

A Systematic Review of Internet-Based Family Intervention for Childhood Obesity

¹M.P.H. Norliza A, ¹M.Z. Nor Afiah, ¹B. Anisah,
¹H.S. Minhat, ²M. Firdaus, ³M.S. Zalilah and ¹M.S. Lye

¹Department of Community Health, Faculty of Medicine and Health Sciences,
Universiti Putra Malaysia, Serdang, Selangor, Malaysia

²Department of Psychiatric, Faculty of Medicine and Health Sciences,
Universiti Putra Malaysia, Serdang, Selangor, Malaysia

³Department of Nutrition and Dietetic, Faculty of Medicine and Health Sciences,
Universiti Putra Malaysia, Serdang, Selangor, Malaysia

Abstract: *Background:* Family based interventions for childhood obesity has been demonstrated to be effective over the past several decades but parents are difficult to engage. Internet-based family intervention could be an alternative to face to face family intervention in meeting the barriers identified from parents. *Objectives:* This review provides an overview of internet-based family intervention for obese children, focusing on effectiveness and attrition rates. *Methods:* Randomized controlled trial studies published between January 2004 and March 2014 were selected from six electronic databases. Intervention using internet or web-based which involved parents of 2 to 17 years old and lifestyles and behavior modification were included. Intervention characteristics were reviewed and salient features were extracted. *Results:* Five related randomized controlled trials were included. Four of five studies found significant adiposity and behavioral changes. Attrition rates ranged from 2% to 47%. Intervention characteristics that could contributed to intervention effectiveness were theory based, used of more behavioral techniques and interactive features like online self-monitoring and e-mail contact with counselors. One of the factors that could have influence on attrition rates was monetary incentives. Parents' empowerment and parenting aspects were lacking in the internet-based family intervention for parents. *Conclusions:* internet-based intervention has a short term impact on adiposity and behavioral changes and has the potential to minimize parents' attrition in family based intervention. Improving the intervention elements in internet-based family intervention might improve effectiveness and attrition rates.

Key words: Childhood Obesity • Family-Based Intervention • Internet • Effectiveness • Attrition Rates
• Systematic Review

INTRODUCTION

The worldwide prevalence of childhood obesity and overweight has increased from 4.2% in 1990 to 6.7% in 2010 [1]. Even though the prevalence is higher in developed countries (11.7%) than in developing countries (6.1%), the relative percentage change in developing countries is higher than in developed countries, 65% and 48% respectively between 1990 and 2010 [1]. There are many health effects of childhood obesity [2-4] that have positioned it as one of public health concerns. Furthermore, obese children are more likely to become

obese adults and have an increased risk of developing adult health problems [5-8]. Thus effective programs targeting the mass to prevent and treat childhood obesity and subsequently reversing these rates are urgently needed both in developed and developing countries.

Family-based behavioral treatment programs, which are lifestyle interventions that included the entire family (or at least one parent and one child) in the treatment, have been demonstrated to be effective over the past several decades [9-11]. Recent systematic review and meta-analysis which involved 42 weight-related health interventions showed that interventions which

required parents' participation were more effective in reducing body mass indexes of child and adolescent participants. In addition, longer interventions that included parents appear to have greater success [12]. Unfortunately ranging from about 20% to 73% of participating families drop out of treatment and most often the reasons were scheduling issues and programs not meeting family needs or expectations [13].

Since the beginning of the 21st century, access to internet is widespread through home, work computers and mobile phones. Percentage of population using the internet are mainly in the North America (78.6%), followed by Oceania/Australia (67.6%) and Europe (63.2%) [14]. Internet use also are increasing in other parts of the world; 42.9% in Latin America/Caribbean, 40.2% in Middle East and 27.5% in Asia [14]. Internet programs could be an attractive option to support effective, long-term weight maintenance because they are not subjected to common barriers to obesity treatment, such as difficulties with scheduling or transportation, or need to be in proximity to a specialty clinic and they have the advantages of accessibility at all times, offered at lower cost than traditional, labor-intensive counseling and increase personal convenience [15,16]. Recent systematic review in internet-based intervention for childhood obesity has concluded that such intervention is useful [17]. However the usefulness of internet intervention in family based for childhood obesity has not been reviewed. Furthermore, whether the use of internet-based intervention is able to reduce attrition rates in family based intervention for obese children has not been discussed.

Therefore the aims of this review were to explore intervention characteristics, examine effectiveness and examine attrition rates of internet-based family intervention for childhood obesity. Three research questions guided this systematic review: i) What are the characteristics of internet-based family intervention for childhood obesity? ii) Does internet-based family intervention for obese children effective? iii) What are the attrition rates in internet-based family intervention for childhood obesity?

