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How effective are the interventions related to physical activities and nutrition in the school-based health promotion programmes: A Review of literature

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Background: *This narrative article reviewed 20 intervention studies which focused on physical activity and nutrition together under the school based health promotion programmes.*

Objective: *To assess and summarize the effectiveness of interventions focussing on physical activity and nutrition together through the school-based health promotion programmes.*

Search method: *The search strategy included search in databases such as pubmed, medline, reference lists of included articles, systematic reviews and background papers to identify relevant studies and references. Efforts were made to retrieve and review full articles, in the absence of which, the abstracts were considered. The following inclusion criteria were considered in the process of literature review:*

i. *Language: published in English*
ii. *Time period: last ten years, i.e; from 2003 till 2013*
iii. *Location of study: intervention must be in the school-based setting.*
iv. *Target group: school going students in any grade.*
v. *Nature of interventions: must be on physical activity and nutrition both; embedded explicitly in the school curriculum.*
vi. *Intervention period: minimum of four weeks.*
vii. *Personnel administering Interventions: there was no specific selection of personnel who delivered interventions. School teachers, counsellors, health educators and any other type of health personnel involved in the study were considered.*

I. Introduction:

Unhealthy diets and physical inactivity are the two key risk factors for the major non-communicable diseases such as cardiovascular diseases, cancer and diabetes. Regular physical activity combined with healthy diet produces benefits such as overall good health, maintain body weight and thus serve as a platform to prevent the onset of non- communicable diseases among the children and adolescents. The World Health Assembly adopted the WHO Global Strategy on Diet, Physical Activity and Health, [1] in May 2004 as focused strategy in order to address the growing burden of the NCDs and to reducing deaths and diseases worldwide by improving diets and increasing levels of physical activity. The 2013 World Health Assembly endorsed the Global NCD Action Plan 2013-2020,[2] which includes a set of actions to promote healthy diets and physical activity, and to attain nine voluntary global targets for NCDs including ones on diet and physical activity to be achieved by 2025 (resolution WHA 66.10).The documented health benefits of regular physical activity which include increased physical fitness (both cardio respiratory fitness and muscular strength), reduced body fatness, favourable cardiovascular and metabolic disease risk profiles, enhanced bone health and reduced symptoms of depression. [3] The scientific evidence available for the age group 5–17 years supports the overall conclusion that physical activity provides fundamental health benefits for children and youth. It is well established that physical activity of amounts greater than 60 minutes daily provides additional health. [4] Comprehensive school-based interventions can increase participation in vigorous physical activity among high-school girls. [5] After-school programmes have also reported increases in physical activity. [6]

Studies have concluded that the nutrition promotion programmes using the Health Promoting Schools approach can increase participants' consumption of high-fibre foods, healthier snacks, water, milk, fruit and vegetables.[7] A number of research studies have demonstrated the feasibility of sustainability of substantially modifying school lunches and school physical education programmes to improve children's diet and physical activity among high school girls.[8] School programmes are effective in preventing childhood obesity [9] and specifically the interventions that adopt multi- component approach are more effective in preventing obesity.[10]

II. Brief review of school based interventions

Physical inactivity and unhealthy diets are the modifiable risk factors and the school settings provide a strong forum to initiate health interventions for the NCDs. McKenzie suggested that studies on school based – interventions presently extend beyond the confines of the school classroom or gymnasium to embrace the

broader school environment, including school policies, facilities, community linkages, and all campus activity programs, such as recess, intramurals, and club sports.[11] Many earlier related reviews had narrower focus.[12] These reviews related to school-based interventions focused on diverse aspects such as physical activity [11, 17], nutrition[13, 14], obesity[9, 10, 11]), participatory health promotion[15] levels of academic achievements[16], cardio-vascular risks [18], in isolation or collectively with other variables.

