Evaluation of a school-based nutrition and physical activity programme for Grade 4 learners in the Western Cape province

Jacobs KL, MBChB, MMed Graduate; **Mash B,** MBChB, DCH, DRCOG, MRCGP, PhD, Head of Division
Division of Family Medicine and Primary Care, Faculty of Medicine and Health Sciences, University of Stellenbosch
Draper CE, PhD, Senior Research Officer; **Forbes J,** MsocSci, Research Assistant; **Lambert EV,** PhD, Professor
University of Cape Town/Medical Research Council Research Unit for Exercise Science and Sports Medicine
Department of Human Biology, Faculty of Health Sciences, University of Cape Town
Correspondence to: Catherine Draper, e-mail: catherine.draper@uct.ac.za
Keywords: school-based intervention, nutrition, physical activity

Abstract

Objective: This study aimed to evaluate the effectiveness of the Making the Difference programme (MTDP), an education- and activity-based intervention for Grade 4 learners at primary schools in the Western Cape.

Design: This was a cross-sectional, post-intervention survey of an existing programme, using control schools as a comparator.

Setting and subjects: The study involved Western Cape primary schools in the 2009 school year. Schools were randomly sampled from two regions. Four intervention (active in the MTDP) and five control (non-participating) schools (n = 325 learners) were selected.

Outcome measures: The following outcome measures were assessed using an administered questionnaire to learners: learners' knowledge of, attitudes towards, and behaviour in relation to nutrition and physical activity.

Results: A small but significant improvement (eating vegetables and taking lunch boxes to school) was demonstrated with regard to self-reported behaviour in relation to nutrition in the intervention group. However, this behaviour was not explained by differences in barriers to healthy eating, self-efficacy or knowledge, which were not different between the groups, or by perceived social support, which was actually significantly increased in the control group. Groups displayed no differences in physical activity or sedentary behaviour. However, the results showed a significant difference between the groups in terms of a reduction in perceived barriers to physical activity and increased physical activity self-efficacy in the active group.

Conclusion: While the MTDP only had a modest effect on the self-reported nutrition and physical activity behaviour of the learners, results regarding lower perceived barriers to physical activity and increased physical activity self-efficacy were promising.

Ⓟ **Peer reviewed. (Submitted: 2012-08-13. Accepted: 2012-11-18.)** **S Afr Fam Pract 2013;55(4):391-397**

Introduction

There is global concern a bout the growing prevalence of noncommunicable chronic diseases, such as hypertension, diabetes mellitus, cardiovascular disease, and others which are associated with obesity and inactivity.[1] The growing prevalence of noncommunicable chronic diseases is evident in South Africa as well.[2-4] In 2000, physical inactivity was estimated to be the ninth leading cause of deaths in South African adults. The majority of these deaths were attributed to ischaemic heart disease.[5] Concurrently, there is a global increase in childhood and adolescent obesity.[6] The prevalence of overweight in school children in South Africa is 17.1% [body mass index (BMI) $\geq$ 25 kg/m^2].[7] Levels of self-reported physical activity in South African adolescents are on the decline.[8]

There are arguments that environmental factors are among the driving forces behind physical inactivity and unhealthy eating.[9] Preliminary evidence from available systematic reviews indicates that social support and modelling, the availability and accessibility of healthy and less healthy foods, socio-economic status, and social and cultural physical factors are important influences on nutrition behaviour.[10]

It has been suggested that factors that influence eating behaviour need to be better understood to develop effective nutrition interventions that are tailored to individuals

to improve their eating habits.[11] Determinants such as habits, attitudes, self-efficacy, barriers to change and the meaning of "healthy" and "unhealthy" diet and food must be considered.[12]

