

Generation-wise difference in adiposity, cardiovascular disease, and Type 2 diabetes due to modernized lifestyle: a brief review

Subhrajyoti Das^{1*} and Mithun Das²

¹ Research Assistant (ICMR), Department of Anthropology, Sree Chaitanya College, Habra, West Bengal, India

² Associate Professor, Department of Anthropology & Tribal Studies, Sidho-Kanho-Birsha University, Purulia, West Bengal, India

*Corresponding author: subhrajyoti1996.das@gmail.com

Keywords: adiposity, CVD, diabetes, lifestyle behaviour, inter-generation

INTRODUCTION

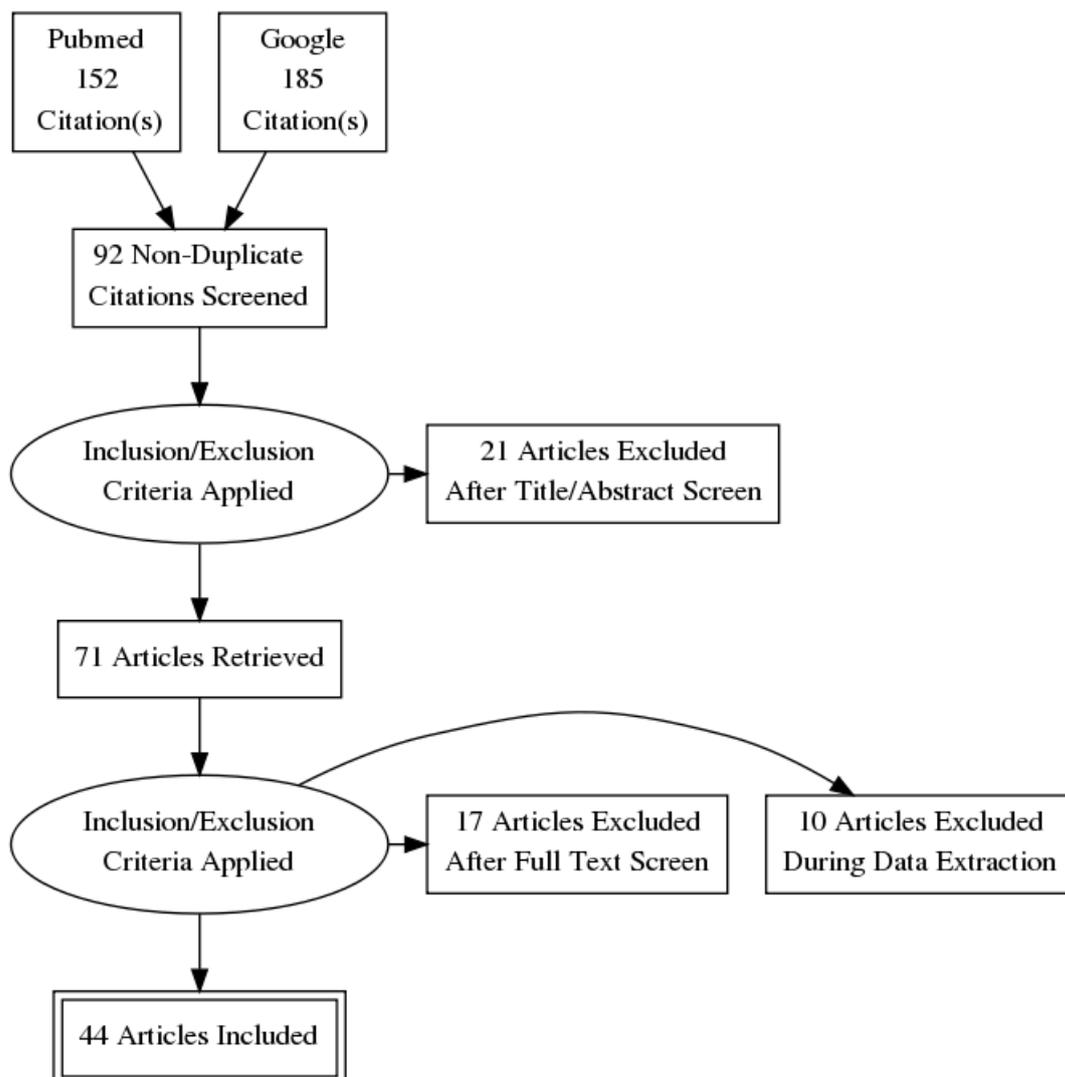
In the past two decades change in lifestyle perhaps mediated through shift in dietary habits, and less physical activity have had significant effect on cardiovascular health among the people worldwide, irrespective of age, sex, and ethnicity. Physical activity (PA) levels have declined globally [1]. Regular PA decreases led many health risks associated with obesity or being overweight [2]. Exercise plays an important role in the prevention as well as control of insulin resistance, pre-diabetes and other diabetes-related health complications such as gestational diabetes mellitus, type 2 diabetes [3]. In adults due to change in lifestyle Type 2 diabetes is becoming an increasingly prevalent disorder leading to increase in body weight. Increasing levels of insulin among young is basically due to genetic and familial factors, foetal environmental factors, maternal gestational diabetes and intrauterine growth retardation, and due to level of physical activity during childhood [4]. The urbanized lifestyle which included unhealthy dietary practices and physical inactivity leads to rise in morbidity and mortality by non-communicable diseases. In India the main cause for emerging epidemic of non-communicable disease is due to demographic and nutrition transition [5]. In children and adolescents the prevalence of overweight and obesity has nearly tripled over the past 30 years [6]. Growing urbanization and associated mechanization in the population often causes an increase in physical inactivity. In the Indian population physical inactivity results in growing burden of obesity predominantly in the urban areas [7]. Over the past few decades growing urbanization and change in lifestyle has significant influence in Indian population as well as other regions of the world. The growing urbanization and lifestyle change has a direct influence on physical activity and diet pattern also. So, in this paper, we have made an effort to found the generation wise difference in Adiposity, CVD and Type 2 diabetes due to modernization.

