

A Systematic Review of the Impact of Lifestyle Intervention on Childhood Obesity

Waad Fuad BinAfif*, Haifa Saeed Alzubaien, Nour Abdulhamid Sadek, Afnan Hassan Mohamed Elsayed Hassan, Mona Talaq R Alsulami, Yasir Fahad Almudaymigh, Hanan Khalid Alghamdi, Sumayah Dhafer Alshehri, Zaynab Hussain M Almukalaf, Elaf Ehssan Tayeb, Raghad Mohammed Ismail Namnqani, Rana Ibrahim Farran, Mona Sitr J Aljuaid, Mohammed Khalid H Alzaidalsharif, Abdu Ibrahim A Alsayed, Khalid Abdullah Ahmad Alghamdi and Shahad Fuad BinAfif

King Abdulaziz Hospital, Jeddah, Saudi Arabia

*Corresponding Author: Waad Fuad Bin Afif, King Abdulaziz Hospital, Jeddah, Saudi Arabia.

Received: February 17, 2017; Published: February 24, 2017

Abstract

Background: Childhood Obesity has become an epidemic. The number of overweight and obese children has increased at an alarming rate over the past years, and there is no chance of it slowing down unless a systemic fix is in place. The aim of this study is to evaluate and conclude on the best approach to control obesity and reverse the negative effect on children in the most convenient way.

Methods: Scientific databases MEDLINE, PubMed, ISI Web of Science, and Scopus were searched electronically for English language article from 2000 to 2014 was conducted in. We included those studies conducted among obese individuals aged up to 18 years. Our search yielded 87 relevant papers, 71 of them were conducted as high quality clinical trials.

Results: Three intervention approaches effect was measured school-based programs can have long-term effects in a large target group. This can be related to this fact that children spend a considerable part of their time in school, and adopt some parts of lifestyle there. They have remarkable consequences on health behaviors, but as there are some common limitations, their effects on anthropometric measures are not clear. Due to the crucial role of parents in development of children's behaviors, family-based interventions are reported to have successful effects in some aspects; but selection bias and high dropout rate can confound their results. Clinic-based interventions revealed favorable effects. They include dietary or other lifestyle changes like increasing physical activity or behavior therapy. It seems that a comprehensive intervention including diet and exercise are more practical. When they have different designs, results are controversial.

Conclusion: A multidisciplinary approach in schools in which children's family are involved, has proved to be the best and most sustainable approach for management of childhood obesity.

Keywords: Child; Control; Obesity; Prevention; Systematic Review; Lifestyle; Intervention

Introduction

Childhood obesity is on the rise and considered as a serious health problem worldwide [1]. The degree of excess weight is still increasing in the group of children who are defined as having obesity [2]. This high level of childhood obesity poses an ever-increasing problem for health-care systems, because a high proportion of children with obesity tend to become adults with obesity [3]. Obesity negatively

affects quality of life and social integration of children with the condition [4], and in the long term, obesity is associated with premature death [5]. The reduced lifespan of children with obesity is primarily caused by associated comorbidities of obesity such as hypertension, dyslipidaemia, and disturbed glucose metabolism, summarized in the definition of the metabolic syndrome [6]. These cardiovascular risk factors already occur frequently in children with obesity [7]. Furthermore, early vascular changes have been demonstrated by autopsy studies [8], and by the detection of increased carotid intima-media thickness, [5] a predictive factor for atherosclerosis, heart attack and stroke, [9] in obese children with cardiovascular risk factors. In addition, obesity in childhood is associated with many other diseases, such as asthma, polycystic ovary syndrome, nonalcoholic fatty liver disease (NAFLD), sleep apnoea syndrome and orthopaedic problems [6]. Therefore, effective therapeutic approaches to tackle childhood obesity are urgently needed. Lifestyle intervention is recommended as the primary treatment for childhood obesity [10]. However, the long-term outcomes of lifestyle interventions for childhood obesity carried out in a clinical-practice setting have varied widely.

Materials and Methods

- Electronic search Database : MEDLINE, PubMed, ISI Web of Science, and Scopus Studies Publication years : 2000 to 2015
- Search terms used : “childhood obesity”, “overweight”, “weight disorder,” “intervention,” “treatment,” “management,” “control,” “PA,” “nutrition,” “behavior therapy,” and “diet therapy”.

Search Yielded: 2305 studies and articles.

