

Effect of Physical Activity on Prevalence of Risk for Obesity and Diabetes in School going Children and Adolescents

Manju Dewan

Abstract

Aim: The purpose of this study was to estimate the effect of physical activity on prevalence of risk for obesity and diabetes. **Method:** 2048 children had undergone questionnaire and dietary survey and health examination. Out of these, 1017 were from urban population and 1031 from rural population Children and adolescent aged 10-19 years were selected randomly for questioning regarding the different aspects of epidemiology and their health examination was done. **Results:** In the total population (2048), 35.21% children were performing > 60 minutes physical activities. Diabetic children are more in the category performing < 60 minutes of physical work. Boys were more physically active than girls. Overweight children were more in those performing <60 minutes activity. When the physical activity of rural and urban children is compared, urban children were inclined towards more sedentary behavior than rural children. Obese diabetic children were more in physically inactive category. Diabetic children were less physically active than normal ones. These findings indicated that promotion of physical activity is an important factor to prevent obesity and its related disorders. Subjects who were having impaired glucose levels were totally unaware of the diagnosis at the time of examination and physical inactive. **Conclusion:** Children can prevent the development of obesity and type -2 diabetes by increasing their level of physical activity. Childhood obesity can be prevented by living actively, eating in healthful ways and creating a nurturing environment.

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Introduction

Overweight and obesity are one of the most important public health problems, which are being escalated as global epidemic (WHO,2014). Over-nutrition predisposes children to insulin resistance, metabolic syndrome, and type- 2 diabetes mellitus. Increasing prevalence of obesity and insulin resistance has been reported in Asian Indian adolescents (Guo et al, 2000). Obesity is not confined to adults but also found among the children and adolescents in the developed countries during the past two decades as well as similar trends are being observed even in the developing world,(Pouliot et al,1994, Martorell et al,2000 and Popkin, 2001). Behaviors influence obesity like eating high-calorie, low-nutrient foods, consuming soft drinks, physical inactivity and sedentary activities such as watching television, computer use and irregular sleeping habits.

Children who have obesity are more likely to have obesity related disorders like high blood pressure, high cholesterol, increased risk of impaired glucose tolerance, insulin resistance and type - 2 diabetes, breathing problems, joint problems etc. (Mohan et al, 2014, Pollock, 2016, Africa et al, 2016 Bacha and Gidding, 2016). If children have obesity, their obesity and disease risk factors in adulthood are likely to be more severe (Bass and Eneli, 2015). Childhood obesity is also related to psychological problems such as anxiety and depression (Beck, 2016). Childhood obesity is one of the most serious public health challenges of the 21st century. One of the factors that is most significantly linked to obesity is physical inactivity. Decrease in physical activity among all age groups has heavily contributed to rising rates of obesity. Each additional hour of television watching per day increase the prevalence of obesity by 2%. Television viewing among young children and adolescents has increased dramatically in recent years (Anderson and Butcher, 2006 and Kapil and Bhadhorai, 2014) . Early recognition of obesity is important; it is possible by routine assessments of activity patterns in children. This study has shown that the increased amount of time spent in sedentary activities has decreased the amount of time spent in physical activity that leads to obesity and its related disorders.

Materials and Methods

2048 children had undergone questionnaire and dietary survey and health examination. Out of these, 1017 were from urban population and 1031 from rural population Children and adolescent aged 10-19 years were selected randomly for questioning regarding the different aspects of epidemiology and their health examination was done. The permission from parents of the children, undergoing examination and questionnaire survey was also taken on the self-designed consent form. The Centers for Disease Control and Prevention (CDC) suggests two levels of concern for children based on the BMI-for-age charts.

At the 85th percentile and above, children are "at risk for overweight". At the 95th percentile or above, they are "overweight". The cutoff for underweight of less than the 5th percentile is based on recommendations by the World Health Organization Expert Committee on Physical Status 1998.