MATERIALS AND METHODS

A systematic literature search was conducted via six databases (Medline, Cinahl, Science Direct, Proquest, Scopus and CENTRAL) for published articles from 2004 to March 2014. Several steps were included to minimize error and bias in the selection process; use two authors to reduce the possibility that relevant reports will be

discarded, if there was doubt in the title or abstract, full texts were obtained to determine whether the article meet the inclusion criteria. If not, then it will be excluded. If the article was not rejected, information from it may then be extracted. Disagreements about whether a study should be included were resolved by consensus of all authors.

The following Medical Subject Headings search terms were used: i) internet, web-based or online, ii) family based intervention, iii) prevention childhood obesity/pediatric obesity. Second level was used whereby database searches were performed based on the findings of previous level and adding more specific keywords including nutrition, physical activity and behavioral modification. Inclusion criteria were i) English language, ii) full text, iii) two to 17 years old children, iv) either parents only or parent with child intervention, v) utilized behavioral intervention on nutrition or physical activity, vi) randomized controlled trial (RCT) and vii) at least one arm of the study must included web-based or internet. Exclusion criteria were i) eating disorders, ii) diabetes type 2, iii) other technological advances or applications which do not use internet, iv) school based intervention and v) parents reported children's weight.

Methodological quality was assessed based on Thomas *et al.* [18]. Six quality components assessed were selection bias, study design, confounders, blinding, data collection methods and withdrawals and drop-outs. A study was rated strong if it has four quality rating assessments rated as strong and no weak ratings. A study was rated moderate if it has less than four criteria were rated strong and one criterion was rated weak. If two or more criteria were rated weak, the study was rated as weak. Due to low number of expected included studies and to gain insights of internet-based family intervention for obese children, no studies will be excluded based on methodological quality.

Description of intervention's characteristics was based on theory used, behavioral modification techniques, behaviors targeted, duration of intervention and interactive elements. These characteristics were used based on other authors work in internet-based behavioral intervention for obesity [19-21]. Parental involvement was also included in the intervention characteristics description to examine role of parents and education/skills imparted to them in the family based intervention. Effectiveness of interventions was based on changes in adiposity (eg. BMI, BMI z-score, waist-hip ratio) and/or behavior (eg. physical activity and food intake). Even though changes in adiposity was widely used to measure effectiveness in weight related intervention, this

review included behavioral changes as it is an important mediating variables to the success of obesity intervention. Attrition in internet intervention was defined by Eysenbach as participants being lost to follow-up from the trial (dropout attrition) and/or stopping usage of eHealth intervention (non-usage attrition) [22]. In this review, only dropout attrition was used anticipating the common definition of attrition reported by researchers and the scope of this review. Variables discussed under factors contributing to attrition in this review included socio-demographic factors, program duration, support from others and incentives [23,24].

RESULTS

The literature search resulted in 115 published papers. After reviewing the titles, abstracts or complete articles, five studies met the criteria (Figure 1). The most important information of the included articles was extracted and summarized in Table 1 and Table 2. Meta-analysis was not attempted due to small number of included studies and heterogeneity of reported data. Thus this review qualitatively yet systematically described and synthesized the data.

Studies Included and Quality Assessment: All included studies were conducted in the United States. The sample size of included studies ranged from 30 to 229 participants. Two studies involved younger children up to 6 years old [25,26] and the rest of the studies targeting middle childhood to teenagers. One study involved girls

only [27]. Three of five studies provided some information on parental socio-demographic/economic status [25,26,28]. In Chen *et al.* study, about 47% of families had an annual income of more than \$60,000 and 40% of families had annual household income less than \$40,000 and mean number of years of education were 13.3 (SD 5.00) years [28]. Both Knowlden and Cooperberg studies participants had about 71% parents who were employed either part-time or full time [25,26].

Three studies involved both children and parents [27-29]. Study by Williamson *et al.* [27] was to examine the efficacy of an internet-based lifestyle behavior modification program among overweight/obese adolescent girls. While Chen *et al.* study was to examine the efficacy of a web-based program in promoting healthy lifestyles and healthy weight among normal and overweight adolescents [28]. Catenacci *et al.* [29] study was done to evaluate the impact of providing family intervention in an internet-based format on sedentary behaviors and time in moderate-to-vigorous activity in both overweight and normal weight children [27]. Two studies involved parents only [25, 26]. Study by Knowlden was to evaluate the efficacy of web-based education and reciprocal determinism on mothers to prevent pediatric obesity [25]. Whereas study by Cooperberg was to test the effectiveness of delivering behavioral intervention by the internet to the parents of obese children [26]. All studies used internet both in the intervention group and control group except for one study [29] used workbook format in control group. All studies used health education control group except one study [29] used similar as program intervention group but in work book format.

