Urbanisation and Activity Pattern of South Asian Children

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Abstract

Objective: To compare the physical activity level and total energy expenditure of 10-12 year old school children living at different levels of urbanization.
Method: All the participating children kept a three-day record of their activities, for every fifteen- minutes, in specially designed diaries. Activities were grouped according to intensity that was determined on the basis of Physical Activity Ratio (PAR). After calculating the average time spent in a day, in activities of varying intensity, overall Physical Activity Level (PAL) of each subject was calculated by factorization method. After measuring bodyweight using a standard equation Basal Metabolic Rate (BMR) of the subjects was calculated. Total Energy Expenditure (TEE) was assessed on the basis of PAL and BMR of each child.
Subjects: Physical activity level of six groups of 10-12 year old children, representing various urbanization categories, was studied. Three groups of children were recruited from Punjab, Pakistan: rural, middle income urban and high income urban, and they were assigned urbanization rank (UR) 1, 2 and 3. Another three groups of children were recruited from Slough, UK: British Pakistani, British Indian, and British Caucasian and they were assigned urbanization rank 4, 5 and 6 respectively.
Results: Physical activity level decreased significantly with the urbanization rank only among girls of Pakistani origin (UR 1-4). Pattern of gender differences in activity level was different in rural and urban children. Rural girls were slightly more active than rural boys, whereas in urban areas boys were significantly more active than girls. Because of lower bodyweight the less urbanized children in spite of having higher PAL had a lower mean TEE as compared to the more urbanized groups.
Conclusion: The activity level of rural children having access to formal education and television could not be expected to be very different from their urban counterparts. Inactivity of urban girls needs particular attention. Because of lower caloric requirements, on similar diets, less urbanized groups may succumb to overweight more easily than the urbanized groups. Participation in active games may present a substitute to decreased involvement in moderately active work and play activities (JPMA 52:402; 2002).

Introduction

Physical activity has positive impact on children's fitness and heaIth[1-7] and could determine life long activity habits[8-10]. Like adults, urban children are also adopting a more sedentary life style' and are found to be less active than rural children[12-13].

South Asian populations because of coupling of genetic predisposition with rapid urbanization[14], are anticipated to have highly increased prevalence of diabetes, CHD and obesity in coming decades. By increasing physical activity level risk for these disorders could be reduced. By assessing the activity level of various groups of less and more urbanized children areas for intervention could be identified and effective educational campaigns can be designed.
This paper presents the result of a study conducted to compare the physical activity level and energy expenditure of South Asian school children.
In order to study the association between urbanization and CHD risk, relative CHD risk status of six groups of 10-12-year-old school children, representing various urbanization categories was compared. Observations regarding biochemical and anthropometric risks have been published earlier[15]. This paper describes observations regarding physical activity level and urbanization rank in the selected groups of children.

Subjects

Six groups of children, representing various urbanization categories were recruited. Three groups of children were recruited from Punjab, Pakistan: rural (RrP), middle-income urban (MUP), and high-income urban Pakistani (HUP); and they were assigned urbanization rank (UR 1, 2, and 3. Another three groups were recruited from Slough, UK: British Pakistani (BrP), British Indian (BrI), and British Caucasian (BrC), and these were assigned urbanization rank 4, 5 and 6 respectively. Assessment of dietary habits and exposure to Western culture confirmed that ranking of Indian and Pakistanis in Britain was correct[16] . Group wise distribution of subjects is presented in Table 1.
The recruitment of schools was purposive. The basic selection criterion was representation of particular demographic status. In UK, Slough (a city adjacent to London) was selected for the study because of the high concentration of South Asians. Out of the total of seven middle schools in Slough, the three schools that were willing to participate were recruited. In Pakistan the subjects were recruited from the province of Punjab because the majority (more than 90%) of the Pakistani immigrants in Slough come from that area. Six urban schools (from Lahore) and one rural school (from Kala-Shah-Kaku) were recruited to represent rural middle income urban and affluent urban groups. Initially principals of several schools fulfilling the criterion were contacted and the ones willing to participate were recruited. Information about rural or urban status of the area and general financial status of the students of particular schools was obtained from the association of private schools, (Punjab). All the ten to twelve year old students studying in year 6 and 7 within each school were invited to take part in the study. Seventy-six to nintey-four percent of the eligble children from various schools participated in the study.

