Socio-demographic risk factors and their association with prevalence of Hypertension among adolescents- A comparative study

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Abstract
Background: Studies in adolescents provide important epidemiological information and aetiology bywhich prevention and modifyingof subsequent coronary risk factors can be achieved. No studies are available for sociodemographic risk factors and knowledge of hypertension forkarad region.
Objective: To study and compare associated socio-demographic risk factors of elevated blood pressure among adolescents and to find out the prevalence of elevated blood pressure and to assess the knowledge about hypertension in adolescents of urban and urban slum areas of Karad.
Methodology: Comparative cross-sectional study was conducted in Karad during the period of 2017 to 2019. Adolescents from Urban (n=310) andurban slum area (n=310) of Karad who satisfied the inclusion criteria were included. A pretested, validated and reliable proforma was developed. Apart from socio-demographic information, other parameters such as behavioural and lifestyle related risk factors, anthropometric measurements and blood pressure were recorded. Analysis was done using IBM SPSS for Windows software version 20.0. Chi square test evaluated categorical variables. p value equal to or less than 0.005 was considered to be statistically significant for a 95% confidence interval.
Result: Out of 310, the prevalence of Hypertension (HTN) in urban adolescents was 54(18.7%), similarly among urban slum adolescents the prevalence of HTN was 46(14.9%). Majority had good knowledge about hypertension in the urban area with 123(39.7%) and 165(53.2%) had satisfactory knowledge in the urban slum area.Diet, added salt intake, sleep inadequacy, addiction to alcohol and tobacco products, obesity and overweight, physical inactivity and family history of hypertension were principal risk factors for elevated blood pressure in adolescents with statistical significance ($p<0.05$).
Conclusion: The study identified age, level of education,lifestyle and behavioural factors as risk factors for elevated blood pressure in adolescents. Early detection will decrease risk of cardiovascular complications in adulthood.
Key words: Adolescent, hypertension, pre-hypertension

Introduction
Hypertension poses a major public health concern due to its high prevalence and associated cardiovascular risk.[1,2] Globally in children, hypertension ranges between 2-4% among diverse ethnicities and goes up to 21%.[3] In India it ranges between 5–10%.[4]Hypertension leads to 54% of strokes, 47% of ischemic heart disease and 12.8% of the total annual deaths worldwide.[5]The prediction raises to1.56 billion adults with hypertension in 2025.[6]Hypertension (or HTN) is defined as abnormally high arterial blood pressure measuring systolic BP level of ≥140mmHg and/or diastolic BP level ≥ 90mmHg. The value between 120–139mmHg systolic BP and 80–89mmHg diastolic BP is defined as "prehypertension". [7,8]
Elevated levels of blood pressure in children can progress to hypertension in adulthood contributing to the major risk factor for cardiovascular morbidity and mortality.[9]If untreated at an earlier age, the risk would obviously be greater as the onset is at younger age.[10]

Scientific evaluation of predictors in childhood provides important epidemiological information whichpromotes prevention of hypertension and ischemic heart disease in adults. Changing lifestyle, dietary pattern, decrease in physical activity and increase in obesity increases the prevalence of hypertension in school going children.[11]. Many studies exist globally on this issue in different regions. But the data shows large disparity in prevalence of hypertension in children worldwide. However, no data is available for determining knowledge about hypertension and socio demographic risk factors in the Karad region. The need for area-specific studies to derive local data and to document area-wise prevalence of hypertension to decrease the burden of cardiovascular disease becomes crucial at this stage.
This study was aimed to compare the associated socio-demographic risk factors of elevated blood pressure among adolescents and to find out the prevalence of elevated blood pressure and to assess the knowledge about hypertension in adolescents of urban and urban slum areas of Karad.