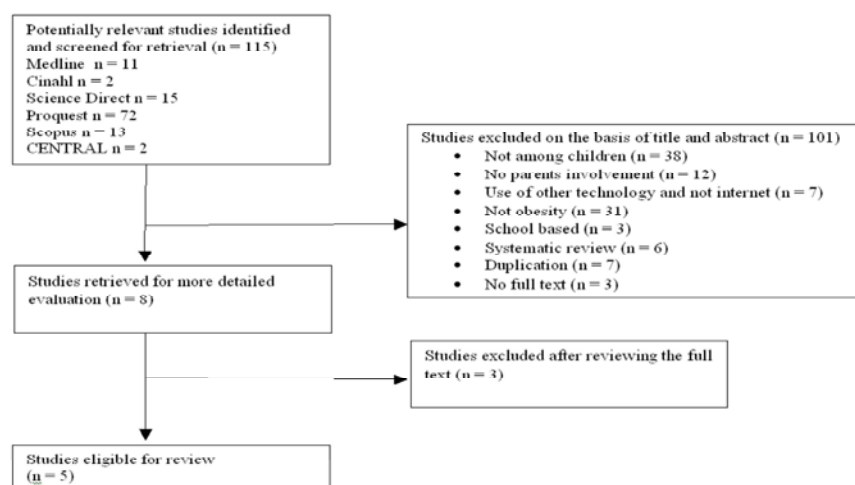


Fig. 1: Diagrammatic flow of study selection process

Table 1: Intervention characteristics of included studies

First author (year; country; quality rating)	Sample	Intervention uration	Behaviors addressed	Theory based
Williamson <i>et al.</i> [27] USA Moderate	11 - 15 years Overweight/ obese African-American girls One obese parent n = 57	2 years	N, PA	Elaboration Likelihood Model and Social cognitive theory [30]
Chen <i>et al.</i> [28] USA Moderate	12-15 years Normal weight and overweight. Chinese American adolescent and parents n = 50	8 weeks	N, PA	Trans-theoretical theory and Social cognitive theory
Knowlden [25] USA Moderate	Mothers of 4-6 years old child Any weight status of children n = 50	5 weeks	PA, FV, SSB, screen time	Social cognitive theory
Cooperberg [26] USA Weak	2-6 years old Parents of obese children n = 30	16 weeks	N, FV, PA	Social learning theory
Catenacci <i>et al.</i> [29] USA Strong	8-12 years Normal weight and overweight. American children and parents n = 98 families n = 131 children	12 weeks	N, PA	Not reported

Table 2: Interventions' elements, attrition and results

First author (year; country; quality rating)	Parents' elements	Child's elements	Attrition rates; Intervention vs control	Results
Williamson <i>et al.</i> [27] USA Moderate	- web site: weekly lesson for 52 lesson plans, nutrition education, behavior modification and interactive components - e-mail to counselor - 4 face to face counseling sessions within 12 weeks	Similar to parents' elements	36% vs 24%	6 months: Behavioral group; Adolescent significantly reduced mean body fat; $-12 \pm 0.47\%$ in intervention group vs $0.43 \pm 0.47\%$ in control group, $p < 0.05$). 18 months: Weight loss regained 24 months: No difference in adolescent and parents adiposity between behavioral and control group. Self-reported level of exercise was significantly associated with changes in body fat and body weight.
Chen <i>et al.</i> [28] USA Moderate	- 3 internet sessions (15 minutes) to increase knowledge and skills in nutrition and physical activity	- web site: Weekly sessions, to enhance self-efficacy and problem solving skills in nutrition and physical activity, interactive dietary preparation software. - pedometer	4% vs 11%	No significant difference in BMI. Significant decline in waist-to-hip ratio (effect size = -1.12 , $p = 0.02$), increased level of physical activity (effect size = 12.46 , $p = 0.01$) and vegetable and fruit intake (effect size = 0.14 , $p = 0.001$).
Knowlden [25] USA Moderate	- web site: 15 min. audio-visual education, interactive worksheets and discussion board postings. - home based activities - weekly e-mail messages - telephone counseling	None	13.8% vs 10.7%.	Increased consumption of fruits and vegetables by 1.613 cups (95% CI: 0.698, 2.529) in intervention group.
Cooperberg [26] USA Weak	- web site: interactive education on N, PA, PB, PS and discussion board postings. - 12 sessions delivered over 16 weeks	None	47% vs 46%	No significant difference between intervention and control group in child BMI z-score.
Catenacci <i>et al.</i> [29] USA Strong	- web site: Weekly information, activities and games/recipes. - pedometer.	Similar to parents	2% vs 18%	internet-based intervention did not increase sedentary behaviors in children.

