Research Paper

Effect of Structured Exercise Program and Nutritional Counselling on Fitness in School Children

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ABSTRACT

Purpose: Childhood and adolescence are important stages of life, as many physical, biological and psychological changes take place during this stage. There are many contributing factors which plays important role during this growing and developmental stages. During these stages, modifiable factors including nutrition and physical fitness are crucial. In order to improve physical fitness, interventions should focus on physical activity, and improving the dietary intake of nutrients. Therefore, the present study aimed to evaluate the impact of nutritional counselling and structured exercise regimen on fitness of elementary school children.

Methods: The study included sixty school-age children, ranging between 6-14 years of age who scored poorly on three of the five tests related to the physical fitness. The exclusion criteria consisted of children with recent ligamentous or muscular injury in previous four weeks and were medically instructed not to engage in any of the physical activity. Children were randomly assigned to Group A-structured exercise program (SEP), Group B-nutritional Counselling program (NCP) and Group C-SEP+NCP. Pre-and post-intervention the children were assessed for their fitness parameters like muscle strength, curl up test, flexibility, agility, and cardiovascular endurance.

Results: It was observed that fitness of children improved in all groups following four weeks of intervention $P<0.05$, however the greatest improvements were observed following structured exercises and nutritional counselling (SEP+NCP).

Conclusion: There is a definite need to focus on healthy lifestyle in elementary school children which should include both structured exercise and nutritional counselling.

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Highlights

- Group B highlighted more BMI followed by Group A and Group C.
- The effect for time and time×group are significant for grip strength, curl-up test, 10×4 shuttle test, and cardiovascular endurance test.
- For flexibility, the mean difference for time is significant.

Plain Language Summary

The elementary school children often avoid either physical fitness or nutritional diet. However, for complete development of child, both exercise as well as nutrition play a crucial role. This study determines the impact of structured exercise program, nutritional counselling, and both in elementary school children. The study reported more improvement in the children who belonged to the group involving both structured exercise and nutritional counselling followed by remaining two groups. This specified the importance of integration of a policy to include structured exercise with nutrition in school curricula. Also, highlighted the need of the multi-disciplinary approach for physical therapists and nutritionists for overall development of children.

Introduction

Physical fitness is considered the key health marker, especially in children, and has also been shown to play a significant role in their academic performance, generalized achievement [1, 2], and quality of life [3]. There is a strong carryover effect as individuals transition from childhood to adolescence to adulthood [4] despite their natural tendencies, children have become less physically active in recent decades, with children today expending approximately 600 kcal days' less than their counterparts 50 years ago. Although the health consequences of a reduced energy expenditure in adults is well documented, there is little direct evidence linking sedentariness with health in children. However, three main benefits arising from adequate childhood physical activity have been postulated. The first is direct improvements in childhood health status; evidence is accumulating that more active children generally display healthier cardiovascular profiles, are leaner and develop higher peak bone masses than their less active counterparts. Secondly, there is a biological carry-over effect into adulthood, whereby improved adult health status results from childhood physical activity. In particular, childhood obesity may be a precursor for a range of adverse health effects in adulthood, while higher bone masses in young people reduce the risk of osteoporosis in old age. Finally, there may be a behavioural carry-over into adulthood, whereby active children are more likely to become more active (healthy. Thus, childhood fitness is a crucial attribute for the physical capacity of individuals in adulthood.

Physical fitness is directly associated with exercises and any type of physical activity [5, 6]. In addition to physical exercise, nutrition is essential for maintaining health and the early detection and treatment of disease. The composition, quality, and quantity of food consumed affect body weight, cognitive ability [7], physical performance, and recovery from exercise [8]. Recently, it has been reported that India is undergoing a nutritional transition where undernutrition and overnutrition coexist. Children's general fitness and cognitive function are negatively impacted by both undernutrition and overnutrition. Since the fitness of children is a growing public health concern globally, it is important to regularly focus on and address related factors, including childhood nutrition.

