

A Cross-Sectional Study on Physical Activity, Sedentary Behavior, and Sleep among Under-Five Children in Slum Areas of Burdwan Municipality, West Bengal

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Abstract

Introduction: Less time in physical activity, increase in sedentary time, and screen time have various negative health consequences and are a matter of concern for childhood health now-a-days. The study was to find out the prevalence of adequate physical activity and sleep, the status of sedentary behaviour and screen time among under-five children residing in the slum areas of Burdwan Municipality and their association with selected demographic and socioeconomic characteristics of study participants. **Materials and Methods:** This cross-sectional study was done among 180 under-five children residing in slums of Burdwan Municipality in Purba Bardhaman District of West Bengal, India, during January to March 2020. A predesigned, pretested schedule was used to collect necessary information on physical activity, sedentary, and sleep behavior of under-five children following the recent guideline by the World Health Organization. Ethical approval was obtained from the Institutional Ethics Committee of Burdwan Medical College and Hospital. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), software version 20. **Results:** Overall 69.4%, 70%, and 63.3% of the children were physically active, restrained themselves in enjoying their sedentary life and screen viewing within recommended timeframe, respectively. 84.4% children had adequate sleep time with nap. Logistic regression revealed that the absence of siblings was associated with inadequate physical activity (adjusted odds ratios [AOR] =3.82 [1.88, 7.77]) and more than recommended sedentary lifestyle (AOR = 5.01 [2.45, 10.26]) while more than recommended screen viewing was associated with age (AOR = 4.84 [2.34, 10.00]) and house condition (AOR = 6.54 [2.32, 18.42]). **Conclusions:** This study put emphasis on the requirement of focussed intervention on increasing physical activity and reduction in screen-based engagement among under-five.

Keywords: Child, exercise, movement, poverty areas, preschool, screen time, sedentary behavior, siblings, sleep

Once considered as a malady principally affecting the affluent societies of high-income countries noncommunicable diseases in general and cardiovascular diseases in particular have expanded their clutches toward the low- and middle-income countries such as India. Various nationwide survey provided evidence in support of this, for example, National Family Health Survey-4 reported that 15% Indian male and 11% of female of 15–49 years of age group suffering from hypertension, and younger population also at risk of hypertension as the data revealed that around 3% of age group 15–19 years are hypertensive.^[1] On the other hand, high blood glucose level even in younger age group (15–19 years) is a serious matter

of concern; 2.1% and 1.4% of the male and female in this age group suffering from high blood glucose level.^[1]

Among the various factors identified in relation to these cardiovascular diseases, the major emphasis is presently being given on movement behaviors (e.g. physical activity, sedentary behavior, and sleep). It has been shown that healthy movement behaviors, if developed during childhood, might shape the

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Submitted: 29-Mar-2021

Revised: 28-May-2021

Accepted: 28-May-2021

Published: 26-Jun-2021

Access this article online

Quick Response Code:



Website:
www.actamedicainternational.com

DOI:
10.4103/amit.amit_58_21

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How to cite this article: Goswami P, Chakraborty A, Das DK, Ray S. A study on physical activity, sedentary behavior, and sleep among under-five children in slum areas of Burdwan Municipality, West Bengal. *Acta Med Int* 2021;8:1-6.

behavior of the concerned individual during adolescence and adulthood.^[2]

Studies have established that physical activity is associated with better health outcomes, academic activity; in the long run, it was found to improve the overall productivity of an individual as well. Not only against cardiovascular diseases, adequate physical activities and playing can improve health and cognitive functions and reduce the risk of developing several diseases in children.^[3-5] Children who engaged in increased levels of physical activities have better quality of physical and mental health and psychosocial well-being than those leading an inactive lifestyle.^[6]

However, it has been observed that with the technological developments, the movement behavior of the children is being affected.^[6] Parents are also giving very nominal time to their children, and most of the time, they found it better to give them access to watching TV or playing mobile games, than playing themselves with their children or to bring them to the playground. This disrupted movement behaviors might lead to various adverse events such as increased risk of obesity, different metabolic diseases in future life,^[7] delay of cognitive development, and a decrease in academic achievement of children.^[8]

Until recently, movement behaviors were assessed in isolation. In other words, physical activity, sedentary lifestyle, screen time, and sleep pattern were used to measure separately, particularly in case of under-five children. However, a day is a bouquet of all of them – different intensity of physical activity (light, moderate, or vigorous), sedentary, and sleep time. Thus, it is prudent to consider overall activity pattern in a 24 h period.^[9] Recently, there is a paradigm shift in this context. The World Health Organization (WHO) has released a guideline on these different activities for under-five children along with recommendations for different age groups.^[10] This guideline will function as ready reference for measuring any deviation from the maximum recommended time which an under-five children should spend on activity, screen time, and sleep in a 24 h period. These recommendations are applicable for all the children irrespective of their demographic and socioeconomic characteristics.^[10]