Data extraction and abstraction

Inclusion criteria

- Literature reported in English language
- 2-18-year-old children; community, family, school, and clinic interventions or a combination of them
- Conducted among obese or overweight children.

Exclusion criteria: Systematic reviews, meta-analysis, and editorials.

The selection process of our systematic review is presented in PRISMA flowchart (Figure 1).

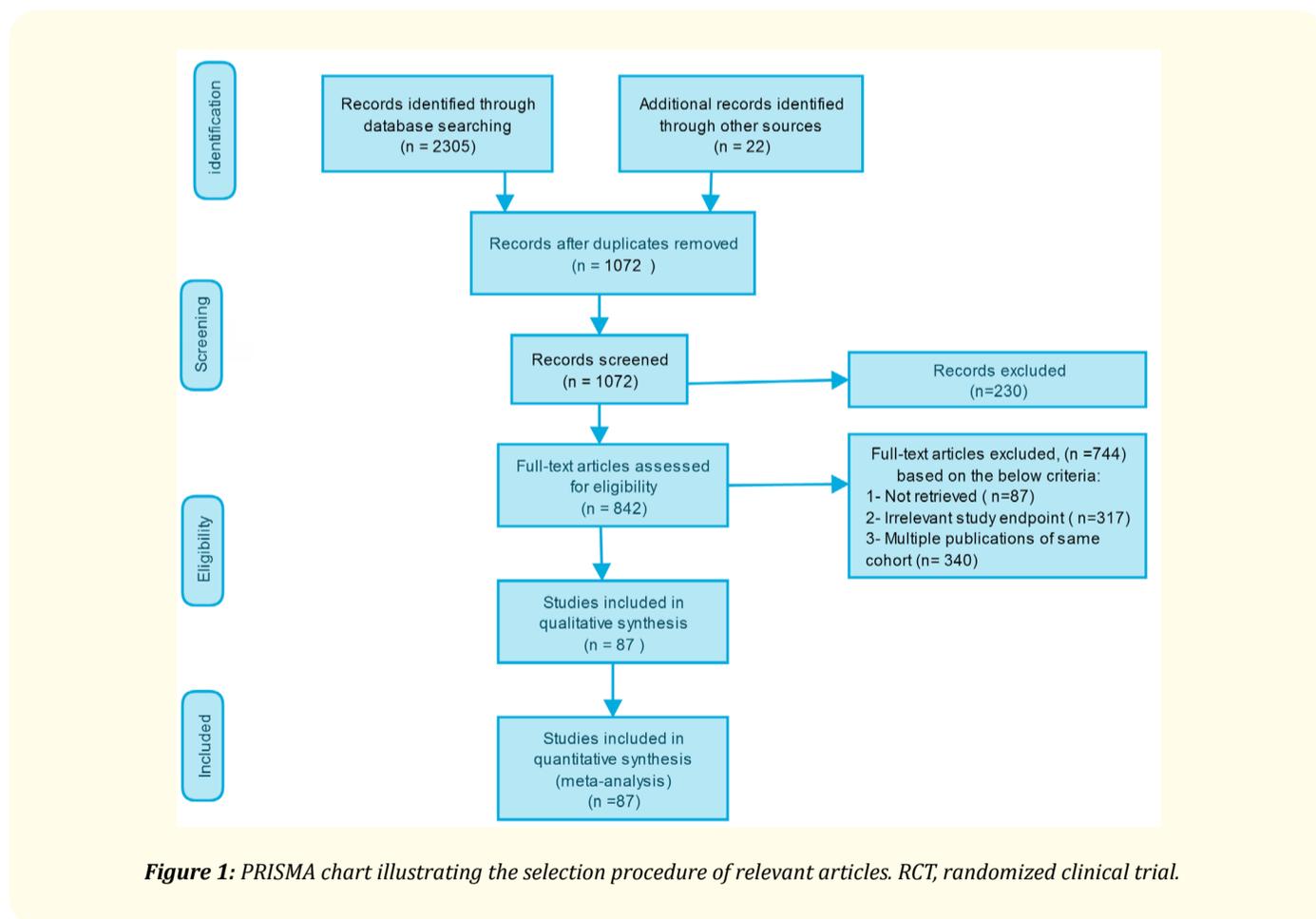


Figure 1: PRISMA chart illustrating the selection procedure of relevant articles. RCT, randomized clinical trial.

