DOI: https://doi.org/10.53350/pjmhs22167750

ORIGINAL ARTICLE

Determination of the Impact of Nutrition Specialist-Led Treatments on Paediatric Weight Management Objectives Such as BMI, BMI Z Score, and Waist Circumference

LATIF ULLAH KHATTAK[1], ABDULFATTAH OMAR[2], HINA MANZOOR[3], RUBINA KOUSAR[4], TALHA SHABBIR[5], AHMAD MUMTAZ BANDAY[6]

[1]*Public Health Consultant, Alelaj Hospital Wah Cantt*
[2]*Department of English, College of Science & Humanities, Prince Sattam Bin Abdulaziz University, Saudi Arabia*
[3]*Poonch medical college Rawalakot*
[4]*Medical Officer, DHQ Haveli AJK*
[5]*Medical Officer RHC, Kahori, AJK*
[6]*PG Radiology, SKBZ CMH Muzzaffarabad*
Correspondence to: Latif Ullah Khattak, Email: dlukhattak@gmail.com

ABSTRACT

Aim: The information that comes from nutrition experts to multicomponent pediatric weight maintenance intervention groups hasn't been assessed despite the fact that they are regarded as essential team members. This methodical study's objective was to determine the relative efficacy of interventions on pediatric weight maintenance results, such as body mass index, BMI z score, in addition waist circumference, for procedure teams that contain a nutrition specialist in comparison to procedure workgroups that do not contain the nutrition specialist.

Methods: The outcomes of an extensive literature seek as well as a structured and more directed keep updating of that search were incorporated into the concept. These searches should include a search of controlled studies that had been accepted for publication among October 2020 and September 2022, which was carried out as part of the 2020 Nephrology Weight Management Notification Scheme of Institute of Education of Nutrition in addition Dietetics Possible to figure Library, as well as a notification of randomized trials that had been authored among October 2020 and September 2022 with only a concentrate based on a more selected demographic. In studies, participants ranged in age from 7 to 19 and were either overweight or obese. They were undergoing outpatient therapy for weight control. The extraction of data from each of the studies that were found was carried out utilizing a standardized tool. The information that was uncovered as a consequence of search and methodical update was combined. In all, 99 publications and 219 diverse research arms were taken into consideration for this research. An exploratory concept was undertaken utilizing alternate meta-analytic approaches that were developed for complex and heterogeneous treatments. The goal of this meta-analysis has been to assess the relative benefits made by each intervention source type at specified time points. In order to determine whether or not each provider category had substantial deviations from the reference group, the meta-regression analysis was carried out.

Results: All across the course of the study, the categorization that consisted of neither nutrition specialists nor behavioralists led to smaller decreases in BMI z score when particularly in comparison to the nutrient consultant situation, the combined nutrition consultant and treat specific classification, and the categorization that consisted of neither nutrition specialists nor behavioralists. According to the results of a research study, the variation in BMI z score here among nutrition specialist-only classification and benchmark classification has been statically important at four different time points: between four and seven months, among eight and 1.5 years, and between one and two years (P140.02, P140.06, and P140.02, including both). This result is significant at the 4 to 7 months and 1-year to 2-years' time periods (P140.002 and P140.06, correspondingly) for the nutrition specialist-only service set, where there were lower rises in BMI over time compared with the original categories. At no moment did we find any statistically significant variations in the body composition across the different provider groups.

Conclusion: Indirect data suggested that the involvement of a nutrition expert in the provision of treatment led to improved results in pediatric weight managing in terms of BMI z score and BMI at chosen time periods.

Keywords: Body Mass Index (BMI), Nutrition Specialist, multicomponent pediatric weight maintenance intervention groups.

