Effects of MyBFF@school Intervention in Health-related Quality of Life among Overweight and Obese Primary School Children

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Abstract

Obesity has been shown to impact the health-related quality of life (HRQOL) among children. This study aimed to determine the effectiveness of MyBFF@school program on health-related quality of life among overweight and obese primary school children in Malaysia. KINDL® Questionnaire was used to collect data on their HRQOL before and after the program. ANCOVA was used to analyse the comparison between intervention and control group after 6 months. There are significant effect on family functioning, F(2,1103)=7.452, p<0.05 and school functioning, F(1,1117)=7.103, p<0.05 after the intervention. Effects can also be seen on physical well-being, emotional well-being and friends functioning. The program is effective in improving the HRQOL significantly in two dimensions namely the family and school functioning. In order to achieve greater overall success, social support should be an integral part of the program and stigma on obesity should be managed and reduced by including normal-weight children in the program.

Keywords

Emotional well-being, Family, Health-related quality of life, Physical well-being, School, Self-esteem

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Introduction

Childhood obesity is becoming a major problem globally and a concern in public health as the prevalence of childhood obesity tends to increase over time in developed and developing countries.\textsuperscript{1} This phenomenon could impair the children’s health-related quality of life (HRQOL) as they may encounter psychological problems due to being stigmatized.\textsuperscript{2} A study among Egyptian children found that obese children have poor HRQOL with all of them suffering from mild to severe anxiety and depression.\textsuperscript{3} This is consistent with another study in New Zealand that discovered obese children have lower HRQOL regardless of their ethnicity as compared to children without obesity.\textsuperscript{4} Another study in Malaysia also reports that obese children have lower HRQOL than their normal counterpart.\textsuperscript{5} Furthermore, childhood obesity also increases the potential of the children growing up into obese adults.\textsuperscript{6,7} These findings indicate that childhood obesity needs to be addressed due to its negative consequences.

In light of the global problem in childhood obesity and the associated potential consequences, early intervention is crucial in combating the problem. A systematic review by Bleich et al. in the interventions of aforementioned problem founds that interventions at schools that incorporate the components of diet and physical activity have the highest effectiveness in dealing with the problem.\textsuperscript{8} However, psychology component is also important in order to directly address the issue of psychological problems faced by these children. In this “My Body is Fit and Fabulous (MyBFF@school)”, a school-based childhood obesity intervention program was implemented with a holistic approach that combines three components which are nutrition, psychology and physical activity in the form of small-sided games (SSG).

The main purpose of the study is to investigate the effectiveness of MyBFF@School program on HRQOL among overweight and obese primary school children in Malaysia.

Methods

Sampling method

School selection

This was a school-based cluster randomised controlled trial with a proportionate stratified random sampling from all types of government school in the states of Selangor, Negeri Sembilan (within 100km radius from central Kuala Lumpur) and Kuala Lumpur which was aimed at primary school children. 23 urban and rural schools were randomly selected from the three states before treatment type (intervention or control) was randomly assigned to the schools. 7 schools out of the 23 schools were assigned as the intervention group while the remaining 16 schools were assigned as the control group. Schools that were already conducting other overweight and obese intervention program were excluded from the study.

Selection of participants

Participants of the intervention program were selected based on their age and BMI. The age of the children must be between 9 to 11 years old in order to participate in the program. On top of that, the children must be overweight or obese which were determined based on their BMI-for-age. The children were classified as overweight if their BMI-for-age is more than +1SD and less than or equal to +2SD while children with BMI-for-age exceeding +2SD were classified as obese which are based on the WHO 2007 Growth Reference.\textsuperscript{9}

On the other hand, children that were not eligible to participate in the program were those that have BMI-for-age less than or equal to +1SD; have mental or physical impairment; have
medical condition that will hinder them from doing physical activity with moderate-to-vigorous intensity; have comorbidities that may impede the study such as diagnosed type 2 diabetes mellitus, hypertension, nephritic syndrome, epilepsy, congenital heart disease and skeletal anomalies; and also those who were on medicine such as steroids, anti-epileptics and methylphenidate.

Data collection

Children from the selected schools were screened by trained personnel to determine their eligibility to join the program. The weight and height of 11950 children from the 23 schools were measured by the trained personnel. Out of those, 3516 were found to meet the criteria for joining the program (overweight and obese students). All were approached for parental/guardian approval to participate in the program but consent were only received for 1397 (39.7%) children. Data was collected from the participating children at baseline and at the end of intervention (month-6) through a survey where the children answered a self-administered questionnaire.