Results

Searches identified 2305 publications in addition to another 22 publications that were found through manual research. After removal of duplicates, abstracts and titles 1072 publications were assessed as identified from title and abstract and 230 papers were excluded. 87

papers full text could not be retrieved and another 340 papers with the same cohort. There were also 317 papers excluded because they did not compare different surgical techniques or did not report an adherence-related outcome. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in reporting the results Figure 1.

School-based programs

10 RCTs were included.

School interventions are suggested to be feasible and effective; [11] because students spend a considerable part of their time in school [12], moreover teachers and peers can be engaged in such programs [13]. These kinds of programs can improve health behaviors in a large target group. They are characterized by nutritional education and changes in dietary habits, as well as increase in PA through structured programs [14]. Findings of various studies proposed that the effects of such interventions will be preserved for several years after intervention [15-17]. This effect has been of special concern about consuming fruits and vegetables, and healthy snacks, as well as increased PA. Nevertheless, the impact of school-based programs on obesity prevention is controversial and remains to be determined by large studies with long-term follow-up research. Some studies have not evaluated the effect of intervention on anthropometric measures [18-20], but they have shown positive impacts on eating and activity behaviors. The most common limitation of these studies is presenting self-reported data, non-randomized selection of schools, short duration of study, and not masking the interventional groups.

Family-based programs

10 RCTs were included.

Reaching a healthy weight is not successful unless children have support for making healthy behavior choices; obviously, providers of this support are families. Family is an applicable target for health promoting interventions. Family-based intervention programs are considered as one of the most successful methods for obesity treatment or prevention [20], Engaging parents in childhood obesity prevention programs may make weight loss easier for children; because they can provide confirmatory conditions to help their children to choose healthy behaviors, furthermore they are important role models for their children [21]. It is difficult for parents to know and accept that their child has excess weight, and that recommended diets would not have adverse health effect for their children; [22] therefore, they often do not comprehend the necessity of obesity prevention. Families are able to construct children's lifestyle habits, perhaps through their "parenting style" and management of "family functioning [23]. Most of these programs were successful in decreasing body mass index (BMI) z-score and some health consequences of overweight. After participation of parents in these kinds of programs, their children consumed more fiber and were less sedentary. In some cases, significant decrease in fat mass is documented, as well [24,25]. It has shown that low parental confidence predicts dropout rate from family-based behavioral treatment [26]. The main limitation of family-based studies is the small sample size, high dropout rate, no follow-up data, and selection of motivated families.

Although most researchers have tried low calorie-low fat diets for treating obesity, experts have recommended to consider a diet with balanced macronutrients [27]. Nevertheless, different dietary changes have been tried to control excess weight in children and adolescents. High protein (HP) diets seems to make more satiety, but two studies did not confirm their advantage versus standard diets [28,29].

Clinical-based programs

10 studies were included.

Findings in studies in which diet, exercise or both of them were taken into account, nutrition plus PA had more effect on anthropometric indices [30-32]. One study showed that combination of aerobic and strength training along with diet therapy results in BMI decrease in comparison with strength training plus diet recommendation [33]. A successful experience is reported about the favorable effects of zinc supplementation on anthropometric and metabolic indices [34,35].

Obesity behavioral therapy has different parts such as motivational interviewing, goal setting, positive reinforcement, monitoring, and cognitive restructuring [36]. Most of behavioral therapies had positive consequences on weight, BMI, or dietary and PA habits [37-41].

All interventions that consisted of nutrition, exercise, and counseling had significant effects on body weight or other obesity-related factors [42-58] except for a study, which had beneficial effects only on obesity related behaviors [59]. The main limitation of some of these studies is lack of comparison with the control group, and short-term follow-up of participants, and the uncertain sustainability of such kinds of interventions.

Eventually, 21 papers describing 21 studies were included Laparoscopy versus laparotomy. All of them were published between 1991 and 2010 and addressed different topics of surgical technique.

Discussion

Lifestyle interventions are effective in reducing weight in children with obesity if parents are actively involved. Young children aged 5 - 12 years and children with overweight rather than obesity profit, in particular, from this kind of intervention.

In clinical practice, lifestyle interventions only reduce mean BMI by --1 to -2 kg/m², and the long-term success rate (a decrease in BMI SD score of < 0.25) at 2 years is <10%.