General exercise positively affects the fitness levels of children; however, we lack standardized fitness programs for school children that are easy to implement in the field as part of a school curriculum. Furthermore, to promote general health, nutritional counseling is crucial in identifying and correcting deficiencies in an individual's regular dietary consumption. Counseling is beneficial in various populations ranging from pregnant women to the elderly [9, 10]. It is thus important for the human capacity building of our nation that standardized fitness programs and nutritional counseling be implemented in elementary schools. Thus, the present study was designed to evaluate the impact of nutritional counseling and structured exercise regimens on the fitness of elementary school children.

Materials and Methods

For the calculation of the sample size, G*Power software, version 3.1 was used with 80% power, an effect size of 0.4, and α=0.05. Participants in the study were elementary school students aged 6 to 14 years who had low physical fitness scores on three of the five fitness test batteries, which included the curl-up, sit-and-reach, hand grip, 10×4 shuttle run, and cardiovascular endurance (1600 m run/walk). Children who had a muscle or ligamentous injury within the previous four weeks and were instructed medically not to engage in any physical activity were excluded from participation. After receiving consent and assent from children, they were assigned to three groups randomly: Group A, which received a structured exercise program (SEP), Group B, which received the nutritional counseling program (NCP), and Group C, which received both SEP and NCP interventions for four weeks. Children were assessed for physical fitness using grip strength, flexibility (with the sit-and-reach test), curl-up test, 10×4 m shuttle run test, and 1600 m run test prior to and after the intervention, following standardized testing procedures.

Group A participated in a SEP that included a 5-minute warm-up, cardio-conditioning games, such as jumping in and out of circles, and a 10-minute one-leg-hopping race on a 10-meter track. The program also included stretching and strengthening exercises, such as hamstring and calf self-stretching, followed by grip strength exercises and curl-ups (5-7 minutes), and a cool-down period (5 minutes). Each session was performed for 30 minutes and was conducted three times a week for four weeks. Group B received counseling sessions, that included active lifestyle and nutritional advice for parents and children, which lasted for 45 minutes. The children and parents received educational materials for their reference. They were asked to follow the instructions regarding a balanced diet and an active lifestyle at home. Group C received the same SEP as Group A, along with nutritional counseling similar to that of group B.

Statistical analysis

SPSS software, version 16.0 was used for the comparison of the pre- and post-test scores of fitness tests by applying a 3×2 repeated measures ANOVA. Furthermore, Tukey's post hoc analysis was done to determine which group showed better improvement. All comparisons were considered significant at $P<0.05$.

Results

Sixty elementary school children (35 boys and 25 girls) aged 6-14 years who met the inclusion criteria were randomly assigned to the three intervention groups. The SEP group and SEP+NCP group each had 12 boys and eight girls in each, while the NCP group included 11 boys and nine girls. The demographics of the samples are denoted in Table 1.

As illustrated in Figure 1 and Table 2, children improved their hand grip strength, as measured by the handheld dynamometer in kilograms, from pre to post-test, regardless of group. The repeated measures ANOVA revealed a non-significant main effect for the group. However, there was a significant main effect for time ($P<0.05$), which was qualified by a significant time×group interaction. All groups improved from pre- to post-test (main effect for time), however, Tukey's post hoc pair-wise comparisons revealed a statistically greater improvement from pre- to post-test in the SEP+NCP group.

Children also improved their abdominal strength, as measured by the number of curl-ups a child could perform, from pre- to post-test, regardless of group. A repeated measures ANOVA revealed a non-significant main effect for the group. However, there was a main effect for time ($P<0.05$), which was qualified by a time×group interaction. Tukey's post hoc pairwise comparisons revealed a statistically significant improvement from pre- to post-test in the SEP+NCP group. The results are illustrated in Figure 2 and Table 2.

Table 1. Demographics of the samples in the three intervention groups (n=20)

Group	Mean±SD	
	Age (y)	BMI (kg/m²)
SEP-group A	11.55±2.01	16.35±2.88
NCP-group B	11.45±1.73	18.22±4.96
SEP+NCP-group C	11.15±2.05	15.72±2.89

BMI: Body mass index.