Schools and worksites are attractive settings in which to improve nutrition and create opportunities for physical activity. School-based interventions, such as the Child and Adolescent Trial for Cardiovascular Health,[13] Pathways,[14] Action Schools! BC[15] and the "Top Grub" intervention,[16] have been shown to have a positive effect on children's diet and behaviour in relation to physical activity.[13,17] Other positive effects on nutrition and physical activity include psychosocial variables, such as self-efficacy.[14] These interventions have been shown to be feasible, acceptable, and in some cases, sustainable, in the school environment.[14,18,19] Approximately one third of all diets or physical activity interventions, and nearly half of all combined interventions, demonstrated significant and positive effects on BMI in a recent systematic review of school-based interventions.[20]

In South Africa, physical education was phased out as a standalone subject from the curriculum in 2004 and placed in the learning area of life orientation as one of four learning outcomes. The national curriculum statement defines life orientation as a broad emphasis on the inculcation of skills, knowledge, values and attitudes that will lead to positive decision-making and action with regard to health promotion, social, personal and physical development, and in the workplace. However, various challenges in implementing physical activity within life orientation have been identified, and the need for capacity development in this area has been highlighted.[21] Additional reforms are currently taking place within the national curriculum. However, these changes have yet to be finalised and issues of capacity remain a concern.

The Making the Difference programme

The Making the Difference programme (MTDP), a unique public-private sector initiative in South African primary schools, is an intervention that promotes healthy lifestyles by focusing on nutrition and physical activity, drawing on a socioecological approach to health behaviour,[22] and comprising theoretical and experiential components. The programme is sponsored by Woolworths, a major national retailer in South Africa, and is implemented in partnership with the Sports Science Institute of South Africa. The MTDP has been put into operation in four of the nine provinces. In 2007/2008, 800 schools, across all areas, were registered with the programme. This increased to 968 schools in 2009/2010. There has been an effort to ensure that up to 50% of MTDP schools are recruited from previously disadvantaged or low- to middle-income communities.

Since its inception, the MTDP has included EduModules, which comprise the curricular component of the programme, on topics ranging from the importance of a healthy, balanced diet and exercise, healthy snacking and encouraging children to be active, e.g. by building a healthy track circuit (a track that is set up with physical exercises at demarcated points around the school grounds), to water conservation and permaculture. In addition, the programme presents educational visits to stores, suppliers and distribution centres, and talks for learners and parents by a network of trained dietitians. Schools that register for the MTDP receive the EduModules and then choose whether or not to engage in the other components of the programme. The health track forms part of the EduModules and specifically supports the inclusion of physical activity in the curriculum.

In 2011, learner talks were introduced as a new component of the MTDP. They are aimed at Grade 4 learners and are delivered by dietitians. They are interactive and focus on a particular fruit or vegetable, and this fruit or vegetable is then distributed to the learners once the talk has been given. Another new component of the MTDP is visits to stores, accompanied by a dietitian, by mothers of learners at MTDP schools.

Study aim

The aim of this study was to evaluate the impact of the MTDP on learners' knowledge, attitude and behaviour in relation to nutrition and physical activity. The objectives were to assess whether any differences existed between an intervention group (students in schools using the MTDP programme) and a non-intervention group (students in schools without the programme), using the following constructs: perceived social support for healthy eating and physical activity, barriers to the adoption of healthy eating and physical activity, self-efficacy with regard to nutrition and physical activity, knowledge of good nutrition and physical activity, as well as practices, e.g. eating fruits and vegetables and bringing a lunch box to school.

Method

This was a cross-sectional, post-intervention survey of an existing programme, using control schools as a comparator.

Study population

Two educational regions in the Western Cape province, one urban and one rural, were purposefully selected for the study. The MTDP and researchers in these regions had a close relationship with the Western Cape Education Department, so it was believed that this would facilitate implementation of the study.

A list of schools from selected regions was obtained from the Western Cape Education Department. The schools in these two regions (52 urban and 38 rural) were then divided into two clusters: active (15 urban and 17 rural) and non-participating (37 urban and 21 rural).