By contrast, some specialist treatment centres report maintenance of weight loss in children with obesity 5 years after the end of the intervention and a success rate of ~50%.

Stable weight in a growing child with obesity is accompanied by an improvement in cardiovascular risk factors and in comorbidities such as diabetes mellitus, nonalcoholic fatty liver disease and polycystic ovary syndrome. Weight loss reduces the basal metabolic rate and affects hunger and the levels of satiety hormones in children with obesity, which might partly explain difficulties in losing weight of the papers reported a positive effect of school-based intervention on dietary habits or anthropometric measures. One of negative effects of this kind intervention is discrimination resulted from stigmatization. This may persuade them to get involved in healthier lifestyle or might have opposite results. All of the studies conducted in the family setting (n = 26), had favorable results on obesity criteria. Although some of them had negligible effects. Clinic-based intervention had different methods but almost the same results.

Some studies had no effects on anthropometric index. However, they had resulted in dietary habits or physical fitness improvement [60-63]. One explanation for this can be self-reported dietary intake and PA data. On the other words, children may not pay attention to the instruction they were given.

Teachers can train students how to choose nutritious and low-calorie foods. In addition, exercise training can be reinforced in the school curriculum [64]. Most students with excess weight prefer to eat fatty, sweetened, and salty snacks; they also choose fast foods as their first meal preference. If attendants get involved in obesity prevention programs, they can provide an environment for children to purchase healthy snacks and foods. Families can also make a circumstance which facilitates dietary and behavioral changes. Furthermore, if parents recognize the importance of weight control, they will be motivated to persuade their children for weight control. Families, especially mothers, are the best paradigm for children to learn a healthful eating pattern and activity habits [65]. Through family meals, children can eat more whole grains, fruits, vegetables, low fat milk, and consume less sweets and unhealthy fats. Parents should involve kids in preparing food to make a positive effect on their attitudes toward obesity prevention. It seems that the family has a key role in long-term weight control [66]. It has been shown that if family confidence is low, rate of dropout from weight loss programs will increase [67]. In this regard, providing parenting styles and skills as well as child management strategies are really critical [68,69]. Principally clinic-setting programs have brought nutrition, PA, and education or counseling together to achieve their goals and they have demonstrated long lasting

results [70]. Most experts advise a low calorie low fat diet for obesity management; but they may have side-effects such as binge eating [71]. Actually weight loss is allowed in severe obesity and in other cases weight maintenance is an appropriate policy [72]. Some studies recommend HP or low carbohydrate diets because they cause more satiety [73]. A review article revealed that low carbohydrate ad libitum diets are as effective as calorie restricted diets [74]. In addition, a Cochrane review showed that low fat diets have no extra advantages in comparison with other diets with calorie restriction [75]. Another review article revealed moderate effect of exercise on adiposity and not on BMI [76]. Clearly, PA is efficient when lasts for more than 60 min, is moderate to vigorous, and is done in all weekdays [77]. As low calorie diets are harmful for growth, and complying with them is difficult, some studies suggested that vigorous exercise can be a suitable substitute for diet therapy [78,79]. As always emphasized, to be effective, PA should be considered as an enjoyable fun, and should be integrated into daily lifestyle. Obesity causes mental problems in children and adolescents [80], so behavior therapy seems to be vital. It sounds that group treatment is more successful than individual ones; [81,82] specifically when parents are engaged. Counselors should persuade children and adolescents to eat breakfast, to have structured meal plan to increase consumption of fruits, vegetables, and family meals, as well as to decrease the intake of sweetened beverages, calorie-dense foods, and eating out, as well as reducing the sedentary behaviors and the screen time [83,84]. Counselors also need to teach families about healthy shopping and cooking habits. Unfortunately, most studies did not show favorable effects, many of them had small sample sizes or had short-term follow-up or lacked of the control group. Managing extra group support sessions or using technologies such as E-mail or SMS for monitoring weight losers can be a good idea. The present study came in line with a systematic analysis conducted by Kelishadi R and Soleiman FA in 2014 [85].

Cardiovascular risk factors and comorbidities of obesity improve even with a stable weight in a growing child. Difficulties in weight reduction should not only be attributed to the child or family's lack of motivation and willingness to change behaviour, as genetic background might affect outcomes, as might adaptive hormonal changes that result in reduced resting metabolic rate and increased hunger during weight-loss attempts. Therefore, blaming unsuccessful children with obesity and their parents is not a useful or appropriate response [86,87].