PHYSICAL TREATMENTS

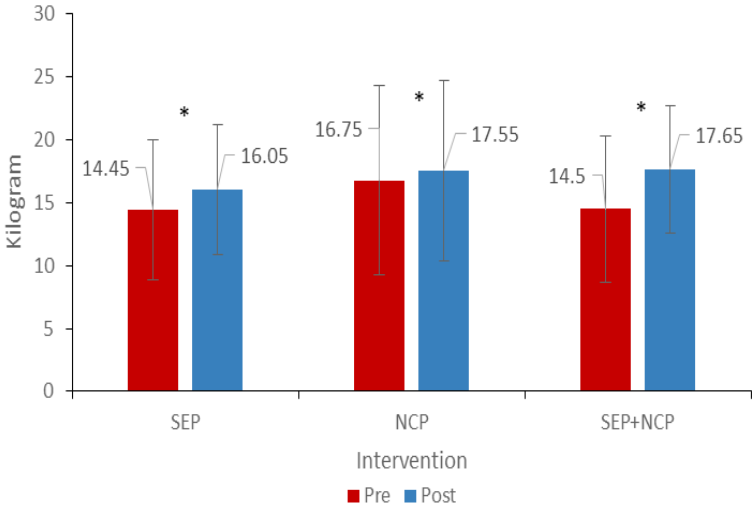
Table 2. Comparison of all physical parameters among the three groups

Test	Stage	Mean±SD			Significance		
		Group A	Group B	Group C	Main Effect of Time	Time×Group	Main Effect of Group
Grip strength (kg)	Pre-test	14.4±5.57	16.7±7.50	14.5±5.83	0.001* (F=175.88)	0.001* (F=24.45)	0.616 (F=0.489)
	Post-test	16.05±5.16	17.55±7.16	17.65±5.05			
Curl-Up Test (No.)	Pre-test	18.5±8.44	15.2±6.61	16.85±5.35	0.001* (F=15.10)	0.035* (F= 3.55)	0.146 (F=1.99)
	Post-test	19.86±7.66	16.3±6.84	21.55±4.75			
Flexibility (cm)	Pre-test	18.00±8.11	17.05±8.96	17.65±7.91	0.000* (F=118.21)	0.329 (F=1.13)	0.925 (F=0.078)
	Post-test	18.8±8.15	17.75±8.93	18.63±7.76			
10×4 shuttle test (sec)	Pre-test	13.74±1.84	12.95±2.03	13.41±1.74	0.000* (F=117.92)	0.004* (F=6.17)	0.472 (F=0.76)
	Post-test	13.00±1.94	12.44±2.04	12.27±1.40			
Cardiovascular endurance test (min)	Pre-test	11.75±2.51	11.22±1.91	11.76±1.98	0.001* (F=270.43)	0.001* (F=22.31)	0.874 (F=0.135)
	Post-test	11.03±2.43	10.87±1.87	10.69±1.87			

PHYSICAL TREATMENTS

As shown in Figure 3, children improved their flexibility, as measured by the distance reached forward (in centimeters) in the sit-and-reach test, from pre- to post-test, regardless of group. The repeated measures ANOVA revealed a non-significant main effect for the group, but there was a significant main effect for time ($P<0.05$) and a non-significant main effect for time×group interaction. Tukey's post hoc analysis revealed a greater improvement from pre- to post-test in the SEP+NCP group.