The definitions, of active and non-participating schools, provided by Woolworths, were as follows:

- An active school was one that was registered for and received the curriculum modules of the MTDP, and which also visited Woolworth's supplier warehouses and held parent talks, or schools at which the teachers had undergone training for the EduModules.
- A non-participating school was a school that had never enrolled or taken part in the MTDP.

Schools were then randomly selected from each cluster, within each region. In order to achieve a statistically significant sample (to reach a power of 90%, delta of 0.25 and type 1 error of 5%), the eventual sample was four intervention schools and five control schools. Entire classes were then randomly selected from these schools to obtain a final number of 325 tested learners (140 in the active schools and 185 in the non-participating schools) (Table I).

Table I: Active and non-participating schools

Active schools	n
Urban schools	
School 1	30
School 2	30
Rural schools	
School 3	40
School 4	40
Total	140
Non-participating schools	
Urban schools	
School 5	36
School 6	31
School 7	14
Rural schools	
School 8	70
School 9	34
Total	185

Research instrument used in data collection

The research instrument, a learner-centred questionnaire, was developed as part of the HealthKick school-based research programme.[23] This questionnaire is aimed at Grade 4-6 learners. The questions in the tool were devised by experts in the field, and previously tested on South African children, to give the questionnaire content and face validity.

The questionnaire aimed to assess the knowledge, attitudes and behaviour of the learners in terms of physical activity and nutrition. It comprised the following sections:

- Tell us about your family.
- All about food.
- Fruit and vegetables.
- Healthy choices.
- Healthy eating before and during school.
- Activities at school, at home and in-between.

Description of constructs

In the development of the questionnaire, certain themes were explored. These included knowledge, attitudes (self-efficacy) and practices in terms of nutrition and physical activity, and were accounted for on different levels: at home, at school and time spent in-between. After collecting all the data from the questionnaires, the researchers discussed the various constructs and performed an item analysis to obtain the most suitable items with which to create a scale for each construct.

These constructs included the following:

- Socio-economic status (an asset index).
- Perceived social support for healthy eating.
- Perceived barriers to healthy eating.
- Nutrition self-efficacy.
- Perceived barriers to physical activity.
- Physical activity self-efficacy.
- Physical activity and nutrition knowledge.

For the purposes of the study, a reliability of Cronbach's alpha of 0.65 was considered to be sufficient for between-group comparisons. The data for the items for the various constructs in the questionnaire were analysed for reliability, and those particular items that gave sufficient reliability were selected for further analysis (Table II).

Table II: Constructs, number of selected items and Cronbach's alpha

Scale	Number of items	Cronbach's alpha
Socio-economic status	9	0.65
Physical activity self-efficacy	3	0.67
Physical activity and nutrition knowledge	19	0.65
Perceived social support for healthy eating	4	0.74
Nutrition self-efficacy	10	0.78
Perceived barriers to healthy eating	6	0.67
Perceived barriers to physical activity	9	0.68

Table III: Characteristics of the learners

Characteristics	All schools	Active schools, n = 140	Non-participating schools n = 185	p-value
Age mean (SD)	11 (0.8)	10.9 (0.8)	11.1 (0.9)	0.75
Socio-economic status score (SD)	6.9 (1.9)	7.2 (1.8)	6.6 (1.8)	0.002
Home language				
Xhosa, n (%)	20 (6.2)	6 (4.3)	14 (7.6)	0.30
English, n (%)	87 (26.8)	44 (31.4)	43 (23.2)	
Afrikaans, n (%)	213 (65.5)	88 (62.9)	125 (67.6)	
Other language, n (%)	5 (1.5)	2 (1.4)	3 (1.6)	

SD = standard deviation

Table IV: Comparison of scores from active and non-participating schools, adjusted for socio-economic status