Estimation of Physical Activity Level (PAL) and Total Energy Expenditure (TEE)

Factorial Method as described by Garrow and James[17] was used for determining Physical Activity Level. In this method, the two components of energy expenditure, i.e. the energy expended at rest for non-voluntary activities and the energy expended in voluntary activities, are separately determined. Energy expended at rest, (Basal Metabolic Rate) can be measured either by INDIRECT CALORIMETRY (rate of oxygen consumption), or can be calculated from standard equations based on measurements in a large number of similar subjects. The energy cost of physical activities can also be measured by INDIRECT CALORIMETRY, or by estimating the energy cost of each activity from tables giving average estimated energy cost of activities as multiples of BMR. Estimated energy cost of activity expressed as multiples of BMR is called the

Physical Activity Ratio (PAR) of that activity. If the duration of each activity is known, its energy cost can be determined from this multiple (PAR) and the assured or predicted BMR of the subject.

Based on Factorial method following procedure was used for determining the Physical Activity Level (PAL) and Total Energy Expenditure (TEE) of the subject.

1) Information about physical activities was collected through 3-day records. Specially printed diaries were distributed to children for keeping the records. Records were kept for two weekdays and one weekend day. The activity record blank for each day was subdivided into fifteen minutes periods. The purpose and method of keeping the activity record was explained to the children and the type of details required were clarified. Data from the Activity records were entered and analyzed on SPSS for windows, (version 6). Duration of time spent in various activities, by each individual was calculated; and this information was used for calculating PAL and TEE of the subjects.

2) Total time spent (in hours) each day in activities of differing PAR (seven categories) was calculated. PAR values were taken form the tables prepared by James and Schofield[18]. Details of categories of activities are given in table 1.

3) Physical Activity Level for each day was determined by using the following equation. Where PAR is average PAR of that group of activities and T is time in hours, spent in that group of activities.

PAL= + (PAR2xT2) + (PAR3xT3) + (PAR4xT4) + (PAR5xT5) + (PAR6x6) + (PAR7xT7)j / 24

4) In order to assure the proper representation of weekdays and weekend days, Average PAL, was calculated by the following equation:

For children in Pakistan: /7

For children in UK: /7

5) BMR was estimated by using the following equation:

Male 10-17 year old: BMR (MJIDay) = 0.74(wt*) + 2.754 Female 10-17 year old: BMR (MJIDay) 0.56(wt*) + 2.898

***weight in kilograms**

This equation is designed by United Kingdom's department of health[19] on the basis of an extensive compilation of data from a world-wide survey of some 11000 technically acceptable measurements on individuals of all ages and both sexes by FAO/WHO in the l980s[20]

6) Total energy expenditure (TEE) for the whole day (24 hours) was calculated by the following equation:

TEE = BMR x PAL

As the equation used for determining BMR uses body weight of the subject it is also taken into account in the estimation of total energy expenditure.

Results

Mean time spent by various groups of girls and boys in various activities is given in Figures 1 and 2 and associations between UR and time spent in various groups of activities are given in Table 1.

Table 1. Correlation between Urbanization rank and meantime spent in activities of varying PAR.

Groups of activities	PAR	Type of activities	Examples of activities	Pearson's correlation Girls r	Girls P	Boys r	Boys P
Group A	1	Sleep/lying	Sleeping, watching TV or reading in lying position.	0.16	0.009	0.17	ns
Group B	1.2	Sitting passively	Watching TV, talking, reading, homework, sitting in classroom etc.	0.05	ns	0.01	ns
Group C	1.4	Sitting work	Drawing, typing, chopping, knitting etc.	0.37	0.000	0.29	0.000
Group D	1.6	Standing passively	Waiting, queuing etc.	-0.50	0.000	-0.47	0.000
Group E	2	Light work/play	Strolling, bathing, dishwashing, cooking, standing board game, working in lab etc.	-0.28	0.000	-0.20	0.014
Group F	3	Moderately heavy work or play	Brisk walking, table tennis, heavy household chores like scrubbing floors etc.	-0.13	0.044	-0.19	0.020
Group G	4	Strenuous games	Running, dancing, climbing stairs, cycling, football, cricket, squash etc.	0.18	0.005	0.18	0.028