The present review study understood the effect of modernized lifestyle on cardiovascular health among the different populations of the world from an anthropological perspective.

Methodology

We have searched literatures from various sources and followed the PRISMA 2020 protocol for review studies. Figure 1 illustrates the flow diagram as per the PRISMA protocol.

Figure 1 PRISMA Flow Diagram



We therefore concentrated only the 44 articles for the present review study. We tried to discuss on the basis of various continents and sub-continent of the world.

Brief Review**TABLE 1: Studies across the world except Asia**

Author Ref.	Year	Studied Area	Study Design	Findings
6	2010	Taiwan	Cross sectional study	Among the participants obesity was identified in 7.2% and 16.1% were overweight. It was found using stepwise logistic regression that those people whose fathers and mothers were obese doing activity like high TV viewing, poor sleep duration or slept for less than 7.75 hours/day at weekends had a greater risk of obesity.
8	2017	North East England	Cohort Study	Increased adiposity is due to greater increase in sedentary time and increase in sedentary fragmentation between the ages of 7 to 15 years.
9	2012	Britain	Focus groups and semi-structured interviews	The grandparents eating pattern were more structured as compare to the children's eating patterns. Those families with an obese child there have more changes and eating is less structured than those of families with a normal weight child.
10	2018	US	Cross sectional study	Occupational activity acts as an effect modifier in the relationship between long work hour and physical activity, employees working long hours had greater risk for obesity. Since this employees were particularly vulnerable physical inactivity and that result in weight gain and obesity
11	2015	University of Minnesota-Twin Cities	Self-report survey	In healthy adolescents consumption of breakfast and fast-food appear to be related to important metabolic syndrome biomarkers for chronic diseases.
12	2017	UK	Cross sectional study	Greater risk of obesity were seen among adults with low level of physical activity, high TV viewing and poor sleep duration and that result in overweight and obesity.
13	2012	Pelotas, Southern Brazil	Birth cohort study	During early adulthood diet has an important role on health. The Brazilian diet pattern showed healthier trend regarding CVD risk factors.