Construct variable	Score range	Active schools n = 140 Mean score (SE)	Non-participating schools n = 185 Mean score (SE)	p-value
Perceived social support for healthy eating	0-8	2.33 (0.22)	3.39 (0.19)	< 0.001*
Perceived barriers to healthy eating	0-12	2.14 (0.23)	2.72 (0.21)	0.07
Nutrition self-efficacy	0-20	16.14 (0.37)	16.37 (0.32)	0.62
Perceived barriers to physical activity	0-18	5.43 (0.35)	6.64 (0.31)	0.01*
Physical activity self-efficacy	0-6	4.46 (0.17)	3.92 (0.15)	0.02*
Physical activity and nutrition knowledge	0-19	11.49 (0.24)	10.90 (0.21)	0.07

SE = standard error
*: p-value < 0.05

Procedure used for data collection

Pilot testing was conducted in order for field workers to familiarise themselves with the questionnaire and to ensure reliable standards of delivery. This was carried out with two different groups of eight learners each, of the same grade, from a school that was not selected to participate in the research study.

The questionnaire was delivered to the learners in a classroom setting by the field workers in the language of instruction (English or Afrikaans). This was achieved in two sessions of 40 minutes each, with a 15-minute rest period between sessions. All questionnaires were reviewed in the classroom immediately after testing to ensure that all of the questions were answered, and so that any omissions could then be corrected. The questionnaire was administered to the learners in the intervention and control schools. The learners were in Grade 5 at the time of the assessment, after having received the MTDP intervention in Grade 4.

Data analysis

Several independent-sample t-tests were conducted to compare scores from the intervention and control schools. Two assumptions were made. The first was that the data were normally distributed, and the second that there was homogeneity of variance. All the data were checked against these assumptions and were found to be normally distributed. Where equal variances could not be assumed, the alternate p-value was then reported. Statistical analysis was performed using Statistica® 11.

Ethical considerations

Ethical approval for the study was obtained from the Human Research Ethics Committee of Stellenbosch University (Reference Number N09/02/068), and written permission was obtained from the Western Cape Education Department and the principals of the selected schools.

Results

Characteristics of the learners

The mean age of the 325 learners was 11 years [standard deviation (SD) 0.8], and the majority were Afrikaans speaking (Table III). Both the selected urban and rural areas were mainly Afrikaans-speaking populations. The Xhosa first language-speaking learners were either in English- or Afrikaans-speaking classes, since no predominately Xhosa speaking schools were selected during randomisation.

Knowledge and attitudes in relation to nutrition and physical activity

Table IV shows the scores for the scales that measured the constructs relating to knowledge, self-efficacy and barriers to participation in physical activity and healthy eating. As there was a significant difference between the socio-economic status of learners in the two groups (Table

Table V: Behaviour pertaining to nutrition and physical activity in active and non-participating schools

Characteristic	Active schools, n = 140 Mean score (%)	Non-participating schools, n = 185 Mean score (%)	All schools	p-value
Nutrition				
Lessons about healthy eating	130 (92.9)	179 (96.8)	309 (95.1)	0.11
Eat fruit	134 (95.7)	175 (94.6)	309 (95.1)	0.76
Like fruit	112 (80)	159 (85.9)	271 (83.4)	0.36
Like vegetables	72 (51.8)	108 (58.7)	180 (55.7)	0.27
Eat breakfast	107 (76.4)	138 (74.6)	245 (75.4)	0.93
Eat vegetables	113 (80.7)	134 (72.4)	247 (76.0)	0.04*
Bring lunch box to school	103 (73.6)	120 (64.9)	223 (68.6)	0.01*
Physical activity				
Participate in school sport	92 (65.7)	123 (67.6)	215 (66.8)	0.94
Like playing with friends as favourite activity	76 (54.3)	102 (55.1)	178 (54.8)	0.94
Spend > 2 hours per day in front of television or a computer during the week	31 (22.1)	48 (25.9)	79 (24.3)	0.10
Spend > 2 hours per day in front of television or a computer during the weekend	51 (36.4)	64 (34.8)	115 (35.5)	0.80

*: p-value < 0.05

III), with the active schools having a higher status, the key nutritional and physical activity outcomes were adjusted for socio-economic status. The adjusted results are shown in Table IV.