Studies on movement behaviors mostly concentrated on adults and adolescents so far. Very few studies are available at present on the movement behaviors among under-five Indian children; and community-based studies are even rarer. Most of them concentrated on school/kindergarten going children. It is generally assumed that slum dwellers are relatively worse off financially and thus are more likely to drop out from the school/kindergarten. As a result, true picture on movement behavior among children from slums is likely to be underrepresented. With 22.4% of the Indian population residing in slum areas,^[11] it is a gap which needs to be filled in.

Hence, the objectives of this study were to find out the prevalence of adequate physical activity, adequate sleep, the status of sedentary behavior, and screen time among under-five

children residing in slum areas of Burdwan Municipality of Purba Bardhaman district. The study also aimed to find out the association between selected demographic and socioeconomic characteristics of study participants with their status of physical activity, sleep, sedentary behavior, and screen time.

MATERIALS AND METHODS

Study design, study area, and study participants

This descriptive type of observational study with cross-sectional design was conducted in the slum areas of Burdwan Municipality of Purba Bardhaman district of West Bengal, India, between January and March 2020 among under-five children residing in that area for at least last 1 year. Children with chronic disease, disability, and seriously ill were excluded. Parents (preferably mother) were the respondents.

Sampling

In spite of exhaustive search in PubMed, Google Scholar, CINAHL, no study was found focusing on the prevalence of movement behaviour among under-fives. A systematic review by Katapally *et al.*^[12] in 2018 with some focus on this age group reported that approximately 30% children and youth are meeting the physical activity guideline. In the absence of other information, considering this prevalence with confidence level 95%, absolute error 10%, design effect as 2 and nonresponse 5%, estimated sample size was 180.

A multi-stage sampling procedure was followed for the selection of study participants. Out of the 144 slums of Burdwan Municipality, 20% of the slums (30) were chosen using simple random sampling. It was decided to include equal number of participants ($180/30 = 6$) from each slum. In the second stage, list of eligible children under 5 years in each selected slum were prepared with the help of Anganwadi workers and other functionaries. From this sampling frame, 6 children were selected again using the simple random sampling through computer-generated random numbers.

Data collection

Data were collected at the household level of each selected subjects. Respondents of the selected subjects were briefed about the purpose of study. Respondents were preferably mother; in the absence of mother, primary care-giver was the respondent. If found absent in the house one more visit was conducted. Thus, at least two attempts were made to reach every randomly selected child. Respondents were interviewed using a predesigned and pretested schedule to collect detailed information about their background characteristics, physical activity, sedentary life including screen time and sleep.

The independent variables included in this study were different sociodemographic characteristics of the study population. The dependent variables of the study were proportion of children with adequate physical activity, adequate sleep, along with controlled sedentary life, and screen viewing within recommended time. Assessment was done according to the

recent guidelines by the WHO on physical activity, sedentary behavior, and sleep for under-five children.^[10]

Operational definitions

Adequate physical activity according to different age group was considered as follows: Those aged 1–11 months should be physically active multiple times a day or if the child is not yet mobile, it should spend at least 30 min in prone position while awake in a 24-h period, ≥ 180 min of physical activity in 24 h, for children aged more than 11 months and in addition 60 min in moderate to vigorous activity within the stipulated time for those aged 36–59 months. Light intensity physical activity was measured as equivalent to 1.5–4 metabolic equivalent of children while moderate to vigorous activities was measured as 4–7 metabolic equivalent. Spending ≤ 1 h at a time in sedentary life is recommended for all under-five children. Screen viewing is not recommended for children below 1–23 months of age group. Above this age, the children can spend maximum 1 h daily in screen viewing. Suggested sleep time for different age group is as follows: 14–17 h (for 0–3 months), 12–16 h (4–11 months), 11–14 h (12–35 months), and 10–13 h (36–59 months).^[10]

Statistical analysis

Collected data were entered in Microsoft Excel™ spreadsheet software. It was checked for erroneous and duplicated entries. After that, analysis was conducted using the Statistical Package for the Social Sciences (IBM SPSS statistics for Windows, version 20.0. Armonk, New York, USA: IBM Corp. 2011). Quantitative data were expressed in mean (standard deviation [SD]) and qualitative data were expressed in frequency (percentages). Multivariable logistic regression was conducted to find out factors responsible for inadequate physical activity and sleep along with more than recommended sedentary life and screen time; $P < 0.05$ was considered for statistical significance.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee of Burdwan Medical College, Purba Bardhaman, West Bengal (BMC/Ethics/097, dated January 28, 2020). Prior to interview, informed consent was obtained from each respondent, and they were assured about the confidentiality of information. The research followed the guidelines laid down in the Declaration of Helsinki, updated in 2013.