14	2019	South-eastern region of the United States	Cross-sectional study	In the diet quality of adolescents, family structure, parental working status and socioeconomic status are all associated. Moreover it was seen that snacks and sweets, processed meat and sugar sweetened beverage and fried food dietary patterns are all associated with CVD risk factors.
15	2014	Rural area (Nabon) in Ecuador	Cross sectional study	Two dietary patterns were observed in this study one is rice – rich non animal fat pattern and the other one is wheat – dense animal fat pattern. Moderate increase in glucose in urban participants was co-related with the first pattern while higher LDL and cholesterol bloods level in rural participants was associated with the second pattern.
16	2019	41 Low- and middle-income countries (LMICs)	Cross sectional study	In low income countries the prevalence of obesity and sedentary behaviour were lowest while highest in upper middle income countries. In adolescence sedentary for ≥ 3 hours/day is associated with increased odds of obesity.
17	2019	Chile	Chilean National Health Survey	Leisure time physical activity was related with lower risk of all major cardiovascular risk factors while occupational physical activity was related with lower risk of diabetes and hypertension.
18	2016	Western Sweden	Cross sectional study	More girls were underweight, whereas more boys were overweight or obese. Significant risk factors for being overweight were seen among boys and girls who were living in rural areas, living in apartments and reporting leisure time physical inactivity.
19	1998	United States	Cross sectional study	Between 1976-80 and 1988-1994 in US the prevalence of obesity (BMI ≥ 30.0) increased markedly. Other than US this trends were seen elsewhere in the world.
20	2013	America	Population Based	CVD risk factors were linked with the diet patterns. While due to evolving methods of preparing traditional food lead the western pattern clearly linked with CVD risk factors and thus made the pattern unhealthy also.
21	2019	Brazil	School based survey	Males favoured the traditional Brazilian food such as

				rice and beans. While people with higher socioeconomic status was associated with consumption of unhealthy foods.
22	2014	Netherlands	Cohort Study	Within all generations the prevalence of overweight, obesity and hypertension increased with age. There had been higher prevalence of these risk factors among more recently born generations at similar age than generation born 10 years earlier. It was observed that among men unfavourable generation shifts in diabetes but not in women. It was observed that between the oldest two generation favourable generation shifts for low high density lipoprotein cholesterol. While no generation shifts for hypercholesterolemia. According to socioeconomic status the pattern of generation shifts did not differ.

TABLE – 2: Studies across Asian continent

Author Ref.	Year	Studied Area	Study Design	Findings
23	2017	Iran	Population based study	Western dietary pattern is seen among the Iranian population. Which is characterised by higher loads of processed meats, salty snack, sweets and soft drinks are dietary risk factor for CVD.
24	2017	Saudi Arabia	A Brief Review	Rise in socioeconomic status of Saudi Arabian population resulted in the adoption of an altered lifestyle as compared to previous generations. There was an increase in case of T2DM in epidemic proportions due to sedentary lifestyle and consumption of fat based diets. Diabetes related issues were substantially increasing in Saudi population. All age groups and gender are affected by this disease.
25	2020	Kuwait	Cross sectional study	Younger adults are addicted with the consumption of fast foods or refined grains/poultry whereas older adults are addicted with vegetable-rich dietary pattern. The fast food dietary pattern was associated with body mass index and refined grains dietary pattern was associated with plasma glucose levels. In this study it was found that fast food and refined grains/poultry dietary patterns results in high prevalence of CVD risk factors among Kuwaiti adults.