There was no difference in knowledge in relation to physical activity or nutrition between active and non-participating schools. Perceived social support for the adoption of healthy nutrition was significantly higher in the non-participating schools. There was also no significant difference between active and non-participating schools in terms of self-efficacy in relation to healthy eating or to perceived barriers to healthy eating. Perceived barriers to physical activity were significantly lower in the active schools (p-value < 0.01), and physical activity self-efficacy was higher (p-value < 0.02) in the active schools.

Nutrition and physical activity behaviours

Table V shows the outcome measurements for actual self-reported behaviour in relation to nutrition and participation in physical activity. Significantly more learners in the active schools brought their own lunch boxes to school and ate vegetables. None of the other nutritional or physical activity measures differed between the groups.

Discussion

The study demonstrated that a small but significant improvement took place with regard to eating vegetables and taking lunch boxes to school in the active schools. These improvements were not explained by differences in perceived barriers, self-efficacy or knowledge in relation to nutrition and physical activity, which were not different between the groups. Improvements were also not explained by perceived social support, which was actually significantly higher in the control group. The latter was unexpected, considering the provision of parent talks at the active schools. The finding of higher perceived social support in the control group could be explained by feeding schemes at the schools or within the communities, and by the fact that the parents of these children were unable to afford luxury foods, and therefore provided bread and cooked foods more regularly at home. However, as these two outcomes (eating vegetables and taking lunch boxes to school) were not adjusted for socio-economic status, they may be difficult to interpret.

The study by Fahlam et al, in which trained individuals were employed to deliver the Michigan Model Nutritional Curriculum, revealed that the intervention group was significantly more likely to eat fruit and vegetables, and less likely to eat junk food, than the control group.[24] The Planet Health study was also successful in shaping dietary habits in participants.[25] The intervention led to reduced television hours in girls and boys and an increase in the consumption of fruit and vegetables. It also resulted in a smaller increment in total energy intake in the girls. It was suggested that lack of an intervention effect among the boys might have been owing to different causal factors between boys and girls, and the fact that girls tend to be more attuned to issues of diet and activity, although there is little published scientific evidence to support this hypothesis.

Greater emphasis was placed on behaviour in relation to nutrition in the MTDP, and less focus on that in relation to physical activity. Nevertheless, there appears to have been

a more significant impact with regard to the physical activity component. Groups displayed no clear difference in self-reported physical activity or sedentary behaviour. However, there was a significant difference between the groups in terms of fewer perceived barriers and higher self-efficacy in the active group in this regard. A possible explanation for this is that exposure to the MTDP programme encouraged active schools to change their emphasis on physical activity, thereby making it more accessible and potentially easier to do. This is a positive finding for the MTDP. Similar changes were found in another South African study of primary schoolchildren.[26] However, this may not translate into increased physical activity or decreased sedentary behaviour.

The need for comprehensive school-based intervention is underscored by Salmon and King.[27] They concluded that interventions that incorporated school- and family-based components could be more successful in increasing at least some elements of children's physical activity. The Kiel Obesity Prevention Study (KOPS) study in Germany showed that intervention resulted in a reduced cumulative four-year incidence in overweight, although only in those children from families with a high socio-economic status.[28] Our study also demonstrated that schools that had implemented the intervention programme (active schools) had a higher socio-economic status. This could be because of several factors. For example, these schools might have had better administration, a more progressive approach, have been more learner-centred, or simply had better access to resources.