RESULTS

In total, 180 under-five children, residing in slums under Burdwan municipality, participated in the study. The findings are presented in the following three broad headings.

Physical activity

Among the children, 69.4% spent adequate time in physical activities. 44.4% of them engaged themselves more in light intensity physical activities and 43.9% in moderate to vigorous activities. About the types of physical activity, there were multiples responses, 47.8% of the children were comfortable in

different floor-based play, 38.3% in running, 29.4% in playing ball games, and 17.8% in different energetic play.

In case of age wise distribution of physical activity, all the children between 1 and 11 months fulfilled the criteria of being physically active. 60.6% of the children of the age group of 12–35 months and 69.3% of children in the age group of 36–59 months were physically active by spending adequate time. The daily average duration of physical activity in minute was 174.17 (SD \pm 52.97).

Sedentary behaviour

Overall 70% of the children fulfilled the criteria of spending sedentary life under recommended time schedule. 77.8% of them enjoying it just by sitting and 14.4% in the lap of their caregivers. This study revealed that availability of screen-based electronic gadgets attracting the children and 36.7% of the children were enjoying screen time more than stipulated time frame. Among all children, 52.2% children spent their screen time by watching television, 26.1% had their attention in mobile phones, and 20% in both.

In case of age wise distribution of spending time in sedentary life, 35.2% children in the age group of 12–35 months spent more time than recommended, while 30.7% and 9.5% of the children in the age group of 36–59 months and 1–11 months, respectively, live sedentary life above suggested time frame.

Sleep

In most of the children (84.4%), total sleep time including nap was adequate as per the WHO recommendations, and the sleep was regular among all of them. 65.6% of the children had regular wake up time. The mean duration of sleep in hour was 12.37 (SD \pm 1.701).

Descriptive characteristics of the study participants are presented in Table 1.

Bivariate analysis and multivariable logistic regression has been done to find out the factors affecting inadequate physical activity and sleep along with harmful sedentary life and screen viewing among study participants.

Risk of inadequate physical activity was found to be more among the children without siblings compared to those having siblings [odds ratio [OR] [confidence interval (CI)] =3.50 [1.78, 6.90]]. Harmful sedentary life was found again to be more among the children without sibling (OR [CI] =4.69 [2.35, 9.36]) as compared to its counterpart. more than recommended screen viewing was found more among children aged between 36 and 59 months (OR [CI] =4.93 [2.34, 9.59]) compared to 1–35 months age group and children living in pucca and semipucca house (OR [CI] =6.34 [2.36, 17.08]) compared to those children resided in kutcha house.

Multivariable logistic regression models for physical activity, sedentary life, sleep and screen time were good fit as evident from Hosmer-Lemeshow statistic. All the independent variables together explained 13.3% (for physical activity), 16.3% (for sedentary life), 28.2% (for screen time), and 4.3% (for sleep)

Table 1: Descriptive characteristics of study participants (n=180)

Descriptive characteristics	Frequency (%)
Age (months)	
1-11	21 (11.7)
12-35	71 (39.4)
36-59	88 (48.9)
Gender	
Male	99 (55.0)
Female	81 (45.0)
Sibling	
Present	126 (70.0)
Absent	54 (30.0)
Family type	
Joint	81 (45.0)
Nuclear	99 (55.0)
House condition	
Kutcha	44 (24.4)
Semipucca and pucca	136 (75.6)
Socioeconomic status*	
Class II + III	20 (11.1)
Class IV + V	160 (88.9)
Physical activity	
Adequate	125 (69.4)
Inadequate	55 (30.6)
Sedentary life	
As recommended**	126 (70.0)
More than recommended	54 (30.0)
Sleep	
Adequate	152 (84.4)
Inadequate	28 (15.6)
Screen time	
As recommended**	114 (63.3)
More than recommended	66 (36.7)

*Socio economic status of the family: elicited by using Modified B.G.

Prasad's Scale (CPI (IW) January 2020: 330), **WHO guidelines^[10].