INTRODUCTION

It really is hard, and even inconceivable in several cases, to fully dominate nutrition studies conducted (with a few notable examples, such as extensive guidance of disciplines who are constrained in specially adapted metabolic rooms located in research labs that are solely devoted to the study) [1]. The complexity of the study rises by an order of magnitude if there is an educational and counseling aspect included in nutrition research, which is the case whenever there is an intervention aimed at the treatment of childhood obesity [2-6]. Countless nutrition interventions, particularly individuals aimed at addressing nutrition education and counseling, are difficult to analyze using meta-analytic techniques because they are heterogeneous, which either indicates that there exists rarely a typical or benchmark arrangement of effective interventions to employ as a basic principle for similarities [7-10]. This makes it difficult to draw conclusions about the effectiveness of these interventions. In addition, nutrition research is culturally situated, which means that they take place inside a larger setting that makes it challenging to separate the effects of individual factors [11]. Therefore, the results of complicated nutrition education are likely to be substantially impacted not just by the form and configuration of the intervention itself but also through the environment in which it is placed. This is because of the relationship between the two factors being discussed here [12-16].

Experiments that aim to investigate the situationally located and accommodative interactions of individual and physician behavior are not able to be monitored to the same degree as traditionally controlled trials. In the former, it is feasible to contrast a particular topic receiving the special agent with such patient whom impact through that agent is either marginal commodity [17]. In the latter, however, it is not possible to do either of those things. Therefore, major and difficult technical challenges in the process of accumulating data across investigations and generating implications from that information are an everyday occurrence for nutrition scientists as well as clinicians of nutrition and dietetics [18-21]. The problem of having conducted scientific proof analysis, such as structured studies and meta-analyses, for complicated, multi-component, highly heterogeneous treatments like PWM initiatives is one of the most pervasive problems facing the dietetics profession today. PWM treatments are just one instance of this problem [22-27].

PWM treatments are considered to be " characterized because they typically include several dietary manipulations (for

example, the hypocaloric diet, the diminished carbohydrate diet, aimed directly adequate nutrition, the plate method, or the stop sign plan), a number of physical activity training (for example, individual or team regular exercise admonition, regular exercise sessions, pedometers, similar technologies to measure physical activity, also alternatives to sedentary behavior), also various intervention programs (for example, the family meal planning program, the stoplight plan, or these kinds of treatments are considered to be heterogeneous due to the lack of typical arrangement with either treatment circumstances or comparator conditions that may serve as a reference standard for drawing parallels across different research. In reality, of course, a perfunctory investigation into PWM research indicates that it is not even all unusual for the specific restrictions in one research to be very comparable to another by in that other research [28].

The difficulties that arise while trying to analyze this scenario are significant. For example, if only one of six separate dietary manipulation methods inside one PWM intercession is matching through solitary one of six main physical activities interventions, then the straightforward utilitarian calculus discloses the prospect of 38 alternate treatment configurations [29-31]. This is just one example. When compared to the reality of the majority of PWM operations, this example computation is very oversimplified. Empirical research made for the newly released Pediatric Weight Maintenance Guidelines by Academy of Nutrition and Dietetics culminated in classification of a total of 36 distinct weight maintenance program features, including the following: According to the calculations, there are more than a billion numerous varieties in which PWM manipulations may take place [32].

The method that the findings of this article took stood to perform the systematic overview in conjunction through both Academy of Nutrition also Dietetics Evidence Analysis Library. They followed the standardized EAL processes for evaluating the literature and upgrading a search engines, search database, and they used alternative systematic review methods for compiling and analyzing the data that they gathered. An epidemiologic assessment is generated as a consequence of the methodology used in this study [33]. This assessment assesses the impact of a factor based on its ability to decrease mysterious heterogeneity, even though a traditional meta-analysis combines the findings of a number of different study results that have been directly compared to one another. Utilizing this technique, it is feasible to evaluate a wide variety of results as a consequence of more complicated treatments. The forensic experts regarded the research to be hypothesis-generating and felt that additional research has been required to confirm the research results; therefore, the meta-analysis remained investigative in manner that not any head-to-head tests could be found for assessment, so they recognized the research to also be hypothesis-generating [34].