Methodology:
The comparative cross-sectional study was conducted in the urban and urban slum area of Karad during a period of December 2017-January 2019.
Using previous prevalence statistics of elevated blood pressure in these regions ofIndia (24.2%and 30.3%),with 95% confidence interval, and 80% power, a difference of 10% in the two groups is considered significant, and the sample size was estimated to be 310 adolescents each in Urban and Urban slum area.[12]
Adolescentsaged 10-18 years, who were permanent resident were included in the study. Adolescents with systemic disease and secondary hypertension were excluded. Ethical clearance was obtained from Institutional Ethics Committee. A written consent and Patient information sheet in the local language was obtained from all parents of the adolescents.
A pretested, validated (from experts in research from the department of Community Medicine and the department of Paediatrics) and reliable proforma was developedfor the study. Apart from the personal and socio-demographic information, other parameters such as behavioural and lifestyle related risk factors, anthropometric measurements and blood pressure were recorded. The five part of the questionnaire was based on Socio-demographic characteristics(age, sex, education, religion, family type, socioeconomic status and education status according to Modified Kuppuswamy‘s socio-economic classification),[13] Behavioural risk and lifestyle related risk factors (type of diet, added salt intake, addictions, physical activity, and family history of hypertension), Anthropometric measurements (Height, Weight, Body Mass Index(BMI), General physical examination including Vitals (Pulse rate, Blood Pressure), Knowledge about hypertension.
Weight (WT)was measured in the upright position to the nearest 0.1 kilogram using a standardized portable analogue weighing balance machine having accuracy up to 0.1 kg with minimum clothes and bare feet measured thrice. An average was then taken.
Height (HT) was measured to the nearest 0.1 centimetre using standard calibrated fixed stadiometer with accuracy of up to 0.5 cm.
Body mass index (BMI) was calculated using the formulae, BMI = weight in kilograms / height in square meters. The adolescents were classified based on their nutritional status using the age and gender specific CDC BMI percentile charts.
Blood pressure was recorded according to standard protocol.[14,15]A cuff of appropriate size was selected.[16]
The point of onset of the first tapping sound was taken to indicate systolic blood pressure (SBP) and the diastolic blood pressure (DBP) reading was taken when the sound disappeared.[17] For each subject, three recordings were taken at an interval of 5 minutes and the average was taken as the final reading.
Twelve questions with true and false statements were framed for eliciting the knowledge about hypertension among the study adolescents.Each statement was given a score of 1. A score of 0 to 4 was considered as poor knowledge, score of 5 to 8 was considered as satisfactory knowledge

and score of 9 to 12 was considered as good knowledge. Maximum score will be twelve (12) and minimum will be zero (0).

Statistical Analysis:

Data was entered into Microsoft excel spread sheet. Analysis was done using IBM SPSS for Windows software version 20.0. Data was analysed using descriptive and inferential statistics. Continuous data were expressed in terms of mean and standard deviation and categorical data as proportions. To test the association Chi square test was used for categorical variables. p value equal to or less than 0.005 was considered to be statistically significant for a 95% confidence interval.

Result:

A total of 620 adolescents were included in the study. Out of 310 adolescents in the urban population, 218(70.3%) were males and 92(29.7%) were females. In the 310 adolescents of the urban slum population, 193(62.3%)were males and 117(37.7%)were females.The mean age of the adolescents was 13.41±2.10 years Figure 1and 2

The demographic details are presented in table 1.

Urban adolescents

Majority (n=117) were primary school students andHindus (n=266). Most (n=123) had Good knowledge about hypertension, followed by satisfactory knowledge (n=117) and poor knowledge (n=70).

Elevated blood pressure was present in 54 adolescents inclusive of prehypertension(n=34) and hypertension (n=24).Prevalence of hypertension showed statistically significant increase ($p<0.05$) with age. Higher prevalence was observed among 16-18 years (Pre-HTN;n=15 & HTN; n=10) followed by 14-15 years (Pre-HTN; n=10 & HTN n= 8).

Considering gender distribution, the prevalence of HTN was significantly higher among urban females (n=10) followed by males (n=14) ($p<0.05$). Similarly, Pre-HTN was also higher among females (n=15) compared to males (n=19).

In post high school adolescents, elevated blood pressure was significantly higher (Pre-HTN ;n=6,19.4% & HTN; n=5,16.1%), while it was lowestin primary school adolescents(Pre-HTN; n= 5 ,4.3%& HTN; n=6,5.1%) ,($p<0.05$). HTN was maximum among Hindus (n=21, 7.9%), while Pre-HTN was more in Muslims (n=7,15.9%) although this was not statistically significant ($p<0.05$). The prevalence of elevated blood pressure was higher in nuclear families where (Pre-HTN; n= 24, 14% & HTN; n=15, 8.7%). It was also seen to be higher among the lower economic class (Pre-HTN; n=14, 15.9% & HTN; n=8, 9.1%). However, differences in both parameters were not statistically significant ($p>0.05$).