26	2016	China	National Survey	With the increase in age the prevalence of overweight, obesity and central obesity is also increasing. It was found that it is higher in men than in women and simultaneous decrease in the prevalence of underweight.
27	2018	Sri Lanka	Case control study	In sufficient physical activity, watching video/DVD \geq 2h, watching television \geq 2h and doing homework \geq 2h are the risk factors for overweight. While consuming meat, fish, fast food, sweets, cookies were dietary risk factors for overweight. Consuming legumes and seeds, vegetables on the other hand found to be the protective factors for overweight
28	2012	Iran	Cross sectional population-based study	In Iranian population increase in the consumption of fast food related to poor dietary intake and this result in CVD risk factors.
29	2016	China	China Health and Nutrition Survey	In urbanization China change in diet, screen time and physical activity behaviour differ between children and parents over the past two decades. Children's behaviours is associated with parental behaviour, although the magnitude of the association declined overtime. In promoting healthy dietary habits and increasing physical activity this study supports household-based versus individual based health interventions for both parents and children.
30	2012	China	Chinese National Survey	During 1985-2000 there was an increase in the prevalence of obesity among 7-18 years old children and during 2005-2010 the rate obesity is higher in rural than in urban.
31	2020	Southeast Asia	Review article	In Asian countries obesity is more common among women. In southeast Asia obesity has become an health problem. Factors causes obesity are sex, age, level of education, physical activity, marital status, history of obesity during childhood, genetics, stress, consumption of alcohol, smoking habits, pattern of consumption, residence, economic status, sleep habits, culture, social media and influence of friends.
32	2020	Laos, Vietnam	Cross sectional study	It was seen that 23.3% adolescents of Lao PDR (People's Demographic Republic) attending private and public

school were overweight/obese while 10.3% were affected by thinness. It was also observed overweight/obesity is due to low physical activity.

33	2014	Southeast Asia	Systematic Review	People living in an urban environment and obesity in countries of southeast Asia both are interrelated across all age groups and genders.
----	------	----------------	-------------------	---

TABLE 3 Studies within India subcontinent

Author Ref.	Year	Studied Area	Study Design	Findings
5	2016	Punjab	Cross-sectional study	In India non communicable disease is due to poor dietary practices and physical inactivity. With gender equity lens non-communicable disease control need to address these issues. Difference in urban rural is due to rapid urbanization of rural India.
7	2016	Mumbai	Community based, cross-sectional epidemiological study	Physical inactivity or sedentary behaviour was more with increasing obesity, women and increasing age. Increased urbanization has resulted in several environment factors like lack of parks, pollution which may discourage participation in physical activity. Habitual moderate physical activity is the key to tackle the epidemic of obesity. For adoption of healthy lifestyle it is necessity of time to create environment by channelled health education and advocacy.
34	2020	Kolkata	Cross-sectional study	Between 1982 and 2011 it is found that in Bengali boys adiposity has significantly changed over the past few decades.
35	2014	Birbhum, West Bengal & Mayurbhanj, Odisha	Population based study	Young tribal males who were against the traditional wisdom have growing body weight which in turn associated with metabolic risk factors. Tribal females at lower BMI facing more danger towards metabolic risk factors. Thus the present status shows an increasing tendency toward double burden of disease.

36	2020	Delhi	Cross-sectional study	Among the majority of population the level of physical activity is very low. Global physical activity questionnaire assessed and found that the males were more active than females. In physically low active group higher proportion of the overweight individual was found as compared to moderately active group. Marked differences in physical activity level of participants were observed at the lower and upper quartiles of conicity index. Overweight and hypertensive participants doing less physical activity as compared to individuals in normal group.
37	2018	Lucknow, Nagpur, Hyderabad and Bangalore	Cross-sectional study	In this study it was observed that in India animal food pattern is positively associated with cardio-metabolic factors.
38	2016	Ludhiana	Cross-sectional study	More than half of the current study population sedentary behaviour is prevalent. This was more with increasing age, female gender and increasing obesity. On long term weight control physical activity plays a major role and therefore to combat the obesity epidemic adequate levels of activity should be prescribed. In order to prevent excess accumulation of fat habitual moderate physical activity may be beneficial.
39	2019	Jawadhu hills, residing in Tirupattur Taluk, Vellore district	Population based cross sectional study	The prevalence of diabetes and hypertension was 3.6% and 16.7%.. Newly detected diabetes people were 77.8% and hypertension was 62.9%.. Both diabetes and hypertension are associated with increasing age. With hypertension high BMI, literacy status and gender are associated. The prevalence of isolated systolic hypertension was 13.2% and isolated diastolic hypertension was 10.7%. On comparison it was observed that in increasing age group there was statistical significant increase in mean BPs. Both diabetes and hypertension is found among eight participants.