The term "nutrition specialist" will be utilized during this whole article to relate to dieticians or dietitian nutritionists whose credentials have been highly qualified by the Commission on Dietetic Enrollment, or nutritionists who have been highly qualified in countries that preserve similar provisions with the CDR; and dietetics professionals who have been deemed competent by their respective international credentialing departments or who are regarded competent in their individual nations by educational achievement. The researchers of the examined research described the function of nutrition professionals as the provision of the dietary constituents of multicomponent initiatives. This encompassed the provision of medical weight management, dietary changes, nutrient-concentrated physical examinations, and other nutrition education [35].

METHODOLOGY

While beginning this evaluation, the procedures that would be used to carry it out were planned out. During the course of the study project examination process carried out by the School of Health Professions at Rutgers University at Jinnah Hospital in Lahore, Pakistan, a committee of certified academic researchers assessed and authorized the methodology that was to be used for the review. This article includes a discussion of any substantial departures from the approach that was originally proposed. Since this experiment was more investigative in character, no protocol has been actually recorded for it. The methods that were applied during the course of this research were derived from Cochrane Handbook for Systematic Reviews of Treatments. Furthermore, they remained implemented inside framework of EAL Research methods for Updating a Literature Review, which incorporates the Cochrane benchmarks inside its various stages of operation. The methods and outcomes portions of this article are structured using the suggested reporting elements for systematic reviews and meta-analyses. The purpose of our current research remained to investigate the relationship between the provision of nutrition interventions by a nutrition specialist working as part of an interprofessional team to cure child and adolescent overweight and obesity and selected three outcomes: body mass index, body mass index z score, and waist circumference.

The position of an individual pediatric BMI on age- and sex-specific normal curve was what was meant when the term "BMI z score" was used. The number of standard deviations in front or behind the mean is how the BMI z score is expressed; hence, a BMI z score of 1.6 shows that the individual's BMI is 1.6 percent greater higher than the mean. BMI z scores are presented in the form of percentile rank in relation to a certain age- and sex-specific BMI distribution. McCarthy and his colleagues proposed defining WC as the length acquired by surrounding the region midway between the 10th rib and the iliac crest with an inflexible tape measure and expressing this value in centimeters. This was the method that was used to determine WC.

The 2019-2021 PWMD research was conducted with very few limitations but without particular possible figure questions in mind because it remained planned to remain utilized as the foundation for upcoming work in PWM, which would include research findings on the effects of PWM treatments. Because of this, the search was successful in meeting its intended purpose. Instead, the knowledgeable group that was in charge of doing the search aimed to get a comprehensive picture of PWM research that was being done throughout the relevant time period. The 2019 PWMP specialist working group has decided to make use of CENTRAL in order to locate high-quality randomized studies that were carried out throughout the search dates that have been defined. MEDLINE and Embase are the primary sources of bibliographic information that are utilized by CENTRAL. This is because CENTRAL places a strong emphasis on randomized controlled trials. The specialist working group came to the conclusion that the CENTRAL database would include a comprehensive representation of a wide range of high-quality PWM publications. The expert advisory committee for the 2019 PWMP set the search period of 2019 to 2021 in order to guarantee that the revised 2019 guidelines were based on the most current PWM clinical outcomes. Furthermore, prior to the time period covered by the research, the Academy of PWM did not have any dietary practice standards, there was no PWM qualification program in place, and different methods of treatment remained in the process of development.

A researcher librarian having experience in the methods of systematic reviews acted as a coinvestigator and contributed to the process of designing the search update strategy for 2019-2021. The lead investigator has been responsible for updating the search throughout the month of December 2015, and the results were discussed with the other investigators. The search included items that were either already completed or were in the process of being published between September 2019 and August 2021. It was necessary to do preliminary searches inside PubMed in order to validate the final search syntax. It was necessary to capture the medical topic headings phrases, keywords, in addition additional pertinent rapports from the papers that remained found. Test searches were executed by means of a wide variety of key phrase permutations, and the search tactics of pertinent observational

studies were taken into consideration. PubMed, Scopus, the Composite Index to Nursing and Allied Health Literature, and CENTRAL were some of databases that were searched throughout this process.