Results of several studies have stressed the need for intervention programmes aimed at increased consumption of fruits and vegetables, targeting proximal factors such as the family environment and distal factors by aiming at integrating other risk factors such as physical activity into health promotion among adolescents. [14] Brown 2006 highlights that as cited in the previous review of reviews, interventions that promoted healthy eating and physical activities were effective. These programmes were among the most sophisticated, and the ones that were effective were more likely to involve changes to the environment of the school and involvement of parents. Students from schools participating in a coordinated program that incorporated recommendations for school-based healthy eating programs had healthier diets, and reported more physical activities than students from schools without nutrition programs[19] and exhibited significantly lower rates of overweight and obesity.[20, 21]

Best practice interventions for promoting healthy diets and increased physical activity in school settings have suggested four components namely parental component, nutrition based curriculum component, food service component and physical activity programme. School interventions were more likely to be successful if they were offered at primary schools and implemented by qualified educators to children in grades 4-7. All best practice studies were based on a firm theory of behaviour, such as cognitive, social or stages of change theories.[22] Studies conducted in middle schools and high schools have also demonstrated that it is feasible to improve the quantity and quality of school physical education through policies, teacher training, use of activity-focused "enhanced" curricula, and smaller class sizes. [23, 24]

Multi-component school-based programmes seem to encompass all of the aforementioned elements. Murillo grouped various strategies which resulted in increased physical activity into 5 broad intervention guidelines (i) design multi-component interventions that foster the empowerment of members of the school community; (ii) develop improvements to physical education curricula as a strategy to promote physical activity to adolescents; (iii) design and implement non-curricular programmes and activities to promote physical activity; (iv) include computer-tailored interventions during the implementation and monitoring of physical activity promotion programmes and (v) design and implement specific strategies that respond to the interests and needs of girls.[25]

Keeping the above in purview, a literature review was undertaken to assess and summarize the effectiveness of interventions which focussed on physical activity and nutrition together in the school –based health promotion programmes. Through this review we aim to identify the most promising elements of existing health promotion programmes and interventions specifically focusing on physical activity and nutrition that could be implemented and evaluated on a large scale and contribute to literature by including studies.

Analysis and Discussion: Twenty research studies published since 2003 till 2013, which had implemented focused interventions both on physical activity and nutrition in the school based settings were selected. Given below is the analysis and discussion of key findings.

Time period of the interventions: Much diversity was found in the time-period of the interventions in the school based settings, varying from 4 weeks to three years.

Target group: An analysis of the target group based on grades revealed that range of interventions planned varied from kindergarten to secondary school students. Two studies were conducted on kindergarten students [27, 43]; one study was done among students in grades 1 to 3 [26]; two studies on grade 4 & 5 students [28, 34]. Five studies planned interventions for primary school students[29,30,35, 38, 39] and four on elementary school students[36,42,44,45]. Two studies included students from the primary through secondary schools, aged 7 and 12 years. [32, 37]

Personnel involved: Teachers participated in all the studies for delivering the planned interventions. One study included the school doctor [36] and other health educator. [40]

Involvement of parents/families: 14 out of 20 studies planned interventions involving the parents/family, which shows that their engagement is critical for ensuring physical activity and nutritional changes. [26,27,28,29,30,32,34,35,37,39,40,41,42,45]

Design of the study: Research on health promotion requires a variety of methodological approaches, including process- and outcome-based evaluation, and quantitative and qualitative methods. Ten studies[26,27,28,30,33,34,37,38,40,45] used randomized control trial method. Four among these used cluster randomized trial method. [28, 30, 33, 44] Quasi experimental study design was used in three studies. [31,32,36,42] Non- randomized control trial was used in one study [10] and study designed based on behavioural epidemiological model was

adopted by one study.[43] Two studies adopted whole school approach.[29,41] Some studies had very small sample size due to which generalization to a larger population was difficult.

Nature of interventions: One of the criteria for inclusion was that it must have been implemented in a classroom setting. The review reveals that a great diversity exists in the nature of interventions designed in the classroom setting for physical activity and nutritional aspects combined. For example, studies were designed to test if the classroom based education could change the knowledge about healthy heart[27, 40]; relationship between nutrition and cardiovascular risk factors[27]; to assess the impact on dietary intake and cognitive and attitudinal variables related to consumption of fruits and vegetables.[28,34] Multi-component interventions were designed for reducing % body fat[26] ; weight status[29,30,43]; BMI & obesity exercise[38] and nutrition[37, 39,42]; healthy life styles including CVDs, tobacco use, nutrition & physical activity.[36] 8 studies exclusively focussed on overweight /obesity by designing interventions through physical activity and nutrition.[26,28,29, 30,31,34,38,42]