N nutrition, PA physical activity, FV fruits and vegetables consumption, SSB sugar-sweetened beverages consumption, PB parenting behaviors related to eating, PS psychosocial issues related to weight.

One RCT were rated of strong quality [29], three RCTs were rated of moderate quality [25,27,28] and one rated of weak quality [26]. The quality criteria which were performed poorly by the studies were those related to selection bias, attrition rates and confounders.

Characteristics of Included Studies: Characteristics of included studies are summarized in Table 1 and Table 2. Four of five studies were theory based [25-28]; social

cognitive theory [25,28,30], trans-theoretical model [28], social learning theories [26] and elaboration likelihood model [30]. Chen *et al.* identified behavioral stage of the adolescent and individually tailored the intervention [28]. The researchers also used five behavioral techniques; problem solving skills, coping skills, self-efficacy, goal setting and self-monitoring [28]. Williamson *et al.* [27] used problem solving, behavior contracting and self-monitoring. Knowlden used five SCT constructs; environment, emotional coping, expectations, self-control

and self-efficacy [25]. Cooperberg used three behavioral techniques; stimulus control, self-monitoring and behavioral contracting [26].

All five studies targeted on nutrition and physical activity. Nutrition education included general healthy eating; food pyramid, portion size, meal planning, traffic light diet and food choices [26-28]. Specific nutrition was on five servings of fruits and vegetables intake daily [25,26] and reduces sugar sweetened beverages [25]. Physical activity advice included i) encouragement to engage in physical activity but without specific target [27,28], ii) specific target; 60 minutes of structured physical activity, 60 minutes of unstructured physical activity [25], 10,000 steps a day [26] and gradual increment in steps from 2,000 steps/day at the beginning of intervention to 4,000 steps/day towards the end of intervention [29]. Limit screen time to 120 minutes each day [25,26]. Cooperberg also included education on parenting behaviors related to eating and psychosocial issue related to weight [26].

Duration of intervention for RCTs varied from 5 weeks [25], 8 weeks [28], 12 weeks [29], 16 weeks [26] and 2 years [27]. Assessment of interventions varied between interventions; two interventions had the assessment immediately post intervention [26,29], three interventions had follow-up assessment post intervention with one of short duration (3 weeks) [25], one medium-long follow-up (6 months) [28] and one intervention over a longer period (1 year) [27].

Studies had incorporated interactive features in their web-based interventions; i) an interactive dietary preparation software program where participants could prepare a dish and check on nutritional information [28], ii) online self-monitoring of food intake and physical activity [25, 27, 28], ii) e-mail to counselors [27], iii) quiz [26, 27], iv) interactive on-line worksheets [25] and discussion board postings [25, 26].

Only two of five studies targeted parents as the exclusive agents of change [25,26]. The other three studies included in this review incorporated parents not as primary agents of change but to support their children [27-29] where in one study parents received three short sessions on healthy lifestyles education and skills [28] and in the other two studies, similar healthy lifestyle education and behavior modification were provided for both parents and children [27,29].

Effectiveness of Internet-Based Intervention: Results of included studies are summarized in Table 2. All included

studies test the efficacy of family-based program delivered online but the outcome measurements varied between studies. Adiposity measurements in three studies were BMI [27,28], BMI percentile [27], BMI z-score [26], body fat percentage [27] and waist-to-hip ratio [28] and behavioral changes were weight loss behavior [27], physical activity [28] and vegetable and fruit intake [25,28]. Williamson *et al.* reported significant body fat reduction at 6 months. However body weight regained after 18 months [27]. There was no difference in body fat after 2 years between intervention and control groups. Chen *et al.* [28] study found no significant difference in BMI but significant decline in waist-to-hip ratio and increase in vegetable and fruit intake and level of physical activity at 6 months post intervention. Knowlden study demonstrated increased consumption of fruits and vegetables at 3 weeks post intervention [25]. Cooperberg did not find any significant difference between intervention and control group [26]. Catenacci *et al.* [29] found internet-based intervention did not increase sedentary behaviors in children.