A higher number of adolescents consuming mixed diet (Pre-HTN; n= 30& HTN; n=21) had elevated blood pressure compared to vegetarian diet. A higher prevalence was also seen in those who had more salt intake (Pre-HTN n= 25 & HTN n= 20) compared to those who did not (Pre HTN; n= 9 & HTN,n=4). Both the parameters (mixed diet and added salt intake) showed a statically significant difference from their counterpart ($p<0.05$)

There was a statistically significant ($p<0.05$) prevalence among adolescents who had inadequate sleep at night (Pre-HTN; n=26& HTN; n=18).

Those who had addictions were seen to have a higher prevalence of elevated blood pressure(Pre-HTN, n= 3,30%& HTN; n=2, 20%) compared to those who had no addictions (Pre-HTN; n= 31, 10.3%& HTN, n= 22, 7.3%). This association between addictions and the development of elevated blood pressure was statistically significant ($p<0.05$). Physically inactive adolescents showed a higher prevalence (Pre-HTN; n= 28& HTN; n= 17),compared to adolescents who were physically active (Pre-HTN, n=6& HTN; n= 7). This difference was statistically significant ($p<0.05$). Positive family H/o hypertension contributed significantly ($p<0.05$)(Pre-HTN; n= 24 & HTN; n=18). Obese adolescents showed statistically significant ($p<0.05$) prevalence (Pre-HTN; n= 17 & HTN; n= 13), compared to overweight adolescents(Pre-HTN; n=10& HTN; n= 6) and normal weight adolescents (Pre-HT; n= 4& HTN; n= 4).

Urban slum area

Elevated blood pressurewas statistically significant ($p<0.05$) with the age where higher prevalence was seen among 16-18 years (Pre-HTN; n= 15& HTN; n= 10) followed by 14-15 years(Pre-HTN; n= 8& HTN; n=2).Higher prevalence of hypertension was in males with (n=11),while pre-hypertension was higher in females (n=14) which was not statistically significant ($p>0.05$).

Hypertension was highest in post high school adolescents(n= 8).Whereas pre-hypertension was higher i high school adolescents (n= 11).Level of education was significantly associated with development of elevated blood pressure($p<0.05$) Non Hindu adolescents showedhigher numbers in elevated blood pressure (Pre-HTN; n= 10& HTN; n=4) compared to Hindus. Religion was significantly associated with the development of elevated blood pressure ($p<0.05$)

Higher prevalence was seen in joint families (Pre-HTN; n= 24 & HTN; n= 13) compared to nuclear families (Pre-HTN; n =5& HTN; n =4). The association between type of family and development of elevated blood pressure was statistically significant ($p<0.05$) Middle and upper class showed higher prevalence (Pre-HTN; n=7 & HTN; n= 5) although not statistically significant ($p>0.05$).

Adolescents consuming vegetarian diet showed statistically significant ($p<0.05$) prevalence (Pre-HTN;n= 6 & HTN; n = 2). Adolescents who added extra salt in their diet showed statistically significant ($p<0.05$) prevalence (Pre-HTN; n= 22& HTN; n= 13). Among adolescents who had inadequate sleep at night showed significant ($p<0.05$) prevalence (Pre-HTN; n= 19 & HTN; n=13).

Adolescents with Addictions in urban slum area showed significantly ($p<0.05$) higher prevalence (Pre-HTN; n= 3 & HTN; n= 3) compared to those who had no addictions (Pre-HTN; n= 26& HTN; n= 14). Physically inactive adolescents showed significant ($p<0.05$) prevalence (Pre-HTN; n = 21 & HTN; n= 13).Adolescents with positive family H/o hypertension showed significant ($p<0.05$) prevalence (Pre-HTN; n= 20 & HTN n=11).Obese adolescents showed significant ($p<0.05$) prevalence (Pre-HTN; n = 14 & HTN; n= 9),compared to overweight (Pre-HTN ; n=7& HTN; n= 4) and normal weight adolescents (Pre-HTN; n= 4 & HTN; n= 2).

Comparison showed no statistically significant difference between age group, level of education and prevalence of HTN, consumption of added salt, duration of sleep, level of nutritional status and family history of HTN and prevalence of hypertension as well as pre-hypertension in urban and urban slum area ($p<0.05$). There was a statistically significant difference between type of diet, physical activity and prevalence of elevated blood pressure among adolescents in urban and urban slum areas.

Discussion

Prevention of hypertension and cardiovascular risk in adults necessitates a scientific evaluation and management of the predictors in childhood. [18]The high yield of hypertension and pre-hypertension in adolescents in the study justifies the need for such studies in children to identify the risk associated and to prevent cardiovascular morbidity in future.