Figure 1 offerings one instance of the keyword syntax that may be used to conduct a search in the PubMed database. Following conversations with the other scientists on the project, we were able to locate relevant websites and conference papers. The lead scientist and the topic professional coinvestigators choose these sources to broadly symbolize the grey literature on the research question. These sources are the American Academy of Children and adolescents, the Obesity Society, Food also Nutrition Conference and Expo, and the Obesity Week convention. All of these conferences were held in the United States. A Google Site Search was used to go through American Academy of Pediatrics and Diabetes Society websites. For the years 2019 through 2021, the conference proceedings of the Food and Nutrition Conference and Expo as well as Obesity Society's Obesity Week were combed through to find relevant references. The primary investigators as well as the coinvestigators went through the process of reviewing the whole search strategy; any conflicts were settled by coming to a decision amongst some of the investigators.

After exporting the abstracts (N1–42,428) to Endnote X6,27 and removing the duplicates, there were a total of 238. A search of grey literature as well as searching the reference lists of observational studies led to the discovery of four records. Screening was performed on a total of 3,198 abstracts using the inclusion and exclusion criteria that had been established beforehand. Two security officers, the lead investigator and a subject matter expert convergence investigator, objectively examined each and every abstract that was submitted. In instances when the two screeners had different opinions, they talked it out until they came to a decision that satisfied both of them. According to the participation criteria, a maximum of 3,096 presentations were disqualified from further consideration. The screening process continued with the leftover 129 abstracts once they were retained. Publications in their whole were tracked down to accompany each of these abstracts.

When conducting the 2006-2016 PWMD search and 2017-2021 search update, evaluation of full-text papers adhered to participation parameters that had been established in advance and were consistent with one another. The criteria for inclusion and exclusion may be found in Table 1. As direct relationships in the literature among multicomponent therapies that included a nutrition expert and equivalent multicomponent arms that did not include a nutrition professional were few, the researchers opted to examine effective therapeutic arms from different trials.

Statistical Analysis: The primary investigator and the statisticians who assisted with the research made sure that all of the information was accurate and consistent by double-checking them. Even during the update to the search that took place between 2019 and 2021, the chief scientist of this comprehensive study discovered an error in the findings section of one of the studies that had been recognized for integration; the principal detective of the research that contained the error was notified and given the adjusted information. 29 In seven of the experiments that were included in the 2018-2021 browse update, the information was displayed either as (mean and 95% confidence level) or rather than, and the Open Meta-Analyst programming is utilized to back-calculate degrees of separation for the purpose of standardizing the information within a week of conducting the meta-analysis. After that, the data that were retrieved from the publications that were found during the search update that took place between 2018 and 2021 were downloaded into an Excel data matrix that was produced by the EAL batch processing platform. The statistical co-investigator at the PWMD combined the data from the 2017 e 2022 search update with statistics from the 2016-2022 PWMD search that was already in existence. After being sanitized, the data were then loaded into Stata version 24 statistical software in order to do the meta-analysis.

RESULTS

The search that covered the period from 2011-2020 and the update that covered the period from 2016-2022 together yielded a total of 3,419 abstracts. Because of the inclusion-exclusion criteria that were used, 3,195 abstracts were disqualified from further consideration. Following the examination of a total of 227 full-text papers, we determined that 97 articles satisfied the admission requirements. None of the 97 studies had poor quality, whereas 45 out of 95 (43%) had positive quality, 56 out of 97 (54%) had neutral performance, and there was not a single study through poor quality. There was no connection identified between research quality and any of the five different internet connections, according to the findings of an analysis (P=0.0795). The merged dataset included a total of 209 different trial arms for analysis.