Attrition Rates: Attrition rates in the intervention group varies from 2% [29], 4% [28], 13.8% [25], 36% [27] to 47% [26]. Two studies limited to attrition rates during intervention [26,29] because no follow up were done after intervention while three studies measured attrition rates inclusive of during intervention and during follow-up [25,27,28]. This review deducted two approaches to minimize attrition rates and improve program adherence were administered in the studies; i) monetary incentives [25,28] and ii) reminder e-mail messages [25,26]. Both studies that provided monetary incentives had attrition rates lower than 20%.

DISCUSSION

This review focused on family based intervention program that were targeted to either parent only or parent and child which were delivered thorough internet or web-based. CD rom and other media conducted through computer but not using internet were not included.

Given the small number of studies conducted, within the time frame between 2004 and 2014 and were exclusively in the United States of America, it is evident that there is a need for more research to be done to explore the potential of using internet in a family based intervention for obese children and especially in other countries as well.

All interventions in this review were heterogeneous in their characteristics based on theory used, behavioral techniques, behaviors targeted, duration of intervention, interactive elements and parental involvement. Four of the five interventions used theory based to drive behavioral changes and improvement in adiposity [25-28]. The frequently used theories in this review were social cognitive theory. Theory based intervention were reported more likely to be effective [31]. All three studies in this review which included social cognitive theory, demonstrated improvement in adiposity and behaviors [25,27,28]. A systematic review and meta-analysis found that the most frequently used theories in intervention delivered on the internet were social cognitive theory, trans-theoretical model and the theory of planned behavior and the use of theory of planned behavior showed larger effects compared to other theories [19].

All studies in this review included both nutrition and physical components but had different scope of nutrition education and physical targets. Two of the studies which measured changes in adiposity and have significant changes used general food education and encouragement of physical activity rather than having specific food education and physical activity targets. However this is inconclusive due to small number of studies in this review. Golley *et al.* [32] in their systematic review found that in face to face interventions, behaviors targeted to energy intake/density and food choices were more likely related to be effective but not the number of lifestyle behaviors targeted.

Intervention duration varies from the shortest 5 weeks intervention to the longest 2 years intervention. The assessment also varied from immediately post intervention to the longest one year post intervention. There was no linear association between intervention duration and effectiveness.

Interactive features which were associated with effectiveness of internet interventions included e-mail feedback on self-monitoring of weight, eating and activity [21,33-35], individualize educational and weight management plan generated automatically [36], ability to e-mail other participants [36], human e-mail counseling [21,37] and brief motivational interviewing telephone calls [35]. Three of five included studies in this review had online self-monitoring features [25,27,28,]. One study had human e-mail counseling [27]. These studies had adiposity and behavioral changes post intervention. Interactive features are important element in contributing efficacy of internet intervention. Researchers should give

extra attention on which interactive features that work according to the theory used when developing internet intervention.

Only two of five studies used parents only compared with parent-child dyad [25,26]. The involvement of parents in parent-child dyad in this review were mainly complementing to the interventions for their children rather than parents being the main change agents. In face to face intervention, targeting parents alone was shown to be more effective than targeting both parents and children [38-40]. The education elements for parents in the included studies were seen lacking in the parenting aspects. More research targeting parents as the primary agents of change and measuring change in adiposity should be conducted and the components of education/behavioral intervention should target parents' perception and healthy lifestyle practices and feeding styles or parenting styles.

Despite several limitations, this present review found that using internet could help to reduce the attrition rates in family based intervention for obese children. This was evident through Catenacci *et al.* [29] and Chen *et al.* [28] who showed very low attrition rates, 2% and 4% respectively compared with traditional face to face intervention which ranging from 27% and 73% [13]. However other studies in this review had higher rates of attrition which was up to 47% [26]. Attrition poses threats to validity especially if it is greater than 20% [41].

Several factors could contribute to attrition. One of them is participants' characteristics. Unfortunately in this review, most studies do not provide enough information on parents' socio-demographic/economic features. Parents features were mention in three [25,26,28] of the five studies. Majority of the parents in the three studies had higher income [28], more educated [28] or employed parents either part time or full time [25,26]. Attrition rates were 4% [28], 13.8% [25] and 47% [26]. Skelton *et al.* reported that clinician's perceived family characteristics and demographics could influence attrition included those at risk families; severe obesity, multiple obese family members, low socioeconomic status, racial/ethnic minorities, highly stressed, family finances, transportation and work schedules [42]. In a face to face intervention, time commitment was cited as barrier for parents to attend educational sessions which resulted in higher attrition rates [43]. Cooperberg study had the highest attrition rate in this review, involved parents who were mainly working either part time or full time, however income level was not provided [26]. This could have contributed to the poor

participation. A more comprehensive report on the parental characteristics could help researchers in understanding the limitations or barriers by the participating parents and could further improve the program adherence and minimize attrition.