40	2013	Asian Indian	A systematic review	In Asian Indian population cardiovascular disease and its risk factors are increasing rapidly. Like urban population CVD risk factors is also increasing at an alarming rate. Thus threatening to the nation CVD may lead to epidemic proportion since majority of the Indian live in rural area.
41	2016	Dehradun, Uttarakhand	Cross-sectional study	Overall 15.6% of children were overweight, of which 5.4% were obese. Overweight and obesity both are associated with physical inactivity like passive transport to school, high TV viewing, lack opportunity to playing lunch break, lack of participation in household work.
42	2004	Chennai, Tamilnadu	Cross-sectional study	In rural India demographic transition is mainly caused due to improved living conditions which was associated with three-fold increase in the prevalence of diabetes with this phenomenon increased upper body adiposity and physical inactivity showed significant association.
43	2018	Lucknow, Nagpur, Hyderabad and Bangalore	Cross-sectional study	In India it was observed that people who intake high animal food dietary pattern was positively related with cardio metabolic risk factors.
44	2012	Pune	Cross-sectional study	Central adiposity showed positive association with higher inactivity and negative association with higher activity.

Conclusion

Over the past few decades growing urbanization and change in lifestyle has significant influence in Indian population as well as in other regions of the world. The growing urbanization and lifestyle change has a direct influence on physical activity and diet pattern also. The prevalence of overweight, T2DM and CVD is common among all generation in today's lifestyle. It was found that in older generation the eating pattern is more structured and healthier than in younger generation. The level of physical activity is more among older generation whereas the millennial are more stuck to sedentary behaviour which include physical inactivity, consumption of fast food, high TV viewing, and poor sleep duration. These lifestyle behaviours are making them more vulnerable to obesity, T2DM and CVD risk at very earlier ages. Early screening, intervention,

and increase of physical activity level among the children and adolescents are needed to curb the global epidemic of chronic diseases.

REFERENCES

1. Ng SW, Popkin BM. Time use and physical activity: A shift away from movement across the globe. *Obes Rev.* 2012; 13: 659–80.
2. Blair SN, Brodney S. Effects of physical inactivity and obesity on morbidity and mortality: Current evidence and research issues. *Med Sci Sports Exerc.* 1999; 31(11 Suppl):S646–62.
3. Colberg SR, Sigal RJ, Fernhall B. Exercise and Type 2 Diabetes. The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care* 2010; 33(12).
4. Bloomgarden ZT. Type 2 Diabetes in the Young: The evolving epidemic. *Diabetes Care*, 27, 2004.
5. Tripathy JP, J S Thakur JS, Jeet G, et al. Urban rural differences in diet, physical activity and obesity in India: are we witnessing the great Indian equalisation? Results from a cross-sectional STEPS survey. *BMC Public Health.* 2016 Aug 18;16(1):816.
6. Liou YM, Liou T, Chang L. Obesity among adolescents: sedentary leisure time and sleeping as determinants. *J Adv Nurs.* 2010; 66(6):1246-56.
7. Kadarkar KS, Tiwari SR, Velhal GD, et al. Physical activity levels during work, leisure time and transport and its association with obesity in urban slum of Mumbai, India. *Int J Community Med Public Health.* 2016 Mar;3(3):715-720.
8. Mann KD, Howe LD, Basterfield L, Parkinson KN, et al. Longitudinal study of the associations between change in sedentary behaviour and change in adiposity during childhood and adolescence: Gateshead Millennium Study. *International Journal of Obesity* (2017) 41, 1042–1047.
9. Kime N. Changes in intergenerational eating patterns and the impact on childhood obesity. *Health Education Journal*, 2012.71 (2). 173 - 179.
10. Cook MA, Gazmararian J. The association between long work hours and leisure-time physical activity and obesity. *Preventive Medicine Reports* 10 (2018) 271–277.
11. Marlatt KL, Farbakhsh K, Dengel DR. Breakfast and fast food consumption are associated with selected biomarkers in adolescents. *Prev Med Rep.* 2015 Dec 4: 49-52.
12. Cassidy S, Chau JY, Catt M, et al. Low physical activity, high television viewing and poor sleep duration cluster in overweight and obese adults; a cross-sectional study of 398,984 participants from the UK Biobank. *International Journal of Behavioral Nutrition and Physical Activity* (2017) 14:57.
13. Olinto MTA, Gigante DP, Horta B et al. Major dietary patterns and cardiovascular risk factors among young Brazilian adults. *Eur J Nutr* (2012) 51:281–291.
14. Chen L, Zhu H, Gutin B, et al. Race, Gender, Family Structure, Socioeconomic Status, Dietary Patterns, and Cardiovascular Health in Adolescents. *Curr Dev Nutr* 2019; 3:nzz117.