MyBFF@school Program

The intervention program comprises of three components which are psychology, nutrition and physical activity (small-sided games SSG). All children who were assigned to the control group followed the current school curriculum, co-curriculum and any other activities as usual. Meanwhile, the children that were assigned to the intervention group followed all three components of the intervention program for 6 months from February 2016 until August 2016. The three components were carried out by trained personnel who was stationed at each participating school to conduct the program. For children in the intervention group, they would join the program during Physical Education class and co-curriculum activities. They played SSG for half an hour twice weekly. The nutrition module and psychology module alternated each other every week with 10 sessions for each component for the whole duration of the program. Each session spanned for about 45 to 60 minutes per session and 30 to 45 minutes per session respectively.

The Psychology Module

In implementing the intervention program for the psychological component, a module has been developed by the researchers based on literature review and developmental theories. The module consisted of five different psychological aspects with varying fun activities to be carried out by the children. Those aspects were self-esteem, friendship, assertive, positive thinking for healthy life and stress management. Obese children need to be strengthen in the aspects of self-esteem, friendship, assertive, positive thinking for healthy life and stress management in order for them to be able to sustain in the intervention program and have confidence in reducing their body weight because they usually face stigmatization. Besides that, all the five aspects have found to be able to produce positive impacts to the HRQOL and psychological wellbeing among children.

The instrument

Data on HRQOL among the children were gathered using KINDL® Questionnaire which was originally developed by Bullinger et al. in German language and later revised by Ravens-Sieberer and Bullinger. The questionnaire was especially developed and validated to measure HRQOL in children and adolescents. It contains 24 Likert-scaled items that are
associated with 6 subscales namely physical well-being, emotional well-being, self-esteem, friend, family and school functioning. The scores range from 4 to a maximum of 20. Higher score on KINDL indicates better HRQOL.15

The instrument had been translated from English to Malay through back-to-back translation by a team of professional translators followed by pretesting and revision. After that, it was piloted in schools in Putrajaya in 2015 where the Cronbach alpha was found to be 0.70. Meanwhile, the value of Cronbach alpha for the instrument in this study is .776 which proves the reliability of the instrument.15 Levene’s test and normality checks were carried out for each subscale and the assumptions met for all subscales except for the subscale of friend functioning. The test shows that the variances for the subscale of friend functioning were not equal, F(1,1123)=4.050, p<.05.

Statistical Analysis

Mean were used to represent the continuous variables. All statistical tests were conducted at 5% significance level. Chi-square test of homogeneity was used to determine the distribution of the children across different variables. ANCOVA was used to compare the mean of the BMI z-score and the means of the subscales of KINDL between intervention and control group at the end of the intervention. In this analysis, we controlled for socioeconomic and demographic variables as confounding factors. Other potential confounding factors found in the literature to be associated with the subscales of KINDL were also incorporated. Covariates appearing in the model are evaluated to adjust the baseline data accordingly. Data after adjustment for covariates were represented with mean and standard error whereas data without adjustment were represented with mean and standard deviation. The IBM Statistical Package for Social Sciences (SPSS) version 20 (SPSS Inc., Chicago,IL., USA) was used to run all data analysis.

Results

There were 1397 primary school children who participated in the intervention program. Of those, 1138 children (81.4%) answered the KINDL questionnaire whether complete or incomplete, where 612 children were from the intervention group and 526 children were from the control group as shown in Table 1. The children have a mean(SD) age of 9.86(0.896) years old. Chi-square test shows that there are statistically significant differences in the ethnicity of the children, X^2(3)=94.810, p<0.001 that reflects the general population of Malaysia where Malay is the major race. On the other hand, the Chi-square test shows no significant differences in the sex, location, age groups and body weight groups of the children. The test shows that the distribution of the children are the same across the aforementioned characteristics apart from their race.

Table 1.Demography of participants

<table>
<thead>
<tr>
<th>Characteristic of respondents</th>
<th>Intervention</th>
<th>Control</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, n(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>331 (54.1)</td>
<td>283 (53.8)</td>
<td>0.009</td>
<td>0.924</td>
</tr>
<tr>
<td>Girls</td>
<td>281 (45.9)</td>
<td>243 (46.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location, n(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>343 (56.0)</td>
<td>317 (60.3)</td>
<td>2.068</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Table 2 shows that there are significant main differences between intervention and control group at post-intervention for the subscale of family functioning, $F(2,1103)=7.436$, $p<0.01$, and school functioning, $F(1,1117)=7.202$, $p<0.01$ after controlling for the respective subscales at baseline. The analysis of the subscale of family functioning was done using the adjusted group means of the children’s pubertal stage and the BMI category to remove the confounding effects of the family functioning at baseline. On the other hand, the mean pubertal stage was adjusted in order to remove the confounding effects of the school functioning at baseline. Thus, there are significant effects of the program on the subscales of family and school functioning.