It is also inconclusive to draw an acceptable duration of intervention by the parents. Chen *et al.* and Catenacci *et al.* with 8 weeks [28] and 12 weeks [29] intervention duration respectively, had low rates of attrition. Importantly to note that assessment in Catenacci *et al.* only involved baseline and immediately post intervention with no follow-up [29]. The shortest duration of intervention was 5 weeks and involved 3 weeks follow up post intervention but received higher attrition rate, 13.8% [25] compared with 8 weeks intervention duration with longer follow-up, 6 months, attrition rate was 4% [28]. The longest follow-up was up to 2 years post baseline with 36% attrition rate [27]. Meta-analysis research has demonstrated that weight loss begins to rebound at 12 months from baseline [44]. Therefore it is vital to have a balance between optimal intervention duration and follow-up to achieve intervention effectiveness and at the same time acceptable intervention duration for parents to prevent high attrition rates. Both Knowlden and Cooperberg had provided social support in the web-based intervention to the parents but were unable to attract participation from them [25,26]. There is a need for more exploration in this approach as intervention which provides social and emotional support appeared to have beneficial effects for mothers of children with feeding problems [45].

There were several measures taken by the included studies that could have contributed to minimizing attrition rates and improve program adherence; i) monetary incentives [25,28], ii) reminder e-mail messages [25,26] and iii) contact with counselors by e-mail or face to face counseling sessions [25,27].

The main strength of this review is being the first systematically review of studies with a design which make it possible to identify the added value of internet-based family intervention for obese children. Limited number of research in this area and large differences in study outcome measures, limit clear and definite conclusions. Findings from this review should be interpreted with caution in view of small number of studies included. All of the studies were in the United States, which raises questions about generalizability of these results in other countries. Some articles might be missed because of limitation to only English language and full text articles.

CONCLUSIONS

This review shed some lights that using internet in family based intervention for childhood obesity has short term impact on adiposity and behavioral changes and has the potential to reduce attrition rates. The small number of studies included in this review showed the need for further research to be conducted in this area and by other countries as well and not only limited to the United States. More studies are needed to explore on improving the characteristics of internet-based family interventions and subsequently help improving its effectiveness and at the same time minimizing attrition rates.

ACKNOWLEDGEMENT

This review was conducted as a part of the “Randomized controlled trial using social media in a family-based intervention for overweight and obese Malay children in Selangor”. This trial is funded by Universiti Putra Malaysia, project’s code GP-IPS/2013/9398400.

REFERENCES

1. De Onis, M., M. Blössner and E. Borghi, 2010. Global prevalence and trends of overweight and obesity among preschool children. *The American Journal of Clinical Nutrition*, 92: 1257-1264.
2. Han, C.J., D.A. Lawlor and S.Y.S. Kimm, 2010. Childhood obesity: Progress and challenges. *Lancet*, 375(9727): 1737-1748. doi:10.1016/S0140-6736(10)60171-7
3. Williams, C.L., 2001. Can childhood obesity be prevented? Bendich, A. Deckelbaum, RJ eds. *Primary and Secondary Preventive Nutrition* 185-204. Humana Press Totowa, NJ.
4. Taylor, E.D., K.R. Theim, M.C. Mirch, S. Ghorbani, M. Tanofsky-Kraff and D.C. Adler-Wailes, *et al*, 2006. Orthopedic Complications of overweight in children and adolescents. *Pediatrics*, 117: 2166-2175. doi:10.1542/peds.2005-1832
5. Freedman, D.S., L.K. Khan, W.H. Dietz, S.R. Srinivasan and G.S. Berenson, 2001. Relationship of childhood overweight to coronary heart disease risk factors in adulthood: The Bogalusa Heart Study. *Pediatrics*, 108: 712-718.
6. Dietz, W.H., 1998. Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*, 101: 518-525.