CPI: Consumer Price Index, IW: Industrial Worker

of dependent variables according to Nagelkerke R^2 squared statistics. After adjusting with other variables, the presence of sibling was found to be significant predictor for both inadequate physical activity (AOR [CI] =3.82 [1.88, 7.77]) and more than recommended sedentary life (AOR [CI] =5.01 [2.45, 10.26]). On the other hand, age (AOR [CI] =4.84 [2.34, 10.00]) and house condition (AOR [CI] =6.54 [2.32, 18.42]) were substantial predictors for more than recommended screen viewing among under-five children [Table 2].

DISCUSSION

Physical activity plays a very important role in the growth and development of a child.^[3-5] The early years in life provides a crucial period for establishing this habit. Instead of physical activity, if sedentary behavior like increased screen time is acquired during this period, it may affect the psychosocial and cognitive development of the child.^[3-5] This study was aimed to assess the status of physical activity, sedentary behavior,

and sleep among under-five children following the recent WHO guideline.

Different studies were done regarding this topic, but mostly on the older age group of children and no study was found among under-five children following the recent WHO guideline.^[10] Thus, this study is unique in nature in time perspective when childhood obesity and being immersed in screen-based gadgets among the children is an issue of concern.

Few studies in this topic can help us to discuss and compare our findings with them. Katapally *et al.* in a publication in 2018^[12] revealed that only 27%–33% children had the adequate overall physical activity while our study revealed much better findings where 69.4% of the children spent adequate time in physical activity. One study on physical activity patterns among school children (children of 3–5 years were included) in India by Gulati *et al.*^[13] in 2014 showed that 79% of the children was physically active. Although not in the Indian context, a study done by Colley *et al.*^[14] in Canada in 2013 revealed where 84% of 3–4 years old children were physically active. Both the studies had better results of physical activity among children than our study.

This study revealed that the presence of sibling is a protective factor both for adequate physical activity and less sedentary life. This possibly due to peer group effect on children. Although no comparable study was found done according to the WHO guidelines, other studies concur with this study. A study by Edwards *et al.*^[15] showed that the presence of siblings had an aspirational influence on the physical activity of the children. Another study done by Kracht and Sisson^[16] also revealed same findings that nonsingleton children had healthier physical activity patterns. Although the age group in both studies was slightly different from this study, it showed that same finding that presence of sibling was a protective factor for physical activity in under-fives also.

Increasing sedentary lifestyle and screen time among the children, both are interrelated issues and matter of thinking nowadays. Giving more time to screen-based gadgets increasing the sedentary lifestyle. In our study, it was found that proportion of children enjoying in sedentary life and screen time within recommended time was 70% and 63.3%, respectively, although according to the 2018 India report card, the children who meet sedentary behavior or screen-time was 40%–46%.^[12] Colley *et al.*^[14] showed that only 18% children of age group 3–4 years had spent appropriate time in front of any screen. Hence, our study revealed much better findings than these two studies.

Our study showed that age group 1–35 months and living in kutcha house appears to be protective factors against harmful screen time. Regarding the age factor, it was hypothesized that using screen based devices requires certain level of cognitive development and below 35 months, children were not cognitively well developed to play with screen-based devices. If proven through other studies, this finding might be helpful

Table 2: Association of background characteristics with movement behaviors (n=180)