On top of that, the program has shown positive changes on the subscales of physical well-being, emotional well-being, and friend functioning, at the end of the intervention program after controlling for the respective subscales at baseline. However, there is no positive changes on self-esteem after the intervention. Positive changes can also be seen on the BMI $z$-score of the children after the intervention as the children in the intervention group were found to have lower BMI $z$-score compared to the control group counterpart where the covariates appearing in the model were evaluated at mean BMI $z$-score baseline value of 2.343.

### Discussion

The effectiveness of the MyBFF@school program corresponds to a review by Ickes et al. on global school-based childhood obesity interventions that was proven to be effective. This also supports the findings by Bleich et al. that concludes school-based intervention program as the most effective method compared to community-based and home-based intervention program. Since there is a significant effect of the program on the family functioning and everyday functioning at school, and the mean of the intervention group for both subscale is higher than the control group counterpart, they imply that the program was effective to some extent in improving the two subscales.

The effectiveness of MyBFF@school program on the subscale of everyday school functioning might indicate that the children found that going to school is enjoyable and their
Table 2. ANCOVA comparing the means of the subscales of HRQOL and BMI z-score between control and intervention group after 6 months of intervention

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Sample size</th>
<th>Mean (SD) at baseline</th>
<th>Adjusted mean at baseline&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Mean (SE) at month-6</th>
<th>Mean (SE) difference&lt;sup&gt;ss&lt;/sup&gt;</th>
<th>F ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI z-score</td>
<td>612/526</td>
<td>2.776 (0.724)</td>
<td>2.850 (.740)</td>
<td>2.343</td>
<td>2.335 (.012)</td>
<td>2.346 (.012)</td>
<td>-.011 (.017)</td>
</tr>
<tr>
<td>PWB</td>
<td>612/523</td>
<td>13.748 (2.816)</td>
<td>14.017 (2.727)</td>
<td>13.89</td>
<td>13.963 (.107)</td>
<td>13.780 (.116)</td>
<td>.018 (.158)</td>
</tr>
<tr>
<td>EWB</td>
<td>611/521</td>
<td>14.036 (2.790)</td>
<td>14.424 (2.897)</td>
<td>14.22</td>
<td>14.109 (.113)</td>
<td>14.107 (.123)</td>
<td>.003 (.167)</td>
</tr>
<tr>
<td>Family</td>
<td>610/518</td>
<td>11.498 (3.265)</td>
<td>11.674 (3.279)</td>
<td>11.57</td>
<td>11.767 (.186)</td>
<td>11.176 (.198)</td>
<td>.591 (.272)*</td>
</tr>
<tr>
<td>Friend</td>
<td>611/522</td>
<td>13.344 (2.720)</td>
<td>13.368 (2.968)</td>
<td>13.37</td>
<td>13.185 (.111)</td>
<td>13.094 (.121)</td>
<td>.091 (.164)</td>
</tr>
<tr>
<td>School</td>
<td>609/521</td>
<td>12.031 (2.277)</td>
<td>11.994 (2.506)</td>
<td>12.01</td>
<td>11.830 (.123)</td>
<td>11.368 (.136)</td>
<td>.461 (.183)*</td>
</tr>
<tr>
<td>SEM</td>
<td>607/507</td>
<td>12.280 (3.524)</td>
<td>12.529 (3.586)</td>
<td>12.39</td>
<td>11.762 (.138)</td>
<td>11.839 (.152)</td>
<td>-.077 (.205)</td>
</tr>
</tbody>
</table>

<sup>1</sup>for both intervention and control groups
<sup>2</sup>intervention/control,
<sup>ss</sup>intervention-control(adjusted for covariate),
<sup>*</sup>p<.01,

EWB – Emotional Well-being
PWB – Physical Well being
SE – Standard Error
SEM – Self-esteem
academic performance might increase following the reduction in their BMI. One of the reasons that the children might find the school to be more enjoyable is because obese children tend to be the victims of bullying such as harassing and name-calling probably because of their big body size which would stressed them out at school. After the intervention program, the children would enjoy going to school as they would probably be less targeted for bullying. This might be due to improvement in global self-worth, self-esteem for physical appearance or body dissatisfaction which are found to be the mediator between body weight and being bullied. On top of that, the children were taught about how to keep calm and control their negative emotions to develop their assertiveness skills through the psychology component module. Acquiring these skills enable them to go through the hardship without feeling much stress.