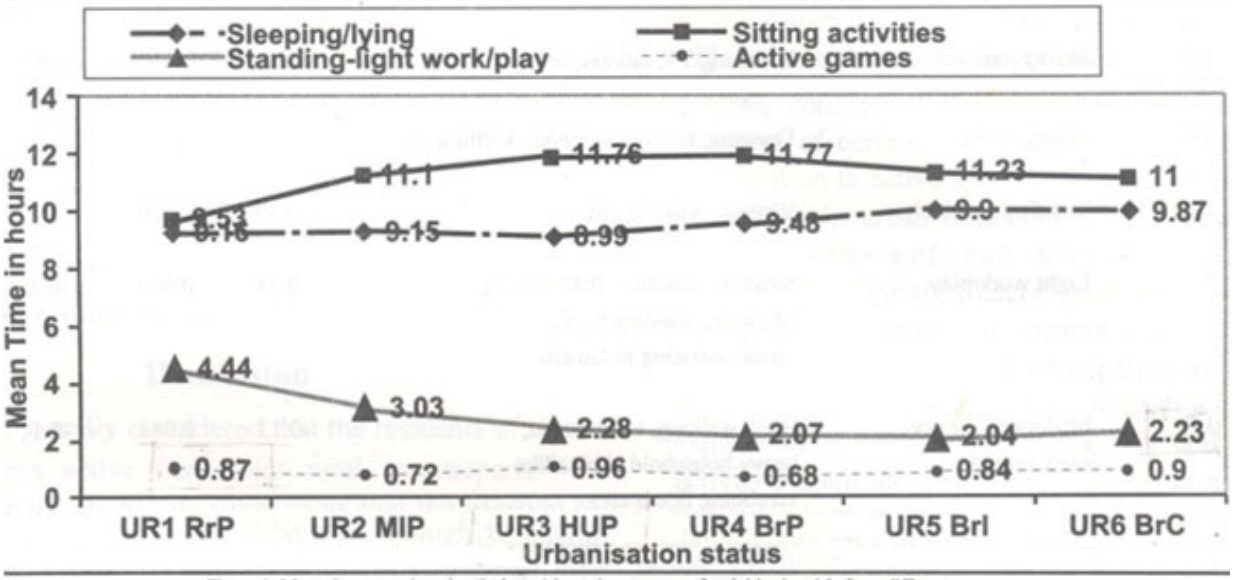

Figure 1. Mean time spent in a day (in hours) in various groups of activities by girls from different groups.

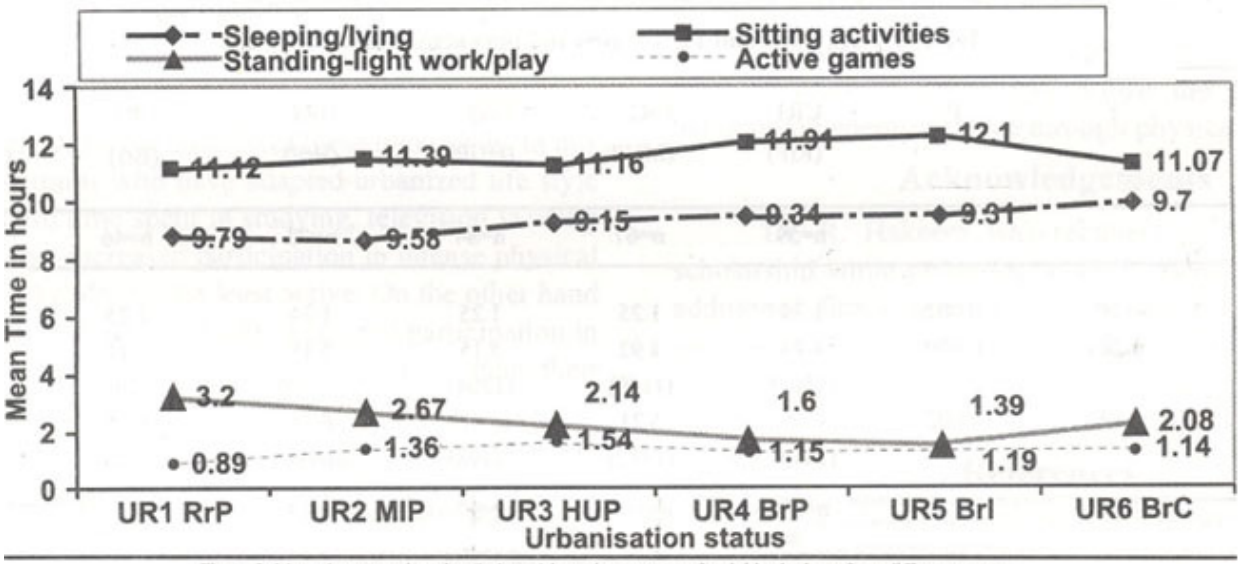

Figure 2. Mean time spent in a day (in hours) in various groups of activities by boys from different groups.

Urbanization status significant. Although time spent in sitting activities increased with urbanization the increase was not linear.

The differences in activity pattern were more pronounced for girls as compared to boys. Mean PAL, TEE and BMR of boys and girls is given in Table 2.

Table 2. PAL, BMR and TEE of girls and boys according To Group.