Table 2 reports the series of research arms that were offered for investigation at each time point. Additionally, it includes the period and the subgroup meta-analyses broken down by provider type. Just group contributed the fewest arms to the analyses; in fact, for WC investigation, here remained not any Behavioralist Solitary arms available between the ages of 4 and 7 months or between 7 months and 2 years. Whenever there are no more than three research arms accessible for assessment, the reader should use care whenever attempting to interpret the data for any given group at the time points that were examined. It was decided not to calculate hyperparameters if there were less than two research arms accessible. There was a total of 13,546 participants who participated in should include research arms, of whom 5,989 remained treating patients. Participants ranging in age from 6 to 17 years old were included in each of the research involving children. Participants came from a diverse range of racial, cultural, and linguistic backgrounds, and they came from both more developed and less developed nations. As per criteria established by the Centers for Disease Control and Preventive for Pediatrics, 38–50 of the individuals has been either overweight or obese. In a few instances, however, the criteria used were part of the world.

In the largest number of studies, adolescents and young people with comorbid conditions that required the use of pharmaceuticals that might affect weight were not included. However, Luca and colleagues excepted subject areas with comorbid conditions who became qualified for bariatric surgery while they were conducting their study on extremely overweight adolescents.

The pharmacological treatment arms were included in a number of research studies; nonetheless, they were not a part of meta-assessment achieved for 2018 PWMP or for our current research. In one trial, there was a surgical arm including lap banding, though this arm was excluded from the subsequent analysis. The procedures consisted of a diverse assortment of different therapy arrangements in their entirety. Strategies with several components comprised modules taught by professionals with expertise in areas such as nutrition, behavior, physical exercise, and medicine. Interventions that concentrated on nutrition made use of a variety of dietary alterations in addition to behavioral changes toward eating. The managing of stress, education of parents, regulation of stimuli, meditation techniques, treatment aimed at elevating feelings of self-effectiveness and self-regard, also instruction in proper nutrition were all components of behavioral therapies.

Education on overall lifestyle action, activity-exact training, and usage of gadgets just like pedometers were all components of the physical activity component of the interprofessional intervention. General nutrition instruction, continuing surveillance of weight-related measures, and treatment of morbidities were all part of the medical interventions that were provided by doctors, nurses, physician assistants, and professional advanced practice nurses. Numerous research made use of creative treatments including parent-only sessions, dancing that was ethnically adapted, reading children's fiction, and outdoor adventure activities. Several studies zeroed in on certain racial or ethnic groups as their subjects. The research was carried out in a number

of different locations, some of which were outpatient hospitals and primary care clinics, while others included community centers and school-based treatment centers.

Table 1:

	n	Change from baseline	Effect LCIa	Effect UCIb	I2	I2 LCI	I2 UCI	H2
BMIZc								
Neither	18	e0.06	e0.19	e0.01	77.55	86.00	64.00	3.46
Nutrition only	12	e0.24d	e0.02	e1.02	89.00	93.05	13.39	96.00
Behavior only	9	-	e1.11	e0.18	47.75	79.00	0.91	0.00
Nutrition þ behavior	6	e0.21	e0.07	e0.14e	43.00	90.00	3.28	76.62
6-12 mo								
Neither	14	e0.29	e0.07	0.00	96.00	98.00	34.05	97.15
Nutrition only	17	e0.05	e0.54	e0.19	9.83	56.22	99.00	98.00
Behavior only	8	e0.16	e0.26	e0.05		81.00	95.00	90.76
Nutritionþ behavior	9	e0.98	e0.02	e0.15	92.19	11.80	87.00	95.00