15. Ochoa-Aviles A, Verstraeten R, Lachat C et al. Dietary intake practices associated with cardiovascular risk in urban and rural Ecuadorian adolescents: a cross-sectional study. *BMC Public Health* 2014, 14:939.
16. Ashdown-Franks G, Vancampfort D, Firth J, et al. Leisure-Time Sedentary Behavior and Obesity Among 116,762 Adolescents Aged 12-15 Years from 41 Low- and Middle-Income Countries. *Obesity (Silver Spring)*. 2019 May;27(5):830-836.
17. Petermann-Rocha F, Brown RE, Diaz-Martínez X, et al. Association of leisure time and occupational physical activity with obesity and cardiovascular risk factors in Chile. *J Sports Sci.* 2019 Nov;37(22):2549-2559.
18. Winkvist A, Hulten B, Kim J, et al. Dietary intake, leisure time activities and obesity among adolescents in Western Sweden: a cross-sectional study. *Nutrition Journal* (2016) 15:41.
19. Flegal KM, Carroll MD, Kuczmarski RJ, et al. Overweight and obesity in the United States: prevalence and trends, 1960-1994. *Int J ObesRelatMetabDisord.* 1998 Jan; 22(1):39-47.
20. Eilat-Adar S, Mete M, Fretts A, et al. Dietary Patterns and Their Association with Cardiovascular Risk Factors in a Population Undergoing Lifestyle Changes: The Strong Heart Study. *Nutr Metab Cardiovasc Dis.* 2013 June; 23(6): 528–535.
21. Alves MA, Souza AM, Barufaldi LA, et al. Dietary patterns of Brazilian adolescents according to geographic region: an analysis of the Study of Cardiovascular Risk in Adolescents (ERICA). *Cad. Saúde Pública* 2019; 35(6):e00153818.
22. Hulsege G, Picavet HS, Blokstra A et al. Today's adult generations are less healthy than their predecessors: generation shifts in metabolic risk factors: the Doetinchem Cohort Study. *European Journal of Preventive Cardiology.*2014; 21: 1134-1144.
23. Mirmiran P, Bahadoran Z, Vakili AZ, Azizi F. Western dietary pattern increases risk of cardiovascular disease in Iranian adults: a prospective population-based study. *Applied Physiology, Nutrition, and Metabolism*, 2017, 42(3): 326-332,
24. Fareed M, Salam N, Khoja AT. Life Style Related Risk Factors of Type 2 Diabetes Mellitus and Its Increased Prevalence in Saudi Arabia: A Brief Review. *International Journal of Medical Research & Health Sciences*, 2017, 6(3): 125-132
25. Al-Lahou B, Ausman LM, Penalvo JL, Huggins GS, et al. Dietary Patterns Associated with the Prevalence of Cardiovascular Disease Risk Factors in Kuwaiti Adults. *J Acad Nutr Diet.* 2020 Mar;120(3):424-436.
26. Tian Ye, Jiang Chongmin, Wang Mei, CaiRui et al. BMI, leisure-time physical activity, and physical fitness in adults in China: results from a series of national surveys, 2000-14. *Lancet Diabetes Endocrinol.* 2016 Jun;4(6):487-97.
27. Godakanda I, Abeysena C, Lokubalasooriya A. Sedentary behaviour during leisure time, physical activity and dietary habits as risk factors of overweight among school children aged 14-15 years: case control study. *BMC Res Notes.* 2018 Mar 20; 11:186.
28. Bahadoran Z, Mirmiran P, Golzarand M, et al. Fast food consumption in Iranian adults; dietary intake and cardiovascular risk factors: Tehran Lipid and Glucose Study. *Arch Iran Med.* 2012 Jun;15(6):346-51.
29. Dong F, Howard AG, Herring AH, Thompson AL, et al. Parent-child associations for changes in diet, screen time, and physical activity across two decades in modernizing China: China Health and Nutrition Survey 1991–2009. *International Journal of Behavioral Nutrition and Physical Activity* (2016) 13:118.