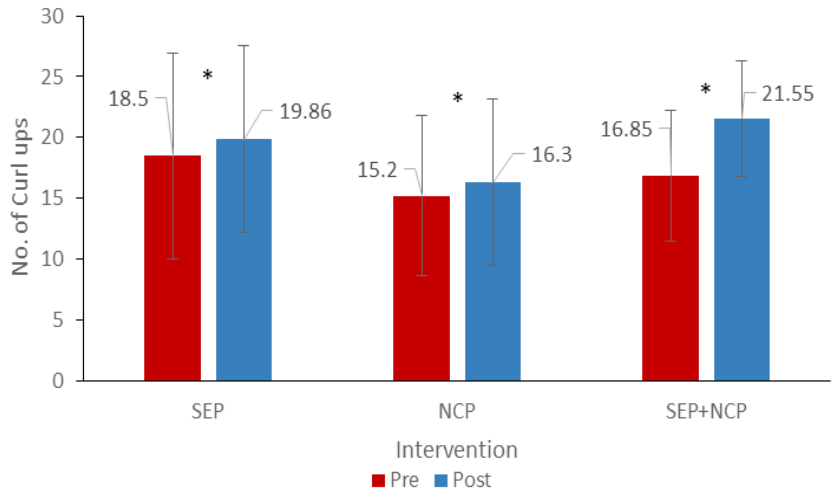
As demonstrated in Figure 4, children improved their agility, as measured by the time (seconds) required to complete the 10×4 meters shuttle run test, from pre- to post-test, regardless of group. There was a non-significant main effect for the group. However, there was a significant main effect for time ($P<0.05$), which was qualified by time×group interaction. Tukey's post hoc pairwise comparisons revealed a statistically greater improvement in the SEP+NCP group compared to the other two groups.



PHYSICAL TREATMENTS

Figure 1. Comparison of hand grip strength test results among the three groups

Abbreviation: SEP: Structured exercise program, NCP: Nutritional counselling program, SEP+NCP: Structured exercise program+nutritional counselling.



PHYSICAL TREATMENTS

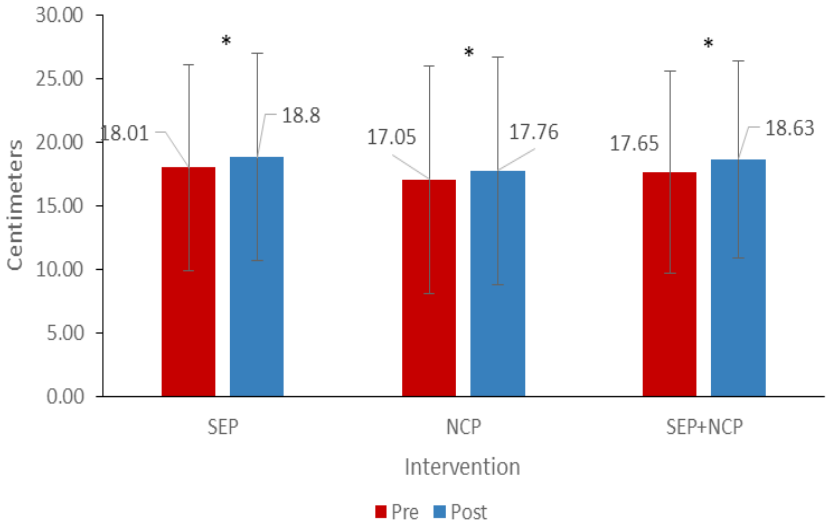
Figure 2. Comparison of curl-up test results among the three groups

SEP: Structured exercise program, NCP: Nutritional counselling program, SEP+NCP: Structured exercise program+nutritional counselling

As illustrated in Figure 5, children improved their cardiovascular endurance, as measured by the time (minutes) required to complete an age-appropriate 1600-meter run/walk test, from pre- to post-test, regardless of group. The repeated measures ANOVA revealed a similar trend to that of the agility test. Furthermore, Tukey's post hoc pairwise comparisons revealed a statistically greater improvement in the combined group (SEP+NCP). The comparison of all the physical parameters among all three groups is demonstrated in Table 2.

Discussion

The current study recruited 60 school children aged 6-14 years with reduced physical fitness and randomly assigned them to three groups: the SEP, referred to as



PHYSICAL TREATMENTS

Figure 3. Comparison of sit-and-reach test results among the three groups

SEP: Structured exercise program, NCP: Nutritional counselling program, SEP+NCP: Structured exercise program+nutritional counselling.