Fasting blood sugar test was performed. The diagnostic criteria for diabetes mellitus have been modified from those previously recommended by WHO (1985).The revised criteria for the diagnosis of diabetes is used which is as follows:

Categories of Fasting plasma glucose (FPG) values are as follows:

- FPG <110 mg/dl(6.1 mmol/l) = normal fasting glucose;
- FPG 110 (6.1 mmol/l)and <126 mg/dl (7.0 mmol/l) = IFG (Impaired Fasting Glucose)/Prediabetes.
- FPG \geq 126 mg/dl (7.0 mmol/l)= diabetes

(Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (2003)

Results and Discussion

Physical activity plays an independent role in protection against obesity and diabetes. In the total population (2048), 35.21% children were performing > 60 minutes physical activities (Table 1,Graph 1,2 &3). Diabetic children are more in performing < 60 minutes physical work category. Boys were more physically active than girls. Overweight children were more in those performing <60 minutes activity. When the physical activity of rural and urban children is compared, urban children were found to have more sedentary behavior than rural children.Diabetes seems to affect groups that are subject to rapid changes in their way of life described as 'Westernization'. Similarly, in the present study, diabetic children were less physically active than normal ones. These findings indicated that promotion of

physical activity may be important in the prevention of diabetes mellitus. The purpose of this study was to estimate the association between physical activity and presence of risk for diabetes. Subjects who were having impaired glucose levels were unaware at the time of diagnosis and physically inactive. On examination of the data regarding their habits, it is found that all such subjects were not performing any physical activity or exercise which indicates fully unawareness in children about their health. Thus, it is very clear that the physical exercise has got a profound affect on this disease. Rural urban shifts and migration are usually accompanied by change in levels of physical activity, almost invariably to a more sedentary pattern.

Table 1: Level of physical activity per day and its relationship with obesity and diabetes

Group/Sub Group	<60 min		=60 min		>60 min.	
	N	%	N	%	N	%
Area						
1.Urban	273	26.84	290	28.52	454	44.64
2.Rural	579	56.16	185	17.94	267	25.90
	Chi ² =181.53**(df:2) C=0.29					
Gender						
Male	532	37.49	325	22.90	562	39.61
Female	320	50.87	150	23.85	159	25.28
	Chi ² =44.34**(df:2) C=0.15					
FBG Categories						
<110	833	41.80	460	23.08	700	35.12
110-126	9	28.12	11	34.38	12	37.50
. >=126	10	43.48	4	17.39	9	39.13
	Chi ² =3.66(df:4) C=0.04					
Percentile Based						
Under Wt.	234	46.06	102	20.08	172	33.86
Healthy Wt.	526	39.76	321	24.26	476	35.98
At Risk	55	43.31	26	20.47	46	36.22
Over Wt	37	41.11	26	28.89	27	30.00
	Chi ² =9.26(df:6) C=0.07;					
All Data	852	41.60	475	23.19	721	35.21