Strengths and limitations of the study

The study demonstrated a number of key strengths. The most important of these was the use of a measuring instrument that was child-friendly. The pictorial nature of some of the items facilitated easy administration and scoring. Clarity of comprehension was enhanced, resulting in fewer respondents becoming frustrated with the process. The other strengths of the study were that it was a reasonable sample size and the HealthKick questionnaire was developed by experts in the field. The low error rate may have been owing to the standard protocol for data entry and cross-checking. However, although the psychometric properties of the scales used during the study were tested using item analysis, no formal validity or reliability data exist for these scales.

The lack of a pre-test baseline makes it difficult to account for the way in which the groups may have differed at baseline, and the extent to which they may have changed. This limitation in the design was owing to a request for an evaluation after the programme having already been implemented, and was therefore unavoidable. Clearly the groups differed in terms of socio-economic status. This was particularly important if recent literature on the close connection between socio-economic status and nutritional habits is taken into account.[14] It was not possible to adjust for socio-economic status with the behavioural outcomes.

Recommendations for future research

Future research into the availability and accessibility of healthy food as determinants of behaviour relating to eating well and participating in physical activity in South African settings is urgently required so that programmes to promote healthy lifestyles in children can be developed and implemented. Any intervention programmes initiated at schools should at least include nutrition and physical activity, and evaluations should include a pre- and post-test design.

A more in-depth study, such as a pragmatic, clustered randomised controlled trial, is required to comprehensively evaluate the effectiveness of the MTDP. Such a study should also develop and properly validate the tools that were used to measure key variables and outcomes. Future research should also use mixed methods to evaluate the qualitative process, as well as quantitative outcomes. Other aspects that could be included in future evaluations include intervention fidelity, the influence of the environment (school, home and recreational), and policy relating to healthy lifestyles and school curricula, with an emphasis on healthy nutrition and regular and compulsory participation in physical activity and sports programmes.

Conclusion

While this study did not show that the MTDP had a substantial impact on activity outcomes pertaining to nutrition and physical activity for learners, it resulted in a small difference in terms of healthy eating behaviour, and there were lower perceived barriers and increased self-efficacy in relation to participating in physical activity. Further research is needed in order to attribute these affects to the programme. However, the preliminary results were favourable.

Acknowledgements

Funding for the primary author (for postgraduate study) was provided by Woolworths. Additional funding support was also provided by the National Research Foundation. Woolworths was involved in the initial conceptualisation of the study. Neither of the funding bodies was involved in the development of the study design, nor in the collection, analysis and interpretation of the data, writing of the manuscript, nor decision to submit the manuscript for publication.