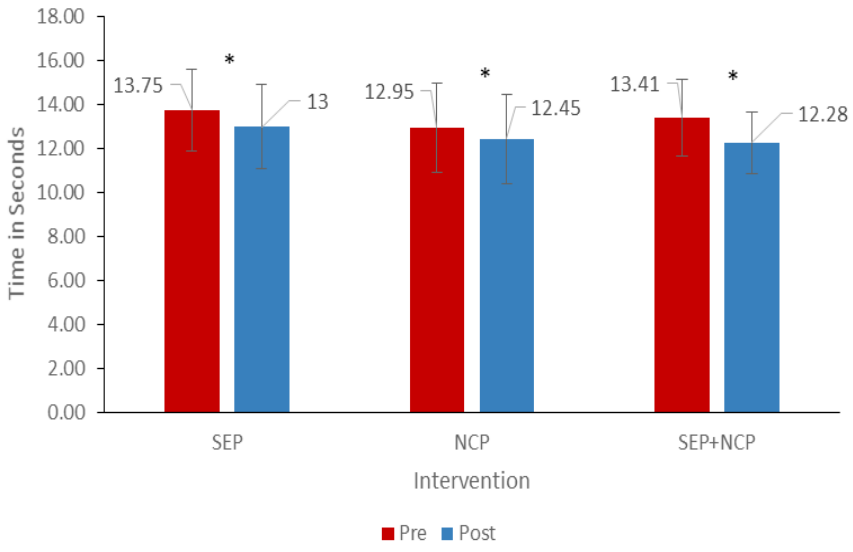


Figure 4. Comparison of the 10×4 meter shuttle run test results among the three groups

PHYSICAL TREATMENTS

SEP: Structured exercise program, NCP: Nutritional counselling program, SEP+NCP: Structured exercise program+nutritional counselling

Group A, NCP referred to as Group B, and the SEP+NCP combined group referred to as Group C. It was observed that the fitness of children improved in all groups following four weeks of intervention; however, the greatest improvements were observed in Group C.

The centre for disease control has suggested that fitness exercise programs should include, at a minimum, warm-up exercises, cardio conditioning exercises, and generalized stretching and strengthening exercises. Several studies have examined and reported the benefits of exercise programs on individual parameters of fitness, such as cardiovascular endurance and body fat percent-

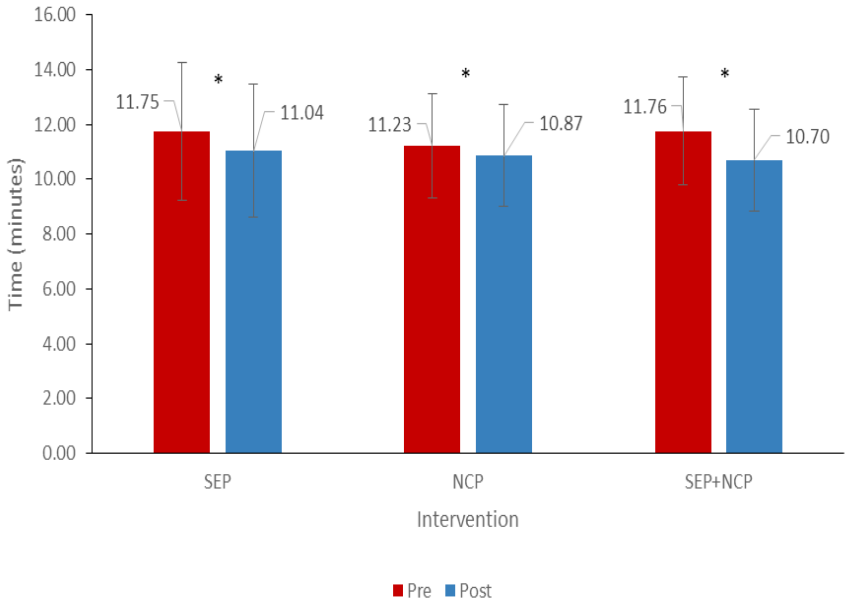


Figure 5. Comparison of the 1600 meter run/walk test results among the three groups