Table 2:

	n	Change from baseline	Effect LCIa	Effect UCIb	I2	I2 LCI	I2 UCI	H2
BMIZc								
Neither	27	e0.24	e0.01	e0.08	98.51	99	65.97	98
Nutrition only	25	e0.48	e0.07	e0.20d	81	91.00	6.62	86.88
Behavior only	14	e0.51	e0.04	e0.16	78	91	6.16	86.03
Nutrition þ behavior	6	e0.20	e0.10	e0.15e	41.53	78	0.71	0
6-12 mo								
Neither	6	e0.24	e0.05	e0.15	55	91	3.87	79.47
Nutrition only	12	e0.98	e0.04	e0.24	79	92	6.84	87.25
Behavior only	5	e0.24	e0.12	0.00	92	79.88	47	3.97
Nutritionþ behavior	6	e0.30	--	e0.15	e0.22	0 90 e	-	0.00

DISCUSSION

Our current exploratory research represents initial meta-analytic research project that can offer quantitative resistant of value of using the nutrition professional to deliver nutrition mechanisms of multicomponent PWM interferences, to the best of investigators' information [26-31]. Our current research remained subsidized by the National Institutes of Health. Furthermore, this research uses a variety of different meta-analytic procedures that were developed for use with data produced from PWM research [32]. These techniques were created for use with complicated and heterogeneous treatments [33]. It is commonly accepted that nutrition therapy is an essential component of obesity treatment programs for children. However, the question of whether or not there is any extensive clinical advantage in having nutrition programs for children conveyed by a nutrition specialist has, up until now, remained unanswered [34-35]. Though variability across studies calls for care when assessing absolute pooled impact sizes at any particular time point, the authors' conviction in the results of increased variability reported for every one of the provider groups is unaffected by this fact [36].

There were no considerable variations between systems that can collect for WC at the 1-year to 2-year time point [37]. Despite this, efficacious meta-analysis and meta-regression were just not possible for this has enough due to the limited number of incorporate, especially the absence of any experiments in behavioralist group at both time points [38]. There is a need for more research that compares the impact of different provider configurations on the results of PWM therapies pertaining to WC [39]. In addition, the fact that there wasn't any correlation between research evaluations and factors pertaining to intervention providers lends credence to the notion that variances in impact size are not the result of variances in the quality of studies. Instead, the result that the supplier category matched decreases in heterogeneity at selected time periods following treatment offers statistical indication that registered dietitian earner category donated to therapeutic efficacy [40].

CONCLUSION

Indirect similarities of a large variety of active intervention groups showed around indication inside this research that nutrition treatment administered through the nutrition professional as part of the healthcare professional makes a significant contribution to speed enhanced with regard to BMI and BMI z score at designated time points. This finding was based on the findings of a single investigation that compared a substantial number of active intervention groups. There were no discernible variations detected across the various provider groups regarding WC performance. This study lends some credence to the claims that nutrition professionals are indispensable participants of PWM healings teams, that nutrition involvement delivered through nutrition consultants improves results BMI also BMI z score, and that charitable donations of nutrition professionals could be incredibly significant at certain involvement time points.

Exploratory investigations have a number of functions, one of the most essential of which is to find potential hypotheses and areas for further inquiry. The findings of this study lead the researchers to the conclusion that additional research should be conducted that is injected into the grid to manipulate and compare the various constituents of multicomponent PWM treatments. These components include medical, nutritional, physical, and behavioral aspects. In particular, research is required that contrasts the outcomes that occur whenever a nutrition expert is included on the medical provider with the outcomes that occur when a nutrition specialist is not included on the medical provider, assuming that all other aspects of the study remain same. Those very experiments might lead to enhanced admittance to successful therapies for overweight in addition overweight offspring also teenagers who are in search of excellence weight organization services. This would be accomplished by identifying best practices for goal achievement, which would lead to the achievement of the outcomes.

REFERENCES

1. Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. Int J Obes (Lond). 2019; 35(7): 891-898.
2. Rankin J, Matthews L, Cobley S, et al. Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. Adolesc Health Med Ther. 2021; 7: 125- 146.
3. Pulgaron ER. Childhood obesity: a review of increased risk for physical and psychological comorbidities. Clin Ther. 2019; 35(1): A18- A32.