Background characteristics	Total	Physical activity				Sedentary behavior			
		Inadequate, n (%)	P	OR (CI)	AOR (CI)	More than recommended, n (%)	P	OR (CI)	AOR (CI)
Background characteristics									
Age (months)									
36-59	88	27 (30.7)	0.971	1.01 (0.54-1.91) Reference	1.24 (0.61-2.53) Reference	27 (30.7) 27 (29.3)	0.845	1.07 (0.56-2.02) Reference	1.32 (0.63-2.73) Reference
1-35	92	28 (30.4)							
Gender									
Male	99	34 (34.3)	0.223	1.50 (0.78-2.86) Reference	1.94 (0.95-3.97) Reference	30 (30.3) 24 (29.6)	0.922	1.03 (0.54-1.96) Reference	1.34 (0.65-2.73) Reference
Female	81	21 (25.9)							
Sibling									
Absent	54	27 (50.0)	0.000	3.50 (1.78,6.90) Reference	3.82 (1.88-7.77) Reference	29 (53.7) 25 (19.8)	0.000	4.69 (2.35-9.36) Reference	5.01 (2.45-10.26) Reference
Present	126	28 (22.2)							
Family type									
Nuclear	99	31 (31.3)	0.807	1.08 (0.57-2.05) Reference	0.93 (0.47-1.87) Reference	29 (29.3) 25 (30.9)	0.819	0.93 (0.49-1.76) Reference	0.75 (0.37-1.52) Reference
Joint	81	24 (29.6)							
House condition									
Semipucca and Pucca	136	45 (33.1)	0.195	1.68 (0.76-3.71) Reference	1.62 (0.70-3.75) Reference	44 (32.4) 10 (22.7)	0.226	1.63 (0.74-3.59) Reference	1.46 (0.62-3.41) Reference
Kutcha	44	10 (22.7)							
Hosmer Lemeshow statistic									
Nagelkerke R ²						0.133			0.163
Background characteristics									
Sleep amount									
Background characteristics		Inadequate, n (%)	P	OR (CI)	AOR (CI)	More than recommended, n (%)	P	OR (CI)	AOR (CI)
Age (months)									
36-59	13 (14.8)	0.777	0.89 (0.40-1.10) Reference	0.81 (0.34-1.91) Reference	48 (54.5) 18 (19.6)	0.000	4.93 (2.54-9.59) Reference	4.84 (2.34-10.00) Reference	
1-35	15 (16.3)								
Gender									
Male	14 (14.1)	0.563	0.79 (0.35-1.77) Reference	0.68 (0.29-1.57) Reference	34 (34.3) 32 (39.5)	0.475	0.80 (0.44-1.47) Reference	1.14 (0.56-2.31) Reference	
Female	14 (17.3)								
Sibling									
Absent	6 (11.1)	0.281	0.59 (0.23-1.55) Reference	0.59 (0.22-1.56) Reference	17 (31.5) 49 (38.9)	0.345	0.72 (0.37-1.42) Reference	0.67 (0.31-1.46) Reference	
Present	22 (17.5)								
Family type									
Nuclear	17 (17.2)	0.508	1.32 (0.58-3.00) Reference	1.40 (0.60-3.29) Reference	39 (39.4) 27 (33.3)	0.401	1.30 (0.70-2.40) Reference	1.07 (0.52-2.19) Reference	
Joint	11 (13.6)								
House condition									
Semipucca and Pucca	18 (13.2)	0.131	0.52 (0.30-1.23) Reference	0.54 (0.22-1.31) Reference	61 (44.9) 5 (11.4)	0.000	6.34 (2.36-17.08) Reference	6.54 (2.32-18.42) Reference	
Kutcha	10 (22.7)								
Hosmer Lemeshow statistic									0.824
Nagelkerke R ²									0.282

OR: Odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

in determining the age group of the targeted beneficiaries for IEC activity against harmful amount of screen time. On the other hand, people residing in kutcha house generally had a lower average income and lack of availability of modern screen-based gadget in their houses relatively protect their children from detrimental screen time. However, further studies are warranted in this regard.

Sleep time and regularity were quite satisfactory in our study as it revealed 84.4% of children had their adequate sleep time. No relevant study was found in this issue in the Indian context. One study by Chen *et al.*^[17] in Singapore in 2019 among children aged 2 years or below showed that mean duration of sleep was 13.9 h. Although age group of their study population was a part of the age group of our study, the mean duration of sleep resembles closely as average sleep time was 12.37 h in our study.

This study showed that there was marked deficit in adequate physical activity and increase in sedentary lifestyle among under-five children. Almost one in three children had higher sedentary lifestyle. On the other hand, engagement of more than one third of children in screen viewing above recommended time is a serious matter of thinking. Adequate sleep time in majority of the children give some relief in context of this study.

Although parents have to work hard and mostly outside, for their livelihood, they need to pay more attention to their children in respect of their physical activity. At the same time, Anganwadi centers need to be strengthened, not just for nutritional supplement purpose but also taking those as an unique opportunity to build the children with adequate physical activity by peer group effect. Thus, combined efforts may lead to healthy India in future.

Limitation

The findings of the study should be interpreted considering its limited generalizability, as it was done in slum areas which consists mostly homogenous population. Instead of socioeconomic status of the family, we used housing condition as the proxy indicator at the time of formation of association table. Detailed qualitative parts behind the harmful lifestyle among children, mother's knowledge regarding this issue, were not assessed.

CONCLUSIONS

The dream of active healthy children is best possible by engaging them in more physical activities along with less sedentary behavior. Coordination among the various stakeholders (e.g. parents, caregivers, teachers, and healthcare professionals) will be helpful for increasing physical activity among this vulnerable age group. Increasing physical activity will also be helpful in reducing sedentary behavior and excess screen time. This is expected to reduce the harmful effect of them on the growth and development of the child. Nevertheless, further researches are warranted in this issue; particularly with the availability of a guideline encompassing all the movement

behaviors in a 24-h period. Studies on developing effective intervention strategies for making children more physically active are thus need of the hour.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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