PHYSICAL TREATMENTS

SEP: Structured exercise program, NCP: Nutritional counselling program, SEP+NCP: Structured exercise program+nutritional counselling.

age in school children [11, 12]. In contrast to the aforementioned studies that focused primarily on cardiovascular fitness, the structured exercises used in this study consisted of strength, flexibility, agility, and endurance exercises that were field-based and carried out during school playtime. These exercises led to significant improvements that were comprehensively measured using a battery of fitness tests. More importantly, the SEP was well designed as it incorporated all the essential components of fitness and significantly did not cause any harm to the participants. Given the fitness deficits in school children, it is suggested that a structured and well-designed exercise program be incorporated into the physical education curriculum of all elementary schools.

Paradoxically, nutritional counseling alone also resulted in improvements in the fitness of school children, albeit to a lesser extent than following a SEP. It appears that over four weeks, children who received nutritional counseling improved their intake of nutritious foods, which indirectly enhanced fitness across all the parameters tested. Previously, studies have reported a reduction in obesity and, to some extent, improved fitness levels [13–15]; however, a comprehensive evaluation of fitness following nutritional counseling has not been carried out. This study, as far as we know, is one of the first to comprehensively examine and demonstrate significant improvements in fitness following nutritional counseling in elementary school children. It is well documented that a nutritious, well-balanced meal plan can help improve muscle strength, increase muscle mass, improve endurance, and improve overall wellness [7, 8].

Not surprisingly, it was observed that children who received both structured exercises and nutritional counseling demonstrated the most significant improvements in fitness compared to children who received only structured exercises or only nutritional counseling. This may be due to the combined effect of exercises and increased awareness regarding the importance of adequate/ balanced intake of macronutrients and micronutrients. Similar results from a combined intervention resulting in improved fitness in children have been reported previously [16]. Interestingly, nutritional counseling provided to parents, in addition to children, resulted in overall improvements in the intake of healthy foods and control of the intake of unhealthy foods [15], which would indirectly lead to improvements in fitness and wellness.

This study has given new insights into the role of SEP combined with nutritional counseling on fitness. Good physical fitness can be achieved by creating a dedicated team of physiotherapists, physical education teachers, and nutritional counselors who will constantly monitor the fitness levels of elementary school children and work towards their improvement through holistic interventions. There were a few limitations of the study, namely that the levels of extracurricular activity, such as screen time and play duration of the children, were not considered, which could have influenced the outcome of the study. Furthermore, factors, such as psychological and social components of health were not considered in this study. Thus, the researchers of this study recommend future studies involving a sample of school children from across India to understand the impact of regional aspects such as culture, food, geography, and anthropometric body type.

The SEP, NCP, and their combination (SEP+NCP) have significant effects on the physical fitness of children, with the greatest improvement observed in the SEP+NCP group. Thus, the inference we can draw from this study is that there is a definite need to focus on a healthy lifestyle in elementary school children, which should include both structured exercise and nutritional counseling. There is a clear requirement for teamwork to achieve a healthy future workforce. The physiotherapists and nutritional counselors, along with school authorities and parents, can collaborate to create a healthier future generation.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Manav Rachna International Institute, Faridabad, India (Code: AJIRB-EC/01/2017) which adhered to the World Medical Association Declaration of Helsinki's ethical guidelines for medical research involving humans, a pre- and post-experimental study design was performed and registered with the Clinical Trial Registry India (Code: CTRI) (CTRI/2017/03/008260).

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Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflicts of interest.

