in population prevalence as a study of children in the Special Supplement Nutrition Program for Women, Infants and Children in Iowa, showed no increase in obesity prevalence in the same time period as our study.²⁸

There are several limitations to this study. First, we only had follow-up data available for 41% of the children. This could be explained by the fact that many children in our study cohort only spent 1 year in HS and then started kindergarten, and reflects the nature of children enrolled in HS who are often moving to different homes and communities for financial- and work-related reasons. Second, there was no control group of students that did not receive the FFI intervention due to the retrospective design of the work. A third limitation is that our study population was limited to 1 Head Start Program which consisted of mostly a Caucasian student population and therefore it is unknown how these study findings apply to more diverse populations. A fourth limitation to this study is the inability to identify or control the dose of delivered/received FFI

initiative. A last limitation was variance in how the BMI measurements were made. BMI data was obtained from different staff using different instruments at each HS site, and some BMI measurements were made in the clinical setting. In spite of these limitations, this study is unique in that it evaluates the impact of a real-world community-based intervention that can be feasibly integrated and sustained within Head Start Programming. There is a paucity of knowledge regarding the outcomes of these regional public health obesity intervention initiatives in high risk populations and we were able to capture data from a large cohort of children in a regional Head Start network.

Conclusion

In summary, a community-based, wellness policy implemented into HS programming showed a small trend toward improvement in BMI between year 1 and 2 of programming but not to a statistically significant level. Longer-term follow-up is needed to determine if obesity interventions in the HS setting can bring positive improvement in BMI. Further research should focus on how integrated curriculums in HS settings can modify obesity and overweight prevalence in this high-risk population.

Acknowledgments

We would like to thank the W. K. Kellogg Foundation, Northeast Iowa Food and Fitness Core Partners and Luther College Center for sustainable Communities for their financial support of the FFI initiative. Our study activities were co-funded by the Mayo Clinic Center for Clinical and Translational Science (CTSA) and the Mayo Clinic Children's Research Center. This study was supported by CTSA Grant Number UL1 TR002377 from the National Center for Advancing Translational Science (NCATS). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH. We would also like to thank Northeast Iowa Head Start staff, including Sharon Burke and Jada Bahls-Kargalskiy, for their collaboration and support of the project. We would like to acknowledge the nursing students of Luther College who were involved in the data collection for the study. Special thanks to Ann R. Mansfield and Haleisa Johnson from Northeast Iowa Food and Fitness Initiative for their role in study coordination for this project.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.


Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by National Center for Advancing Translational Science (grant number UL1TR002377).

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