Conclusion

Lifestyle interventions should be offered primarily to children with a real chance of success (such as motivated young children aged 5 – 12 years and children who are less overweight). A multidisciplinary approach in schools in which children's family are involved, has proved to be the best and most sustainable approach for management of childhood obesity.

Bibliography

1. Catenacci VA, *et al.* "The obesity epidemic". *Clinics in Chest Medicine* 30 (2009): 415-44.
2. May AL, *et al.* "Prevalence of cardiovascular disease risk factors among US adolescents, 1999–2008". *Pediatrics* 129.6 (2012): 1035-1041.
3. Bray GA. "Predicting obesity in adults from childhood and adolescent weight". *American Journal of Clinical Nutrition* 76.3 (2002): 497-498.
4. Franks PW, *et al.* "Childhood obesity, other cardiovascular risk factors, and premature death". *New England Journal of Medicine* 362.6 (2010): 485-493.
5. Zimmet P, *et al.* "The metabolic syndrome in children and adolescents - an IDF consensus report". *Pediatric Diabetes* 8.5 (2007): 299-306.
6. l'Allemand D, *et al.* "Cardiovascular risk in 26,008 European overweight children as established by a multicenter database". *Obesity (Silver Spring)* 16.7 (2008): 1672-1679.

7. Wissler RW, *et al.* "Risk factors and progression of atherosclerosis in youth. PDAY Research Group. Pathological Determinants of Atherosclerosis in Youth". *American Journal of Pathology* 153.4 (1998): 1023-1033.
8. Reinehr T, *et al.* "Intima media thickness in childhood obesity: relations to inflammatory marker, glucose metabolism, and blood pressure". *Metabolism* 55.1 (2006): 113-118.
9. Reinehr T. "Calculating cardiac risk in obese adolescents before and after onset of lifestyle intervention". *Expert Review of Cardiovascular Therapy* 11.3 (2013): 297-306.
10. Han JC, *et al.* "Childhood obesity". *Lancet* 375 (2010): 1737-1748.
11. August GP, *et al.* "Prevention and treatment of pediatric obesity: an endocrine society clinical practice guideline based on expert opinion". *Journal of Clinical Endocrinology & Metabolism* 93.12 (2008): 4576-4599.
12. McMurray RG, *et al.* "A school-based intervention can reduce body fat and blood pressure in young adolescents". *Journal of Adolescent Health* 31.2 (2002): 125-132.
13. Contento IR, *et al.* "Adolescents demonstrate improvement in obesity risk behaviors after completion of choice, control & change, a curriculum addressing personal agency and autonomous motivation". *Journal of the American Dietetic Association* 110.12 (2010): 1830-1839.
14. Bacardí-Gascon M, *et al.* "A six month randomized school intervention and an 18-month follow-up intervention to prevent childhood obesity in Mexican elementary schools". *Nutricion Hospitalaria* 27.3 (2012): 755-762.
15. Lubans DR, *et al.* "Exploring the mechanisms of physical activity and dietary behavior change in the program x intervention for adolescents". *Journal of Adolescent Health* 47.1 (2010): 83-91.
16. Plachta-Danielzik S, *et al.* "Eight-year follow-up of school-based intervention on childhood overweight – The Kiel Obesity Prevention Study". *Obesity Facts* 4.1 (2011): 35-43.
17. Muckelbauer R, *et al.* "A simple dietary intervention in the school setting decreased incidence of overweight in children". *Obesity Facts* 2.5 (2009): 282-285.
18. Plachta-Danielzik S, *et al.* "Four-year follow-up of school-based intervention on overweight children: The KOPS study". *Obesity (Silver Spring)* 15.12 (2007): 3159-3169.
19. Kipping RR, *et al.* "Diet outcomes of a pilot school-based randomised controlled obesity prevention study with 9-10 year olds in England". *Preventive Medicine* 51.1 (2010): 56-62.
20. Shah P, *et al.* "Improvement in nutrition-related knowledge and behaviour of urban Asian Indian school children: Findings from the 'Medical education for children/Adolescents for Realistic prevention of obesity and diabetes and for healthy ageing' (MARG) intervention study". *British Journal of Nutrition* 104.3 (2010): 427-436.
21. Gruber KJ and Haldeman LA. "Using the family to combat childhood and adult obesity". *Preventing Chronic Disease* 6.3 (2009): A106.
22. Ball GD, *et al.* "Parents as agents of change (PAC) in pediatric weight management: The protocol for the PAC randomized clinical trial". *BMC Pediatrics* 12 (2012): 114.
23. Warschburger P and Kröller K. "Childhood overweight and obesity: Maternal perceptions of the time for engaging in child weight management". *BMC Public Health* 12 (2012): 295.
24. Wen LM, *et al.* "Family functioning and obesity risk behaviors: Implications for early obesity intervention". *Obesity (Silver Spring)* 19.6 (2011): 1252-1258.