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References

[1] Fedewa AL, Ahn S. The effects of physical activity and physical fitness on children's achievement and cognitive outcomes: A meta-analysis. Research Quarterly for Exercise and Sport. 2011; 82(3):521-35. [DOI:10.1080/02701367.2011.10599785] [PMID]

[2] Shook RP, Lee DC, Sui X, Prasad V, Hooker SP, Church TS, et al. Cardiorespiratory fitness reduces the risk of incident hypertension associated with a parental history of hypertension. Hypertension. 2012; 59(6):1220-4. [DOI:10.1161/HYPERTENSIONAHA.112.191676] [PMID]

[3] Adelantado-Renau M, Jiménez-Pavón D, Beltran-Valls MR, Ponce-González JG, Chiva-Bartoll Ó, Moliner-Urdiales D. Fitness and academic performance in adolescents. The mediating role of leptin: DADOS study. European Journal of Pediatrics. 2018; 177(10):1555-63. [DOI:10.1007/s00431-018-3213-z] [PMID]

[4] Boreham C, Riddoch C. The physical activity, fitness and health of children. Journal of Sports Sciences. 2001; 19(12):915-29. [DOI:10.1080/026404101317108426] [PMID]

[5] Messiah SE, D'Agostino EM, Patel HH, Hansen E, Mathew MS, Arheart KL. Sex differences in fitness outcomes among minority youth after participation in a park-based after-school program. Annals of Epidemiology. 2018; 28(7):432-9. [DOI:10.1016/j.annepidem.2018.03.020] [PMID]

[6] D'Agostino EM, Patel HH, Hansen E, Mathew MS, Nardi MI, Messiah SE. Effect of participation in a park-based afterschool program on cardiovascular disease risk among severely obese youth. Public Health. 2018; 159:137-43. [DOI:10.1016/j.puhe.2018.02.025] [PMID]

[7] Nyaradi A, Li J, Hickling S, Foster J, Oddy WH. The role of nutrition in children's neurocognitive development, from pregnancy through childhood. Frontiers in Human Neuroscience. 2013; 7:97. [DOI:0.3389/fnhum.2013.00097] [PMID]

[8] Corbin CB, Pangrazi RP, Young D. Nutrition and physical activity: Fueling the active individual. Research Digets. 2004; 5(1):1-8. [Link]

[9] Räsänen M, Niinikoski H, Keskinen S, Heino T, Lagström H, Simell O, et al. Impact of nutrition counselling on nutrition knowledge and nutrient intake of 7- to 9-y-old children in an atherosclerosis prevention project. European Journal of Clinical Nutrition. 2004; 58(1):162-72. [DOI:10.1038/sj.ejcn.1601763] [PMID]

[10] Vasiloglou MF, Fletcher J, Poulia KA. Challenges and perspectives in nutritional counselling and nursing: A narrative review. Journal of Clinical Medicine. 2019; 8(9):1489. [DOI:10.3390/jcm8091489] [PMID]

[11] Jamner MS, Spruijt-Metz D, Bassin S, Cooper DM. A controlled evaluation of a school-based intervention to promote physical activity among sedentary adolescent females: Project FAB. The Journal of Adolescent Health. 2004; 34(4):279-89. [DOI:10.1016/j.jadohealth.2003.06.003] [PMID]

[12] Carrel AL, Clark RR, Peterson SE, Nemeth BA, Sullivan J, Allen DB. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: A randomized, controlled study. Archives of Pediatrics & Adolescent Medicine. 2005; 159(10):963-8. [DOI:10.1001/archpedi.159.10.963] [PMID]

[13] Molenaar EA, van Ameijden EJ, Vergouwe Y, Grobbee DE, Numans ME. Effect of nutritional counselling and nutritional plus exercise counselling in overweight adults: A randomized trial in multidisciplinary primary care practice. Family Practice. 2010; 27(2):143-50. [DOI:10.1093/fampra/cmp104] [PMID]

[14] Kelley GA, Kelley KS, Pate RR. Exercise and adiposity in overweight and obese children and adolescents: A systematic review with network meta-analysis of randomised trials. BMJ Open. 2019; 9(11):e031220. [DOI:10.1136/bmjopen-2019-031220] [PMID]

[15] Arunachalam S, KM. Nutritional counseling on modifying lifestyle practices of obese children. Current Pediatric Research. 2020; 24(6):1. [Link]

[16] Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, et al. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet health. Archives of Pediatrics & Adolescent Medicine. 1999; 153(4):409-18. [DOI:10.1001/archpedi.153.4.409] [PMID]