4. Ells LJ, Rees K, Brown T, et al. Interventions for treating children and adolescents with overweight and obesity: an overview of cochrane reviews. Int J Obes (Lond). 2018; 42(11): 1823- 1833.
5. Elvsaas IKO, Giske L, Fure B, Juvet LK. Multicomponent lifestyle interventions for treating overweight and obesity in children and adolescents: a systematic review and meta-analyses. J Obes. 2017; 2019: 5021902.
6. Muhlig Y, Wabitsch M, Moss A, Hebebrand J. Weight loss in children and adolescents. Dtsch Arztebl Int. 2018; 111(48): 818- 824.
7. Dalla Valle M, Laatikainen T, Lehikoinen M, Nykanen P, Jaaskelainen J. Paediatric obesity treatment had better outcomes when children were younger, well motivated and did not have acanthosis nigricans. Acta Paediatr. 2017; 106(11): 1842- 1850.
8. Wiegand S, Keller KM, Lob-Corzilius T, et al. Predicting weight loss and maintenance in overweight/obese pediatric patients. Horm Res Paediatr. 2014; 82(6): 380- 387.
9. Goldschmidt AB, Best JR, Stein RI, Saelens BE, Epstein LH, Wilfley DE. Predictors of child weight loss and maintenance among family-based treatment completers. J Consult Clin Psychol. 2018; 82(6): 1140- 1150.
10. Walker SE, Smolkin ME, O'Leary ML, et al. Predictors of retention and BMI loss or stabilization in obese youth enrolled in a weight loss intervention. Obes Res Clin Pract. 2022; 6(4): e330- e339.
11. Taylor JH, Xu Y, Li F, et al. Psychosocial predictors and moderators of weight management programme outcomes in ethnically diverse obese youth. Pediatr Obes. 2017; 12(6): 453- 461.
12. Barriuso L, Miqueleiz E, Albaladejo R, Villanueva R, Santos JM, Regidor E. Socioeconomic position and childhood-adolescent weight status in rich countries: a systematic review, 1990–2013. BMC Pediatr. 2015; 15: 129.
13. Newton S, Braithwaite D, Akinyemiju TF. Socio-economic status over the life course and obesity: systematic review and meta-analysis. PLoS One. 2017; 12(5):e0177151.
14. Lobstein T, Neveux M, Brown T, et al. Social disparities in obesity treatment for children age 3–10 years: a systematic review. Obes Rev. 2021; 22(2):e13153.
15. Miller MA, Kruisbrink M, Wallace J, Ji C, Cappuccio FP. Sleep duration and incidence of obesity in infants, children, and adolescents: a systematic review and meta-analysis of prospective studies. Sleep. 2018; 41: 19.
16. Kokkvoll A, Jeppesen E, Juliusson PB, Flaegstad T, Njolstad I. High prevalence of overweight and obesity among 6-year-old children in Finnmark County, North Norway. Acta Paediatr. 2012; 101(9): 924- 928.
17. Cole TJ, Freeman JV, Preece MA. Body mass index reference curves for the UK, 1990. Arch Dis Child. 1995; 73(1): 25- 29.
18. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ (Clinical Research ed). 2000; 320(7244): 1240- 1243.
19. Kokkvoll A, Grimsgaard S, Odegaard R, Flaegstad T, Njolstad I. Single versus multiple-family intervention in childhood overweight–Finnmark activity school: a randomised trial. Arch Dis Child. 2014; 99(3): 225- 231.
20. Kokkvoll A, Grimsgaard S, Steinsbekk S, Flaegstad T, Njolstad I. Health in overweight children: 2-year follow-up of Finnmark activity school–a randomised trial. Arch Dis Child. 2015; 100(5): 441- 448.
21. Kokkvoll AS, Grimsgaard S, Flaegstad T, et al. No additional long-term effect of group vs individual family intervention in the treatment of childhood obesity-A randomised trial. Acta Paediatr. 2019; 109(1): 183- 192.