How the assessment of interventions was undertaken: Most studies used intervention and control groups and pre-test –post test design. Fung et al; conducted annual surveys related to diet; physical activity and health with 84% student participation rate. [34] Gorely et al report that the intervention was most successful when it was taken on board as a whole initiative with the staff providing organized activities for the children.[35] The study by Caballero used process evaluation and revealed a strong degree of implementation for the classroom curriculum, with 94% of lessons completed. [26] Formative assessment approach was used by Naylor,[26] while Jansen used multi-level analysis which supported evidence of multi component interventions.[38] Ribeiro et al used pre-intervention and follow-up student surveys based on the trans-theoretical model of the stages of behaviour change. This intervention encouraged the students to make healthy lifestyle choices related to eating habits and physical activity behaviours.

Process evaluations form a crucial part of the design/methodology. 'Health promoting interventions cannot be expected to work unless they are appropriately implemented; to be clear that this has happened, process evaluations are needed alongside trials. It is, however, unusual for process evaluations to be undertaken or for those reporting controlled trials to include information on the extent to which programmes were implemented'. [25] Only three studies weaved in process evaluation in the design. [32,38,41]

Main outcome measures in the studies varied from percentage body fat & BMI,[28, 30, 36, 42] physical activity, sedentary life style, dietary intake, eating patterns [37, 39, 42], obesity[26, 28, 29, 30,31,34,38,42].

Result/Effect of interventions: The result of interventions related to physical activity and nutrition were assessed for measures such as effects on BMI, % body fat, consumption of more fruits, total energy intake and effect on knowledge, attitude and behaviour change. Studies which evaluated the effect of interventions on BMI demonstrated mixed results. Significant between group effects were observed for waist circumference for BMI z scores in two studies.[33, 41] Results of three studies[28,30,36,42] found no significant changes in the % body fat or BMI, but improvements were seen. Cunha[28] explain that despite the failure of the intervention to bring about an overall change in the students' BMI, the results of this study are important because the dietary patterns of Brazilian adolescents are characterized by low consumption of vegetables and fruits and high consumption of sweets and sodas as well as foods high in sodium.[28] No significant reduction in body fat was found in two studies[26,43]; whereas slowing in rate of increase in estimated % body fat was informed by two studies.[35, 39]

The knowledge and attitude related to nutritional aspects were reported to be significantly positively changed in many studies.[26,27,36,40,42] Many studies reported significant increase in knowledge related to physical activity and nutritional aspects.[27,31, 34, 36, 37] Physical activity levels were reported be higher in studies [26,31, 35, 36,37] in the intervention than the control groups. Studies also reported that children consumed more fruits [28, 34]; engaged in more physical activity[34] and consumed less sugar.[27, 28] One study found no difference in fruits and vegetables intake.[35] Study by Hopper, 2005 [37] concluded that including family was effective in improving nutritional knowledge rather than changes in diet and behaviour. Significant behaviour change was observed related to physical activity and physical fitness in studies [36, 43]; nutrition. [37]

Schools can adjust curriculum to meet some health needs of the students and achieve modest changes in exercise and nutrition knowledge and diet.[37] Overall, 18 out of 20 interventions reported that interventions were successful. Only 2 studies reported no significant effect of intervention at student level.[32,36]

III. Limitations observed in the studies

Many studies did not report the limitations observed. Cunha et al observed that many students bring processed salty snacks, filled cookies, and sodas to school. In addition, physical activities were not possible because of lack of support from principals and teachers. School facilities were inadequate; only 2 of the 20 schools had a sports field. [28] Gorely et al cite a methodological limitation that due to the local media content, it was not possible to conduct a randomised control trial and hence the schools were matched on key variables. An assessment of diet may not have been sensitive enough; the lack of a long term follow-up as yet means the sustainability of behavioural changes cannot be assessed. Further, matching the groups on SES was not successful and group level matching was not reflected at the individual level resulting in the intervention group

being of lower socioeconomic status than the control.[35] Staff highlighted challenges such as limited time, high staff turnover at the schools, & lack of financial resources, but felt with continued support they could continue to implement programme.[41] Decline in enthusiasm and need for more support & guidance to maintain programme was suggested by another study.[32]