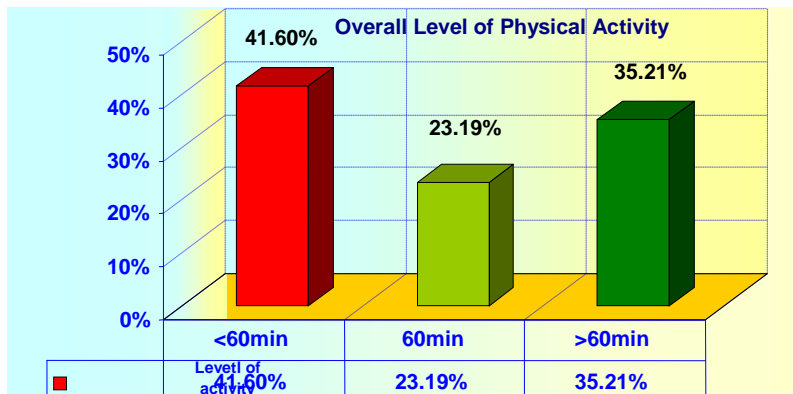


Figure 1. Level of physical activity per day in total population

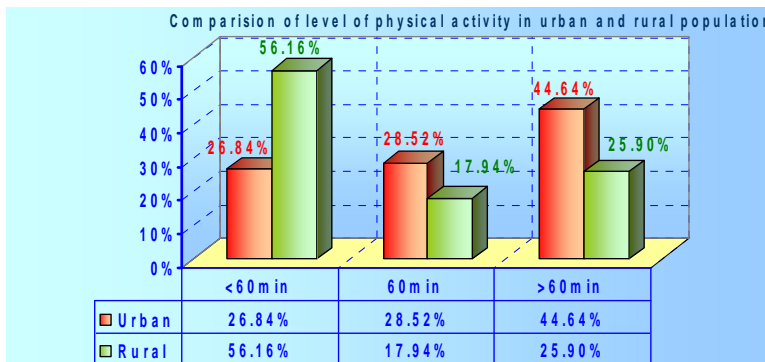


Figure 2. Comparison of level of physical activity per day in urban and rural population

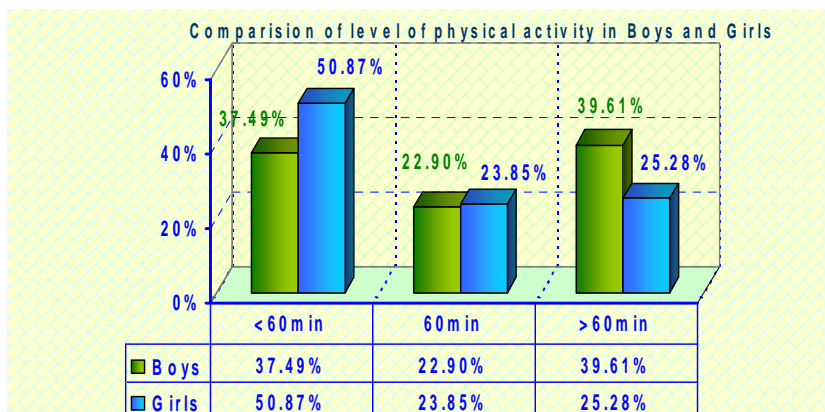


Figure 3. Comparison of level of physical activity per day amongst boys and girls

Physical inactivity was found to be a risk factor in the incidence of diabetes mellitus, independent of body weight (Baan *et al.*, 1999). Similarly, in the present study, obese diabetic children are more in physically inactive category. The Centers for Disease Control and Prevention recommend that schoolchildren should participate in at least 60 minutes of physical activity every day (Strong *et al.* 2005). Among U.S. high school students, approximately one-third are not active enough to achieve the recommended levels of physical activity (Eisenmann, 2002). Cross-sectional data show that among children aged 9 to 13 years, 23% do not engage in any physical activity during free time (Duke, 2003). In California, 30% of adolescents aged 12-17 years do not achieve the recommended levels of physical activity and 7% get no regular physical activity (Babey *et al.*, 2005). Inadequate physical activity is associated with increased risks for chronic diseases like type 2 diabetes mellitus and cardiovascular disease and is also associated with increased risks for becoming overweight or obese (Strong *et al.*, 2005 and Babey *et al.* 2005). In addition to its association with health, physical activity is also related to academic performance. Research suggests that regular physical activity is associated with better academic performance (Dwyer *et al.*, 2001, Shephard, 1997 and California Department of Education 2005). Among U.S. high school students, daily participation in physical education classes decreased from 42% during 1991 to 28% during 2003. Specific data is not available for younger students but on average, half of schools require physical education for students. In California, 15% of adolescents aged 12 to 17 years reported that their school does not require or offer physical education classes. These students are less likely to engage in regular physical activity than are students whose schools require physical education classes (Babey *et al.*, 2005). Physical activity is known to reduce the risk of non-insulin dependent diabetes mellitus in younger. According to Williams *et al.* (1999), people with newly diagnosed diabetes were less physically active than their counter parts. In the study of Baan *et al.* (1999), a significant inverse association between physical activity and presence of diabetes was observed. There is evidence that physical activity increases peripheral sensitivity to insulin, especially in skeletal muscle and adipose tissue (Pescatello and Dipietro, 1993; Feskens *et al.*, 1994). Besides, physical activity may improve weight reduction by increasing the energy expenditure associated with exercise because obesity is a major risk factor for developing diabetes (Horton, 1988 & 1991). These findings, therefore, serves to strengthen the grounds for encouraging physical activity and exercise. A major characteristic of type- 2 diabetes is insulin resistance at the level of target tissues - possibly a post receptor defect (Taylor *et al.*, 1984). A sedentary type of life could be one of the numbers of factors causing insulin resistance in an individual with genetic susceptibility to diabetes. Physical exercise is recommended as a part of therapy for type-2 diabetes because of increased insulin sensitivity during the exercise (Bjorntorp, 1982). Hence the main finding of the present study is repeated encouragement to increase physical activity and to do exercise to prevent the diabetes and its complications. Though the children were well informed about the good effects of physical activity but studies found that they were not engaged in daily physical activity. Only 30 % of the overweight and obese children were engaged in at least 60 minutes of daily physical activity, which is suggestive of the sedentary lifestyle of the younger generation. The recent trend is that the school children concentrate more on academics and less in sports and physical activities. Leisure hours are spent in watching TV or playing computer/ video games, thus explaining the sedentary lifestyle of today's school children (Anthony *et al.* 2000). Exercise is associated with improvement in short- and long-term metabolic control (Bloomgarden, 1999) and physical activity