7. Biro, F.M. and M. Wien, 2010. Childhood obesity and adult morbidities. *The American Journal of Clinical Nutrition*, 91(Suppl.): 1499S-1505S. doi:10.3945/ajcn.2010.28701B
8. Reilly, J.J. and J. Kelly, 2011. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *International Journal of Obesity*, 35: 891-898. doi:10.1038/ijo.2010.222
9. Epstein, L.H., M.D. Myers, H.A. Raynor and B.E. Saelens, 1998. Treatment of pediatric obesity. *pediatrics*, 101(3 Pt 2): 554-570.
10. Epstein, L.H., R.A. Paluch, J.N. Roemmich and M.D. Beecher, 2007. Family-based obesity treatment, then and now: Twenty-five years of pediatric obesity treatment. *Health Psychology*, 26(4): 381-391.
11. Golan, M., A. Weizman, A. Apter and M. Fainaru, 1998. Parents as the exclusive agents of change in the treatment of childhood obesity. *The American Journal of Clinical Nutrition*, 67: 1130-1135.
12. Niemeier, B.S., J.M. Hektner and K.B. Enger, 2012. Parent participation in weight-related health interventions for children and adolescents: A systematic review and meta-analysis. *Prev. Med.*, 1: 3-13.
13. Skelton, J.A. and B.M. Beech, 2010. Attrition in pediatric weight management: a review of the literature and new directions. *International Association for the Study of Obesity*, 12: e273-e281. doi:10.1111/j.1467-789X.2010.00803.x
14. Internet World Stats, 2012. Usage and population statistics. URL: <http://www.internetworldstats.com/stats.htm>. Assessed 2014 May15. <http://www.webcitation.org/6PaMKOf0i>
15. Winett, R.A., D.F. Tate, E.S. Anderson, J.R. Wojcik and S.G. Winett, 2005. Long-term weight gain prevention: A theoretically based internet approach. *Preventive Medicine*, 41(2): 629-641. doi:10.1016/j.ypmed.2004.12.005
16. Harvey-Berino, J., S.J. Pintauro and E.C. Gold, 2002. The feasibility of using internet support for the maintenance of weight loss. *behavior Modification*, 26: 102-116. doi:10.1177/0145445502026001006
17. Antwi, F., N. Fazylova, M.C. Garcon, L. Lopez, R. Rubiano and J. Slyer, 2013. A systematic review of the effectiveness of web-based programs on the reduction of childhood obesity in school-aged children. *The JBI Database of Systematic Reviews and Implementation Reports*, 11(6). doi.org/10.11124/jbisrir-2013-459
18. Thomas, B.H., D. Ciliska, M. Dobbins and S. Micucci, 2004. A process for systematically reviewing the literature: Providing the research evidence for public health nursing interventions. *Worldviews on Evidence-Based Nursing*, 1(3): 176-184.
19. Webb, T.L., J. Joseph, L. Yardley and S. Michie, 2010. Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques and mode of delivery on efficacy. *Journal of Medical Internet Research*, 12(1): 1438-8871.
20. Manzoni, G.M., F. Pagnini, S. Corti, E. Molinari and G. Castelnovo, 2011. Internet-based behavioral interventions for obesity: An updated systematic review. *Clin Pract Epidemiol Ment Health*, 7: 19-28. doi: 10.2174/1745017901107010019
21. Tate, D.F., R.R. Wing and R.A. Winett, 2001. Using internet technology to deliver a behavioral weight loss program. *JAMA*, 285(9): 1172-1177. doi:10.1001/jama.285.9.1172
22. Eysenbach Gunther, 2005. The law of attrition. *J Med Internet Res.*, 7(1):e11. doi: 10.2196/jmir.7.1.e11. URL: <http://www.jmir.org/2005/1/e11/> PMID: 15829473
23. Karlson, C.W. and M.A. Rapoff, 2008. Attrition in randomized controlled trials for pediatric chronic conditions. *Journal of Pediatric Psychology*, 34(7): 782-793. doi:10.1093/jpepsy/jsn122
24. Davis, M.J. and M.E. Addis, 1999. Predictors of attrition from behavioral medicine treatments. *Ann Behav Med.*, 21(4): 339-49. doi: 10.1007/BF02895967
25. Knowlden, A.P., 2013. Feasibility and efficacy of the enabling mothers to prevent pediatric obesity through web-based education and reciprocal determinism (EMPOWER) randomized control trial. Dissertation, University of Cincinnati.
26. Cooperberg, J., 2013. Food for Thought: A parental internet-based intervention to treat childhood obesity in preschool-aged children. Dissertation, Washington University.
27. Williamson, D.A., H.M. Walden, M.A. White, E. York-Crowe, R.L. Newton, A. Alfonso, *et al.*, 2006. Two-year internet-based randomized controlled trial for weight loss in African-American girls. *Pennington Biomedical Research Centre*, 14(7): 1231-1243.
28. Chen, J.L., S. Weiss, M.B. Heyman, B. Cooper and R.H. Lustig, 2011. The efficacy of the web-based childhood obesity prevention program in Chinese American adolescents (Web ABC Study). *Journal of Adolescent Health*, 49(2): 148-154. doi:10.1016/j.jadohealth.2010.11.243