22. McCarthy HD, Jarrett KV, Crawley HF. The development of waist circumference percentiles in British children aged 5.0-16.9 y. Eur J Clin Nutr. 2001; 55(10): 902- 907.
23. Brannsether B, Roelants M, Bjerknes R, Júlíusson PB. Waist circumference and waist-to-height ratio in Norwegian children 4–18 years of age: reference values and cut-off levels. Acta Paediatr. 2021; 100(12): 1576- 1582.
24. SSB Ss. Income and wealth statistics for households 2019.
25. World Health Organization. Physical acitivity. https://www.who.int/news-room/fact-sheets/detail/physical-activity. Accessed March 7, 2022. World Health Organization; 2020.
26. Altman M, Wilfley DE. Evidence update on the treatment of overweight and obesity in children and adolescents. J Clin Child Adolesc Psychol. 2015; 44(4): 521- 537.
27. Sacher PM, Kolotourou M, Chadwick PM, et al. Randomized controlled trial of the MEND program: a family-based community intervention for childhood obesity. Obesity (Silver Spring, Md). 2010; 18(Suppl 1): S62- S68.
28. Miller AL, Lumeng JC. Pathways of association from stress to obesity in early childhood. Obesity (Silver Spring, Md). 2018; 26(7): 1117- 1124.
29. Franckle R, Adler R, Davison K. Accelerated weight gain among children during summer versus school year and related racial/ethnic disparities: a systematic review. Prev Chronic Dis. 2014; 11: E101.
30. Darmon N, Drewnowski A. Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis. Nutr Rev. 2015; 73(10): 643- 660.
31. Gow ML, Baur LA, Ho M, et al. Can early weight loss, eating behaviors and socioeconomic factors predict successful weight loss at 12- and 24-months in adolescents with obesity and insulin resistance participating in a randomised controlled trial? Int J Behav Nutr Phys Act. 2016; 13: 43.
32. Frohlich G, Pott W, Albayrak O, Hebebrand J, Pauli-Pott U. Conditions of long-term success in a lifestyle intervention for overweight and obese youths. Pediatrics. 2011; 128(4): e779- e785.
33. Reinehr T, Brylak K, Alexy U, Kersting M, Andler W. Predictors to success in outpatient training in obese children and adolescents. Int J Obes Relat Metab Disord. 2003; 27(9): 1087- 1092.
34. Moens E, Braet C, Van Winckel M. An 8-year follow-up of treated obese children: children's, process and parental predictors of successful outcome. Behav Res Ther. 2010; 48(7): 626- 633.
35. Li L, Zhang S, Huang Y, Chen K. Sleep duration and obesity in children: a systematic review and meta-analysis of prospective cohort studies. J Paediatr Child Health. 2017; 53(4): 378- 385.
36. Knutson KL, Spiegel K, Penev P, Van Cauter E. The metabolic consequences of sleep deprivation. Sleep Med Rev. 2007; 11(3): 163- 178.
37. Jenssen BP, Kelly MK, Powell M, Bouchelle Z, Mayne SL, Fiks AG. COVID-19 and changes in child obesity. Pediatrics. 2021; 147:e2021050123.
38. Hart CN, Carskadon MA, Considine RV, et al. Changes in children's sleep duration on food intake, weight, and leptin. Pediatrics. 2013; 132(6): e1473- e1480.
39. Etindele Sosso FA, Holmes SD, Weinstein AA. Influence of socioeconomic status on objective sleep measurement: a systematic review and meta-analysis of actigraphy studies. Sleep Health. 2021; 7(4): 417- 428.
40. Babyak MA. What you see may not be what you get: a brief, nontechnical introduction to overfitting in regression-type models. Psychosom Med. 2014; 66(3): 411- 421.