	Pearson's correlation		Group					
	r	P	UR1 (RrP)	UR2 (MUP)	UR3 (HUP)	UR4 (BrP)	UR5 (Brl)	UR6 (BrC)
GIRLS			n=59	n=67	n=84	n=73	n=46	n=21
PAL	-0.20	0.002	1.30	1.25	1.25	1.24	1.25	1.26
BMR MJ	0.28	0.000	4.74	4.92	5.15	5.18	5.11	5.36
(KCalorie)			(1107)	(1149)	(1204)	(1209)	(1193)	(1253)
TEE (MJ)	0.20	0.002	6.05	6.21	6.41	6.41	6.35	6.82
(KCalorie)			(1414)	(1452)	(1498)	(1498)	(1485)	(1595)
BOYS			n=80	n=105	n=97	n=63	n=36	n=18
PAL	-0.11	ns	1.28	1.31	1.31	1.28	1.28	1.28
BMR MJ	0.42	0.000	4.89	5.28	5.44	5.48	5.74	5.77
(KCalorie)			(1142)	(1233)	(1272)	(1280)	(1340)	(1348)
TEE (MJ)	0.29	0.000	6.23	6.91	7.49	7.08	7.47	7.14
(KCalorie)			(1456)	(1615)	(1751)	(1656)	(1746)	(1669)

Overall physical activity level increased steadily with urbanization status only among girls of UR 1-4. Association between effected the activity pattern of both boys and girls. Time spent in sitting activities increased with urbanization rank and time spent in activities requiring standing and walking decreased with urbanization rank. Association between urbanization status and time spent in sitting activities was in most cases positive and significant while the association between urbanization status and time spent in more strenuous activities was in most cases negative and PAL and UR was significantly positive for girls only. Rural boys spent significantly less time in strenuous games like football, cricket etc. and thus in spite of spending more time in other

standing/walking activities had lower PAL than the urban groups.
In all urban groups (UR2-6) boys had higher PAL than girls whereas in the rural Pakistani groups girls had higher mean PAL than boys from the same group. Gender difference in PAL was statistically significant only in the three urban groups of Pakistani origin (UR 2-4, ANOVA $P<0.005$ in each case).
In general, in case of girls 'U' shape curve is apparent where the least and the most urbanized have higher PAL than the moderately urbanized groups. It may be due to the fact that time spent in physically demanding work activities decreases with urbanization but due to gender bias or cultural constraints girls from the moderately urbanized groups could not avail opportunities of physically active play activities.

Total Energy Expenditure

TEE increased steadily with urbanization rank both for boys and girls. The reason for rural children having significantly lower total energy expenditure in spite of having higher Physical Activity Level is the lower body weights of rural children. The calculation of total energy expenditure uses BMR and assessment of BMR takes into account weight of the subjects.

Discussion

It is generally considered that the residents of urban areas are less active than their rural counterparts[12,13]. However the results of this study show that the lifestyle of those rural children, who are urbanized enough to attend formal schools and have access to television, is not necessarily very different from their urban counterparts. It appears that while with urbanization, involvement of children in various kind of work and play type physical activities decrease; for some groups involvement in physically demanding games is likely to increase. The PAL of any particular group on the continuum of rural-urban transition depends on the balance of these two trends. In this regard those groups who have adapted urbanized life style so as to increase time spent in studying, television viewing etc, but have not increased participation in intense physical activities are likely to be the least active. On the other hand those groups who have markedly increased participation in such activities may have even a higher PAL than their relatively less urbanized counterparts.
In this study, the rate of transition in PAL appears to be different for girls and boys. Because of greater participation in moderately active pursuits continuum the physical activity level of rural girls was significantly higher than that of the more urbanized girls. But as the involvement in active recreational activities was not proportionately increased the PAL of the girls at Urbanization rank 2,3 and 4 was lower than that of girls at UR 5 and 6. Cultural background may have played a part in this trend.
Low level of Physical Activity Level of Pakistani girls in urban areas points towards the need for providing opportunities for active games for them. Similar concerns are for more urbanized rural boys.
In conclusion, in the course of urbanisation provision of opportunities and encouragement, for participation in physically active games is essential to compensate for the more or less inevitable involvement in sedentary activities like studying, use of motorized transport, time spent in front of television or computer screens etc.
Another aspect of increase in sedentary activities with urbanization is decreased caloric requirement. Thus the energy requirements of the more urbanized groups are in general, considered to be lower than the rural groups. However of certain factors like higher body weights

and participation in active sports this trend may not be the same throughout the urban-rural continuum. Closer monitoring of the energy balance of newly urbanized groups could help in preparing appropriate dietary guidelines. Basal Metabolic rate is effected not only by current bodyweight but also by the history of nutrition and participation in intense physical activities (aerobic exercises). Research is required to explore the effect of improved nutrition and modification in activity pattern on the BMR of various groups of more and less urbanized groups. In Pakistan no studies have been done in the area of energy expenditure and BMR. Energy expenditure in similar activities may also be different by various groups of children and adults because of variations in speed, intensity and steadiness of activities.
As manipulation of dietary intake for maintaining energy balance does have certain limits and limitations, we need to assess, explore and utilize the possibilities of maintaining energy balance through physical activity.

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