29. Catenacci, V., C. Barrett, L. Odgen, R. Browning, C.A. Schaefer, J. Hill and H. Wyatt, 2014. Changes in physical activity and sedentary behavior in a randomized trial of an internet-based versus workbook-based family intervention study. *Journal of Physical Activity and Health*, 11: 348-358. doi.org/10.1123/jpah.2012-0043
30. Thompson, D., J. Baranowski, K. Cullen and T. Baranowski, 2004. Development of a theory-based internet program promoting maintenance of diet and physical activity change to 8-year-old African American girls. *Computers & Education*, 48: 446-459. doi:10.1016/j.compedu.2005.02.005
31. Michie, S., M. Johnston, J. Francis, W. Hardeman and M. Eccles, 2008. From theory to intervention: Mapping theoretically derived behavioral determinants to behavior change techniques. *Applied Psychology*, 57(4): 660-680. doi:10.1111/j.1464-0597.2008.00341.x
32. Golley, R.K., G.A. Hendrie, A. Slater and N. Corsini, 2010. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - What nutrition and activity targets and behavior change techniques are associated with intervention effectiveness? *Obesity Reviews*, 12: 114-130.
33. Brouwer, W., W. Kroeze, R. Crutzen, J. De Nooijer, N.K. de Vries, J. Brug and A. Oenema, 2011. Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review. *Journal of Medical Internet Research*, 13(1): e2. doi:10.2196/jmir.1639
34. Gold, B.C., S. Burke, S. Pintauro, P. Buzzell and J. Harvey-Berino, 2007. Weight loss on the web: a pilot study comparing a structural behavioral intervention to a commercial program. *Obesity (Silver Spring)*, 15: 155.
35. Hunter, C.M., A.L. Peterson, L.M. Alvarez, W.C. Poston, A.R. Brundige, C.K. Haddock, D.L. Van Brunt and J.P. Foreyt, 2008. Weight management using the internet a randomized controlled trial. *Am J. Prev. Med.*, 34: 119.
36. Rothert, K., V.J. Strecher, L.A. Doyle, W.M. Caplan, J.S. Joyce, H.B. Jimison, L.M. Karm, A.D. Mims and M.A. Roth, 2006. Web-based weight management programs in an integrated health care setting: a randomized controlled trial. *Obesity (Silver Spring)*, 14: 266.
37. Van Wier, M.F., G.A. Ariens, J.C. Dekkers, I.J. Hendriksen, T. Smid and W. Van Mechelen, 2009. Phone and e-mail counseling are effective for weight management in an overweight working population: a randomized controlled trial. *BMC Public Health*, 9: 6.
38. Golan, M. and S. Crow, 2004. Targeting parents exclusively in the treatment of childhood obesity: Long-term results. *Obesity Research*, 12(2): 357-361.
39. Golan, M., 2006. Parents as agents of change in childhood obesity-From research to practice. *International Journal of Pediatric Obesity*, 1: 66-76.
40. Ewald, H., J. Kirby, K. Rees and W. Robertson, 2013. Parent-only interventions in the treatment of childhood obesity: a systematic review of randomized controlled trials. *Journal of Public Health Advance*, pp: 1-14.
41. Schulz, K.F. and D.A. Grimes, 2002. Sample size slippages in randomized trials: exclusions and the lost and wayward. *Lancet*, 359: 781-85.
42. Skelton, J.A., M.B. Irby, B.M. Beech and S.D. Rhodes, 2012. Attrition and family participation in obesity treatment programs: Clinicians' perceptions. *Academic Pediatrics*, 12(5): 420-428.
43. Ayala, G.X., J.P. Elder, N.R. Campbell, E. Arredondo, B. Baquero and N.C. Crespo and D.J. Slymen, 2010. Longitudinal intervention effects on parenting of the Aventuras para Niños Study. *American Journal of Preventive Medicine*, 38(2): 154-162.
44. Oude Luttikhuis, H., L. Baur, H. Jansen, V.A. Shrewsbury, C. O'Malley, R.P. Stolk and C.D. Summerbell, 2009. Interventions for treating obesity in children. *The Cochrane Library*, 1: 1-18.
45. Jones, C.J. and R. Bryant-Waugh, 2012. Development and pilot of a group skills-and-support intervention for mothers of children with feeding problems. *Appetite*, 5(2): 450-456. doi:10.1016/j.appet.2011.12.017.