improves insulin sensitivity. Physical education classes may be helpful for children who are overweight. Monitoring changes in a child’s environment may also play a role in the youth’s physical activity behaviors today as compared to the past few decades (Ebbeling and Pawlak, 2002). Some environmental factors that may affect physical activity include the expense of the participation in some physical activities/ sports, the parents’ lack of time to facilitate the child’s active interests, and concerns about neighborhood and playground safety. As well, more and more schools are cutting physical education programs in the schools and the offered physical education programs are not providing requisite physical activity.

Table 2. Barriers to physical activity in total population

Group/ Sub Group	No Ground		Traffic		Home Work		Study Stress		Parents		Other	
	N	%	N	%	N	%	N	%	N	%	N	%
All Data	292	14.26	157	7.67	420	20.51	458	22.36	362	17.68	359	17.53
Area												
Urban	108	10.62	62	6.10	255	25.07	246	24.19	84	8.26	262	25.76
Rural	184	17.85	95	9.21	165	16.00	212	20.56	278	26.96	97	9.41
Chi²=228.24**(df:5) C=0.32												

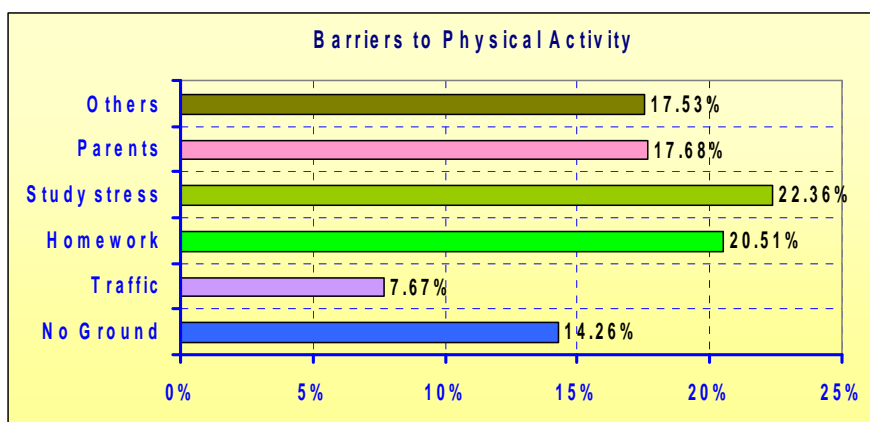


Figure 4. Barriers to Physical Activity

Table 3. Mode of transport used for school in total population

Group / Sub Group	Bus		Rickshaw		Auto		Bicycle		Walk		Car		Bike/ Scoot		M. Cycle	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All Data	33	16.5	17	8.50	4	2.1	31	15.4	98	48.1	14	7.23	3	1.8	6	0.2
Area																
Urban	27	27.0	11	11.1	3	3.0	24	24.3	19	19.2	12	11.8	2	2.8	5	0.4
Rural	63	6.11	61	5.92	1	1.2	68	6.60	78	76.5	28	2.72	8	0.7	1	0.1
	Chi²=687.12**(df:7) C=0.50															