25. Kalavainen M., *et al.* "Impact of childhood obesity treatment on body composition and metabolic profile". *World Journal of Pediatrics* 8.1 (2012): 31-37.
26. Savoye M., *et al.* "Long-term results of an obesity program in an ethnically diverse pediatric population". *Pediatrics* 127 (2011): 402-410.
27. Gunnarsdottir T., *et al.* "The role of parental motivation in family-based treatment for childhood obesity". *Obesity (Silver Spring)* 19.8 (2011): 1654-1662.
28. Ben Ounis O., *et al.* "Two-month effects of individualized exercise training with or without caloric restriction on plasma adipocytokine levels in obese female adolescents". *Annales d'Endocrinologie (Paris)* 70.4 (2009): 235-241.
29. Lisón JF., *et al.* "Exercise intervention in childhood obesity: A randomized controlled trial comparing hospital-versus home-based groups". *Academic Pediatrics* 12.4 (2012): 319-325.
30. Ribeiro MM., *et al.* "Diet and exercise training restore blood pressure and vasodilatory responses during physiological maneuvers in obese children". *Circulation* 111.15 (2005): 1915-1923.
31. Davis JN., *et al.* "Aerobic and strength training reduces adiposity in overweight Latina adolescents". *Medicine & Science in Sports & Exercise* 41.7 (2009): 1494-14503.
32. Kelishadi R., *et al.* "Effect of zinc supplementation on markers of insulin resistance, oxidative stress, and inflammation among prepubescent children with metabolic syndrome". *Metabolic Syndrome and Related Disorders* 8.6 (2010): 505-510.
33. Hashemipour M., *et al.* "Effect of zinc supplementation on insulin resistance and components of the metabolic syndrome in prepubertal obese children". *Hormones (Athens)* 8.4 (2009): 279-285.
34. Davis MM., *et al.* "Recommendations for prevention of childhood obesity". *Pediatrics* 120(Suppl 4) (2007): S229-S253.
35. Bauer S., *et al.* "Enhancement of care through self-monitoring and tailored feedback via text messaging and their use in the treatment of childhood overweight". *Patient Education and Counseling* 79.3 (2010): 315-319.
36. Bloom T., *et al.* "A pilot evaluation of appetite-awareness training in the treatment of childhood overweight and obesity: A preliminary investigation". *International Journal of Eating Disorders* 46.1 (2013): 47-51.
37. Ford AL., *et al.* "Treatment of childhood obesity by retraining eating behaviour: Randomised controlled trial". *BMJ* 340 (2009): B5388.
38. Tan-Ting AM and Llido L. "Outcome of a hospital based multidisciplinary weight loss program in obese Filipino children". *Nutrition* 27.1 (2011): 50-54.
39. Tsiros MD., *et al.* "Cognitive behavioral therapy improves diet and body composition in overweight and obese adolescents". *American Journal of Clinical Nutrition* 87.5 (2008): 1134-1140.
40. Skelton JA., *et al.* "A pediatric weight management program for high-risk populations: A preliminary analysis". *Obesity (Silver Spring)* 16.7 (2008): 1698-1701.
41. Knöpfli BH., *et al.* "Effects of a multidisciplinary inpatient intervention on body composition, aerobic fitness, and quality of life in severely obese girls and boys". *Journal of Adolescent Health* 42.2 (2008): 119-127.
42. Alexy U., *et al.* "Positive changes of dietary habits after an outpatient training program for overweight children". *Nutrition Research* 26 (2006): 202-208.
43. Dreimane D., *et al.* "Feasibility of a hospital-based, family-centered intervention to reduce weight gain in overweight children and adolescents". *Diabetes Research and Clinical Practice* 75.2 (2007): 159-168.