References

1. The world health report: global strategy on diet, physical activity and health. World Health Organization [homepage on the Internet]. c2012. Available from: http://www.who.int/dietphysicalactivity/en/
2. Kruger HS, Puoane T, Senekal M, Van der Merwe MT. Obesity in South Africa: challenges for government and health professionals. Public Health Nutr. 2005;8(5):491-500.
3. Senekal M, Steyn NP, Nel JH. Factors associated with overweight/obesity in economically active South Africa populations. Ethn Dis. 2003;13(1):109-116.
4. Walker AR, Walker BF, Segal I. Some puzzling situations in the onset, occurrence and future of coronary heart disease in developed and developing populations, particularly such in sub-Saharan Africa. J R Soc Health. 2004;124(1):40-46.
5. Joubert J, Norman R, Lambert EV, et al. Estimating the burden of disease attributable to physical inactivity in South Africa in 2000. S Afr Med J. 2007;97(8 Pt 2):725-731.
6. Obesity: preventing and managing the global epidemic. World Health Organization [homepage on the Internet]. c2012. Available from: www.who.int/entity/nutrition/publications/obesity/WHO_TRS_894/en/
7. Steyn NP, Labadarios D, Maunder E, et al. Secondary anthropometric data analysis of the National Food Consumption Survey in South Africa: the double burden. Nutrition. 2005;21(1):4-13.
8. Reddy SP, James S, Sewpaul R, et al. *Umthente Uhlaba Usamila:* The South African Youth Risk Behaviour Survey 2008. Cape Town: South African Medical Research Council; 2010.
9. Ball K, Timperio AF, Crawford DA. Understanding environmental influences on nutrition and physical activity behaviours: where should we look and what should we count? Int J Behav Nutr Phys Act. 2006;3:33-42.
10. Brug J. Determinants of healthy eating: motivation, abilities and environmental opportunities. Fam Pract. 2008;25 Suppl 1:i50-i55.
11. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviours. J Am Diet Assoc. 2002;102(Suppl 3):S40-S51.
12. Turconi G, Guarcello M, Maccarini L, et al. Eating habits and behaviours, physical activity, nutritional and food safety knowledge and beliefs in an adolescent Italian population. J Am Coll Nutr. 2008;27(1):31-43.
13. Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity. The Child and Adolescent Trial for Cardiovascular Health. CATCH collaborative group. JAMA. 1996;275(10):768-776.
14. Stevens J, Story M, Ring K, et al. The impact of the Pathways intervention on psychosocial variables related to diet and physical activity in American Indian schoolchildren. Prev Med. 2003;37(Suppl 2):70-79.
15. Naylor PJ, MacDonald HM, Zebedee JA, McKay HA. Lessons learned from Action Schools! BC: an "active school" model to promote physical activity in elementary schools. J Sci Med Sport. 2006;9(5):413-423.
16. Lakshman R, Sharp S, Ong K, Forouhi N. A novel school-based intervention to improve nutrition knowledge in children: cluster randomised controlled trial. BMC Public Health. 2010;10:123.
17. Day ME, Strange KS, McKay HA, Naylor PJ. Action Schools! BC-Healthy Eating: effects of a whole-school model to modifying eating behaviours of elementary school children. Can J Public Health. 2008;99(4):328-331.
18. Stickler A, Ethelbah B, Martin CJ, et al. Pathways process evaluation results: a school-based prevention trial to promote healthful diet and physical activity in American Indian third, fourth and fifth grade students. Prev Med. 2003;37:S80-S90.
19. Perry CL, Sellers DE, Johnson C, et al. The Child and Adolescent Trial for Cardiovascular Health (CATCH): intervention, implementation, and feasibility for elementary schools in the United States. Health Educ Behav. 1997;24(6):716-735.
20. Brown T, Summerbell C. Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obes Rev. 2009;10:110-141.
21. Van Deventer K. Perspectives of teachers on the implementation of Life Orientation in grades R-11 from selected Western Cape schools. S Afr J Educ. 2009;29:127-145.
22. Sallis JF, Prochaska JJ, Taylor W. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc. 2000;32(5):963-975.
23. Draper CE, De Villiers A, Lambert EV, et al. HealthKick: a nutrition and physical activity intervention for primary schools in low-income settings. BMC Public Health. 2010;10:938.
24. Fahlam MM, Dake JA, McCaughtry N, Martin JA. A pilot study to examine the effects of a nutrition intervention on nutrition knowledge, behaviours, and efficacy expectations in middle school children. J School Health. 2008;78(4):216-222.
25. Gortmaker S, Petersen K, Wiecha J, et al. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. Arch Pediat Adol Med. 1999;153(4):409-418.
26. Draper CE, De Kock L, Grimsrud AT, et al. Evaluation of the implementation of a school-based physical activity intervention in Alexandra township, South Africa. S Afr J Sports Med. 2010;22:12-29.
27. Salmon J, King A. Population approaches to increasing physical activity among children and adults. In: Crawford D, Jeffrey R, editors. Obesity prevention in the 21st century: public health approaches to tackle the obesity epidemic. Oxford: Oxford University Press, 2005; p. 129-152.
28. Plachta-Danielzik S, Pust S, Asbeck I, et al. Four-year follow-up of school-based intervention on overweight children: the KOPS study. Obesity (Silver Spring). 2007;15(12):315-316.