30. Ma J, Cai C, Wang H, et al. The trend analysis of overweight and obesity in Chinese students during 1985 – 2010. *Zhonghua Yu Fang Yi Xue Za Zhi*. 2012 Sep; 46(9):776-80.
31. Ni SM, Putri K, Christina M, et al. Factors Associated with Obesity in Adults in South East Asia. *International Journal of Psychosocial Rehabilitation*. 2020; 24(7):1475-7192.
32. Ivanovitch K, Keolangsy S, and Homkham N. Overweight and Obesity Coexist with Thinness among Lao's Urban Area Adolescents. *Journal of Obesity* 2020.
33. Angkurawaranon C, Jiraporncharoen W, Chenthanakij B, et al. Urban Environments and Obesity in Southeast Asia: A Systematic Review, Meta-Analysis and Meta-Regression. *PLoS ONE* 2014; 9: e113547.
34. Kryst L, Zeglen M, Das S, Dasgupta P, Saha R, Das R. Intergenerational changes in adiposity and fat distribution from 1982 to 2011 in male children and adolescents from Kolkata (India). *PediatrObes*. 2020; 1: e12585.
35. Kshatriya GK. Changing Perspectives of Tribal Health in the Context of Increasing Lifestyle Diseases in India. *J Environ Soc Sci*. 2014; 1(1):101.
36. Devi KS, Nilupher, Gupta U, Dhall M, Kapoor S. Incidence of obesity, adiposity and physical activity pattern as risk factor in adults of Delhi, India. *Clinical Epidemiology and Global Health* 8 (2020) 8–12.
37. Shridhar K, Satija A, Dhillon PK. Association between empirically derived dietary patterns with blood lipids, fasting blood glucose and blood pressure in adults - the India migration study. *Nutr J*. 2018 Feb 8;17(1):15.
38. Singh S, Issac R, Benjamin AI, et al. Prevalence and Association of Physical Activity with Obesity: An Urban, Community-Based, Cross-Sectional Study. *Indian J Community Med*. 2016;41(1): 77.
39. Sathiyarayanan S, Muthunarayanan L, and Devaparthasarathy TA. Changing Perspectives in Tribal Health: Rising Prevalence of Lifestyle Diseases among Tribal Population in India. *Indian J Community Med*. 2019 Oct-Dec; 44(4): 342–346.
40. Nag T, Ghosh A. Cardiovascular disease risk factors in Asian Indian population: A systematic review. *J Cardiovasc Dis Res*. 2013 Dec;4(4):222-8.
41. Bhargava M, Kandpal SD, and Aggarwal P. Physical activity correlates of overweight and obesity in school-going children of Dehradun, Uttarakhand. *J Family Med Prim Care*. 2016 Jul-Sep; 5(3): 564–568.
42. Ramachandran A, Snehalatha C, Baskar ADS, et al. Temporal changes in prevalence of diabetes and impaired glucose tolerance associated with lifestyle transition occurring in the rural population in India. *Diabetologia* (2004) 47:860–865.
43. Shridhar K, Satija A, Dhillon PK, et al. Association between empirically derived dietary patterns with blood lipids, fasting blood glucose and blood pressure in adults - the India migration study. *Nutrition Journal* (2018) 17:15.
44. Shobha R and Priti A, J. Physical Activity, Adiposity and Blood Pressure Levels among Urban Affluent Adolescents in India. *Obes Wt Loss Ther* 2012, 2:5.