44. Chen AK, *et al.* "Effect of a short-term diet and exercise intervention on metabolic syndrome in overweight children". *Metabolism* 55.7 (2006): 871-878.
45. Kirk S, *et al.* "Role of carbohydrate modification in weight management among obese children: A randomized clinical trial". *Journal of Pediatrics* 161.2 (2012): 320-371.
46. Kelishadi R, *et al.* "Can a trial of motivational lifestyle counseling be effective for controlling childhood obesity and the associated cardiometabolic risk factors?" *Pediatrics & Neonatology* 53.2 (2012): 90-97.
47. Savoye M, *et al.* "Anthropometric and psychosocial changes in obese adolescents enrolled in a Weight Management Program". *Journal of the American Dietetic Association* 105.3 (2005): 364-370.
48. Reinehr T, *et al.* "Two-year follow-up in 21,784 overweight children and adolescents with lifestyle intervention". *Obesity (Silver Spring)* 17.6 (2009): 1196-1199.
49. Adam S, *et al.* "Effects of a combined inpatient-outpatient treatment of obese children and adolescents". *Obesity Facts* 2.5 (2009): 286-293.
50. Nemet D, *et al.* "Short- and long-term beneficial effects of a combined dietary-behavioral-physical activity intervention for the treatment of childhood obesity". *Pediatrics* 115.4 (2005): e443-e449.
51. Reinehr T, *et al.* "An effective lifestyle intervention in overweight children: Findings from a randomized controlled trial on "Obeldicks light". *Clinical Nutrition* 29 (2010): 331-336.
52. Murer SB, *et al.* "Baseline leptin and leptin reduction predict improvements in metabolic variables and long-term fat loss in obese children and adolescents: A prospective study of an inpatient weight-loss program". *The American Journal of Clinical Nutrition* 93 (2011): 695-702.
53. Lofrano-Prado MC, *et al.* "Quality of life in Brazilian obese adolescents: Effects of a long-term multidisciplinary lifestyle therapy". *Health and Quality of Life Outcomes* 7 (2009): 61.
54. Kelishadi R, *et al.* "Can a dairy-rich diet be effective in long-term weight control of young children?" *The Journal of the American College of Nutrition* 28.5 (2009): 601-610.
55. Madsen KA, *et al.* "A clinic-based lifestyle intervention for pediatric obesity: Efficacy and behavioral and biochemical predictors of response". *Journal of Pediatric Endocrinology Metabolism* 22.9 (2009): 805-814.
56. Weigel C, *et al.* "Childhood obesity: Concept, feasibility, and interim results of a local group-based, long-term treatment program. *Journal of Nutrition Education and Behavior* 40.6 (2008): 369-373.
57. Taveras EM, *et al.* "Randomized controlled trial to improve primary care to prevent and manage childhood obesity: The High Five for Kids study. *Archives of Pediatrics and Adolescent Medicine* 165.8 (2011): 714-722.
58. Fajcsak Z, *et al.* "The effects of 6-week low glycemic load diet based on low glycemic index foods in overweight/obese children - Pilot study". *The Journal of the American College of Nutrition* 27.1 (2008): 12-21.
59. Mohn A, *et al.* "Increased oxidative stress in prepubertal severely obese children: Effect of a dietary restriction-weight loss program". *The Journal of Clinical Endocrinology & Metabolism* 90.5 (2005): 2653-2658.
60. Bayer O, *et al.* "Short- and mid-term effects of a setting based prevention program to reduce obesity risk factors in children: A cluster-randomized trial". *Clinical Nutrition* 28.2 (2009): 122-128.
61. Neumark-Sztainer D, *et al.* "New Moves: A school-based obesity prevention program for adolescent girls". *Preventive Medicine* 37 (2003): 41-51.