A study found that being overweight is associated with reduced cognitive functioning among children which might impair their academic performance in school. In contrast, the reduction of their body weight would improve their cognitive functioning along with their academic performance. Hence, as the BMI z-score of the children decreases after the intervention, their cognitive functioning might have increase as well. Research has also proven that physical activity could help children in facing difficulties in academic which would benefit the children in the intervention program as they were committed in performing physical activity during the intervention. The effects were reflected in the improvement of school functioning as it also measures the difficulties in doing homework apart from other criteria.

The program is also proven to be effective in improving the family functioning among the children. A study has found that high family functioning can lead to the children involving in less behaviour that will increase their weight such as disordered eating, consuming fast food and lack of physical activity. The quality of relationship between the children and their parents could also affect the weight of the children in which the chance of the children to be overweight or obese is reduced with a greater quality of their relationship. Poor communication and behaviour control were also associated with greater risk of childhood obesity. Even though there is no available data on whether the reverse is true, it can be inferred from this study that the reduction in the weight of the children could also affect the quality of the children’s relationship with their family to an extent.

The units of assertive, positive thinking for a healthy life and stress management in the psychology component module could be one of the contributing factors that improve the children’s family functioning. The three units equipped the children with skills to understand the nature of relationship better without them feeling overburdened with stress. These skills could be applied by the children in family setting to cope with the parenting style of their family. As a result, the children scored better in the subscale of family functioning after the intervention program.

Overweight children have high chance to be teased by their friends, family members or both due to their weight and size. This problem could cause low self-esteem and emotional problems among the children. At the end of the intervention program, the subscale of self-esteem and emotional well-being did not show any statistically significant changes. It may be caused by the continuous teasing faced by the children and the lasting effect that it may cause on the children. However, although not significant, the emotional well-being of the children had improved slightly. This could be caused by the ability of the children to handle stress better after they underwent the module that comprised stress management, as one of the units in the module. The self-esteem of the students declined at the end of the intervention which corresponds to a study that found obese children are highly likely to have low self-esteem. This is especially true if they are faced with weight-based stigma.
The subscale of physical well-being does not show any significant changes although it did show some improvement with small-sided games incorporated into the program. This could be due to the lack of improvement in their emotional well-being as stress could manifest as somatic symptoms according to Hart et. al, leading to low physical well-being. Stress from peers and school as well as conflicts in family may also be associated with somatic complaints.

In this study, only children with BMI-for-age exceeding +1SD were selected to participate in the intervention program. However, their peers with normal BMI did not carry out the module to receive the benefits from it. Children with the same BMI would most likely tend to befriend each other as seen in a study which found the same friendship pattern among adolescents. Therefore, it was highly unlikely for the participants to share what they have got from the module with their peers that did not join the program. As a result, it was difficult to address the stigma that is often faced by children with obesity. This could explain why the friend subscale only shows little improvement after the intervention program.

Future school-based intervention programs should also include children with normal BMI-for-age in the program in order to further improve the HRQOL of the children. As obese children usually faced stigma and shame from their peers, this step is imperative to reduce the stigma by increasing the awareness among all children in the school about the detrimental effects of the stigmatization. Educating their peers with normal weight about this might induce them to support obese children instead of teasing or isolating them which would be helpful to improve their HRQOL. This is supported by a study that found the importance of supports from classmates to improve the HRQOL of the children.

A limitation of this study is the usage of KINDL as an assessment tool to deduce the HRQOL of the children. Another limitation is the differences in the implementation of the intervention by the trained personnel due to non-compliance and the differences in the facilities available at each school.

**Conclusion**

The program is effective in improving the HRQOL significantly among overweight and obese primary school children in two subscales which are family and school functioning that shows the positive impacts of the psychology module. There are also improvements in the subscales of physical well-being, emotional well-being and friend functioning. The findings suggest that future intervention programs need to focus more on these three subscales in order to have significant improvements after the intervention. Redesigning the module carefully with units to specifically address each of the problems is crucial to enhance the effectiveness of the program. Social support should also be integrated as an important part of the module to improve the HRQOL of the children especially in the subscale of friend functioning. The stigma faced by the children also needs to be properly addressed as it brings detrimental effect to the self-esteem of the children. This could be done by making all children in the schools to participate in the program which includes children with normal weight. Combating both self-stigma and social stigma on obesity could be the key for the program to attain a higher overall effectiveness across all subscales of HRQOL.

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**Ethical standards disclosure**

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia and Educational Planning and Research Division (EPRD), Ministry of Education Malaysia (ethical code: NMRR-13-439-16563). Written informed consent was obtained from the parents or guardian of all subjects and written informed assent was obtained from all subjects.

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