IV. Recommendations/suggestions given in the studies

More professional training for teachers in the Health Promoting School approach is required.[32] A lack of effect of the intervention on % body fat suggests that more intense or longer interventions may be needed to modify the continuing trend toward higher adiposity.[26] Studies using multi-component intervention strategies are able to increase consumption of healthy dietary items, a good strategy thus would be to incorporate classroom-based physical activities incorporating multi-component approach. Further studies are required to develop messages and strategies that not only change specific eating behaviors but also lead to reductions in weight gain, especially among low socio-economic groups.[28] Since the environmental contributors to the obesity problem are more societal rather than individual responsibility, it suggests that dissecting and tackling the obesogenic environment is necessary to complement school- and family-based interventions.[29] The future programs should take into account SES, parental body weight, and sex as confounders. They should include the primary care and/or clinical setting.[30] Better student outcomes could probably be attained by a more focused and evidence-based approach with stepwise implementation of action plans.[32] Cabellero et al 2003, state that over the past 30 years, several school-based studies have implemented and evaluated programs aimed at reducing cardiovascular disease risk or obesity prevalence. Several of these programs were targeted at only obese children and thus did not attempt to modify risk behaviors in non-obese children. [26]

V. Conclusion

The review suggests that school health promotion interventions related to physical activity and nutrition are effective. Interventions in all the studies were implemented by the teachers. In some cases doctors, health educators, sport teacher and additional support personnel was deployed. There is also evidence that most studies involved the parents/ families in the intervention programmes. The type of interventions for parents included briefing about the programme, seeking their consent and participation, lectures for the parents/families; health education material; and interaction with the school team. 25% interventions had target group consisting of primary school and 25% for the elementary school children. Many studies adopted randomized controlled trial design, though there is debate as to the appropriateness of RCTs for evaluating health promotion interventions. [47] All the studies adopted the multi-component approach for the intervention; that is; having a physical activity component and the nutrition component embedded in the curricula and parental/family involvement. The intervention for the students in the classroom environment revolved around both the physical activity and nutrition. Regarding physical activity, the interventions designated a specific time and aimed to provide increased opportunity for physical activities such as activity breaks for 10-15 minutes; running games, physical activity events, additional sport activities outside school hours and fitness testing. The intervention for nutritional aspects included nutrition education provided through learning resource materials, lectures focussing on healthy eating and life styles and choices with the involvement of parents/families. Studies which evaluated the effect of interventions on BMI demonstrated mixed results. Many studies reported significant increase in knowledge related to physical activity and nutritional aspects. Physical activity levels were reported be higher in the intervention than the control groups. Process evaluation which gives an indication on whether the programme strategy and other components was successful or not and to what extent, was not elaborated in many studies.

Directions for future research: There is a paucity of research in an Indian context in this area. Longitudinal studies need to be developed with robust study design. The school health programmes must be evaluated for their long term effects on the sedentary behaviour and dietary habits. More randomized strategies within each intervention should be discussed. Successful control trials are needed to overcome methodological limitations of existing literature. Socio-economic variables have a very important role to play in the diet/eating habits and physical activities, hence should be given due consideration while selecting the sample. Process evaluation should be weaved in the methodology. The schools while designing the interventions should take care of these aspects and plan activities accordingly.

Recommendations: The public health effect of these interventions depends on a number of factors such as; is there a school health policy? What types of health promotion programmes are planned? Do they meet the developmental needs, socio- environmental status concerns of the children and community? Is there regular monitoring and evaluation of these programmes? Are the parents/family members an integral part of planning? Given the global burden of NCDs, and the rise of obesity and overweight among the children and the adolescents, the schools must plan for systematic health promotion programmes and especially weave in the physical activity and nutrition education programmes in the curricula. Research studies need to determine what

programme characteristics contribute to specific outcomes and the differential benefits for various student groups and how programmes can be adapted to meet the needs of specific groups. Training of teachers and setting aside specific time in the curriculum would go a long way to strengthen the health promoting school policy.

Policy implications: Schools serve as a major platform for initiating preventive and promotive measures. Evidence-based interventions have shown to be effective in increasing physical activity and nutrition education which can be adopted and implemented, as recommended by national organizations. Because there is evidence that risk factors continue into adulthood,[36] such interventions if carried out for longer period of time, with monitoring and process evaluations, could have an impact on control of NCDs. Hence focused school health programmes and implementation of various educational activities; with respect to life-styles in the framework of parents/community need to be developed and implemented as necessary component of health education in schools.

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