62. Thivel D, *et al.* "Effect of a 6-month school-based physical activity program on body composition and physical fitness in lean and obese schoolchildren". *European Journal of Pediatrics* 170.11 (2011): 1435-1443.
63. Caballero B, *et al.* "Pathways: A school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren". *American Journal of Clinical Nutrition* 78.5 (2003): 1030-1038.
64. Bean MK, "Dietary intake in a randomized-controlled pilot of NOURISH: A parent intervention for overweight children". *Preventive Medicine* 55 (2012): 224-227.
65. Bauer S, *et al.* "Enhancement of care through self-monitoring and tailored feedback via text messaging and their use in the treatment of childhood overweight". *Patient Education and Counseling* 79.3 (2010): 315-319.
66. Looney SM and Raynor HA. "Are changes in consumption of "healthy" foods related to changes in consumption of "unhealthy" foods during pediatric obesity treatment?" *International Journal of Environmental Research and Public Health* 9.4 (2012): 1368-1378.
67. Waling M, *et al.* "A one-year intervention has modest effects on energy and macronutrient intakes of overweight and obese Swedish children. *Journal of Nutrition* 140 (2010): 1793-1798.
68. Barlow SE. "Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report". *Pediatrics* 120.Suppl 4 (2007): S164-S192.
69. Klohe-Lehman DM, *et al.* "Low-income, overweight and obese mothers as agents of change to improve food choices, fat habits, and physical activity in their 1-to-3-year-old. ch Edwards C, *et al.* "Family-based behavioural treatment of obesity: Acceptability and effectiveness in the UK". *European Journal Clinical Nutrition* 60 (2006): 587-592.
70. Gunnarsdottir T, *et al.* "The role of parental motivation in family-based treatment for childhood obesity. *Obesity (Silver Spring)* 19.8 (2011): 1654-1662.
71. Golley RK, *et al.* "Twelve-month effectiveness of a parent-led, family-focused weight-management program for prepubertal children: A randomized, controlled trial". *Pediatrics* 119.3 (2007): 517-525.
72. Kitzman-Ulrich H, *et al.* "The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs". *Clinical Child and Family Psychology Review* 13 (2010): 231-553.
73. Latzer Y, *et al.* "Managing childhood overweight: Behavior, family, pharmacology, and bariatric surgery interventions". *Obesity (Silver Spring)* 17 (2009): 411-423.
74. Polivy J. "Psychological consequences of food restriction". *Journal of the American Dietetic Association* 96.6 (1996): 589-592.
75. Nemet D, *et al.* "Short- and long-term beneficial effects of a combined dietary-behavioral-physical activity intervention for the treatment of childhood obesity". *Pediatrics* 115.4 (2005): e443-e449.
76. Gibson LJ, *et al.* "Lack of evidence on diets for obesity for children: A systematic review". *International Journal of Epidemiology* 35.6 (2006): 1544-1552.
77. Summerbell CD, *et al.* WITHDRAWN: Advice on low-fat diets for obesity". *Cochrane Database of Systematic Reviews* (2008): CD003640.
78. McGovern L, *et al.* "Clinical review: Treatment of pediatric obesity: A systematic review and meta-analysis of randomized trials". *Journal of Clinical Endocrinology and Metabolism* 93.12 (2008): 4600-4605.
79. Davis MM, *et al.* "Recommendations for prevention of childhood obesity". *Pediatrics* 120.Suppl 4 (2007): S229-S253.
80. Barlow SE. "Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report". *Pediatrics* 120. Suppl 4 (2007): S164-S192.

81. Gately PJ, *et al.* "Does a high-protein diet improve weight loss in overweight and obese children?" *Obesity (Silver Spring)* 15.6 (2007): 1527-1534.
82. Kalavainen M, *et al.* "Impact of childhood obesity treatment on body composition and metabolic profile". *World Journal of Pediatrics* 8.1 (2012): 31-37.
83. Bauer S, *et al.* "Enhancement of care through self-monitoring and tailored feedback via text messaging and their use in the treatment of childhood overweight". *Patient Education and Counseling* 79.3 (2010): 315-319.
84. de Niet J, *et al.* "The effect of a short message service maintenance treatment on body mass index and psychological well-being in overweight and obese children: A randomized controlled trial". *Pediatric Obesity* 7.3 (2012): 205-219.
85. Roya Kelishadi and Fatemeh Azizi-Soleiman. "Controlling childhood obesity: A systematic review on strategies and challenges". *Journal of Research in Medical Sciences* 19.10 (2014): 993-1008.
86. Reinehr T. *et al.* "Lifestyle intervention in obese children with variations in the melanocortin 4 receptor gene". *Obesity (Silver Spring)* 17.2 (2009): 382-389.
87. Reinehr T. "Lifestyle intervention in childhood". *Nature Reviews Endocrinology* 9.10 (2013): 607-614.

Volume 3 Issue 5 February 2017

© All rights reserved by Waad Fuad Bin Afif, *et al.*