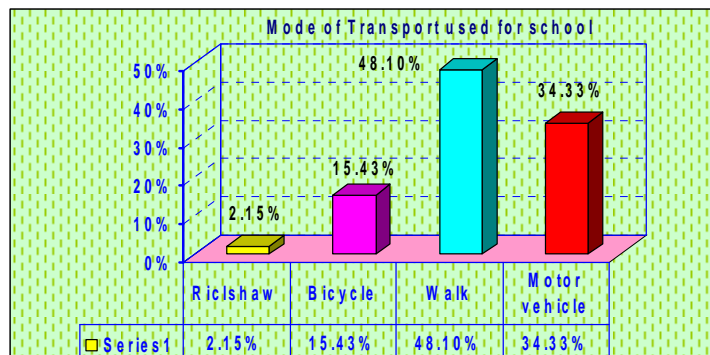


Figure 5. Modes of Transport used in schools

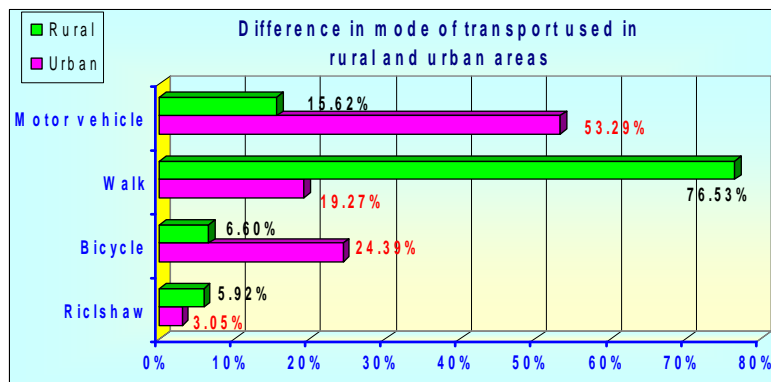


Figure 6. Modes of Transport used in schools of rural and urban areas

In this study, barrier to physical activity is found to be study stress which is more in urban area as compared to rural areas. Another important factor is the parental pressure on children to perform well in academics at the cost of sports and other physical activities. Lack of play fields in schools and open spaces around homes, has further aggravated the problem. Table 3 shows the mode of transport to school, in urban areas most of the students were traveling by motor vehicles (53.29%) and in rural areas by walking (76.53%). 11.7% obese and 13.6% overweight subjects were not involved in playing activities and this finding was statistically significant. The prevalence of overweight and obesity among subjects using bus as mode of transport was found as 20.4% and 8.7% compared to subjects using cycle as a mode of transport in which it was 7.2% and 4.4%, respectively. Using bus as the mode of transport, not playing outdoor games, and sibling count more than two are independent predictors for being overweight and obesity. Goyal *et al.* observed that going to school by bus/auto was associated with 2.14 times risk of developing obesity (Goyal *et al.*, 2011) while Joshi *et al.* reported that the mode of conveyance to school differed significantly among normal, overweight, and obese subjects (Joshi *et al.*, 2012). Guedes *et al.* on multivariate analysis found 1.5 times risk of developing obesity with car being used as a mode of transport (Guedes *et al.*, 2011). Similarly, increases in active modes of transport to and from school (walking, cycling, and public transport) would require policy changes at the school and local government levels, as well as support from parents and the community. In some communities a variety of such programs have been implemented e.g. road crossings, 'walking bus', and designated safe walking and cycling routes (Swinburn and Egger, 2002).

Conclusion: Schools influence the food and physical activity environments of children. School-based preventive programs for lifestyle and behavioral modification will play important role to combat this problem. The significance of this study, thus, lies in the fact that children and adolescents were unaware of their disease status and have a sedentary life style. Obesity can be prevented may be achieved through a variety of interventions like to introduce compulsory games period in schools, physical education classes, better walking arrangement like footpaths, the cycling roads, parks and recreation centers etc. These strategies can be initiated at home and in schools to form an appropriate built environment. However, further research is needed to examine the most effective strategies of intervention, prevention, and treatment of obesity.

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Conflict of Interest: None Declared