The study comprised of urban adolescents in age group of 10-13 years (53.9%) followed by 14-15 years (27.4%) and the least among 16-18 years (18.7%). Similar to urban subjects a higher proportion of urban slum adolescents were in 10-13 years with 168(54.2%), followed by 16-18 years 75(24.2%) and the least among 14-15 years with 67(21.6%). Many other studies showed the similar ages but in contrast some studies had variations in proportion of age groups. This variation could be a result of differences in age groups included in each study. [19, 20,21]

In urban adolescents, males constituted 70% while females 30%. Among urban slum adolescents, males constituted 62% and females 38%. This is because the proportion of male adolescents was higher than females.Among urban adolescents maximum proportion were Hindus (85.8%), similarly in urban slum adolescents, 89 % were Hindus, which explains the dominant religion o the geographical region. The level of education varied in both groups as age group in majority also varied.

In urban adolescents, majority belonged to middle class (56.5%) and least among lower class (10%), whereas in urban slum group majority belonged to lower class (80.9%) and least among upper class (2.9%). Difference in socio-economic status could be due to the variations in education, occupation and income status of each household.

The prevalence of pre-hypertension and hypertension among adolescents in urban study population was 11% and 7.7%, while in urban slum it was 9.4% and 5.5% respectively. The difference may be due to age differences, socio-cultural and socioeconomic backgrounds.

In both the study groups prevalence of hypertension increased with age; (16-18 years), Urban; Pre-HTN (25.9%) & HTN (17.2%) and urban slum; Pre-HTN (20%) & HTN (13.3%). This age-related increase in BP can be attributable to increase in body mass and increased levels of stress with an increase in age.

In urban area Females were at higher risk withhigher rate of both pre-hypertension (16.3%) and hypertension (10.9%). In Urban slum adolescents,prevalence of Pre-HTN was high in females (12%) and HTN high in males (5.7%).Differences in patterns of blood pressure between genders are probably related to certain biological and psychosocial factors. The appearance of secondary sex characters together with menarche, associated with a high level of anxiety resulting in higher blood pressure values in girls can be an explanation

Type of family, socioeconomic condition and religion didn't show significant relation to hypertension. Higher number of Hindus could be due to the higher proportion of Hindu adolescents (85- 89%) in this study.

In this study, the prevalence of elevated blood pressure among urban and urban slum adolescents was more in the post high school and high school adolescents respectively. Similar findings were observed by Sundar JS*et al.*While contrasting to our study a low prevalence has been observed by Gupta GK *et al.*(8.2%).[22,16]This higher prevalence in this study may be attributed to the high stress level among the high school and post high school students due to huge academic burden and responsibilities.

Knowledge wise distribution shows that majority had good knowledge about hypertension in urban area 123(39.7%), whereas a higher proportion of adolescents with satisfactory knowledge 165(53.2%) was found among urban slum adolescents. Higher education and high socioeconomic status could explain the awareness and knowledge in urban population.

Urban area showedmaximum prevalence of elevated blood pressure among adolescents who consume mixed diet,while among urban slum showed HTN in adolescents who consume vegetarian diet.Significant difference was observed between diet type and prevalence of hypertension as well as prehypertension in urban and urban slum area. ($p<0.05$) In contrast to our study, low prevalence among mixed diet eaters was found by Rajashree *et al.*Amritanshu*et al.*and higher prevalence in vegetarians by Gupta *et al.*[23,24,16]The disparity may be due to higher number of mixed diet population in the study.

Maximum prevalence of elevated blood pressure was noticed among adolescents who consume extra salt in their diet in urban and urban slum population. Many studies confirm the association of sodium intake directly affecting the increase in blood pressure.[25,26]

Both urban and urban slum area shows a higher prevalence among study adolescents with inadequate sleep duration at night representing it as a significant risk factor. The higher prevalence in our study could be the time frame we used when compared to other studies was lower or higher.[27,28]

In this study, prevalence of elevated blood pressure was greater among adolescents who had addiction to alcohol and tobacco products in both urban and urban slum area. As per WHO report, alcohol consumption is the third largest risk factor indeveloped countries and tobacco the second major cause of death worldwide.[29]The study shows positive relation between addiction and hypertension.

The study showedmaximum prevalence of elevated blood pressure among physically inactive adolescents in both urban and urban slum areas. Comparison showed a statistical significance. In contrast to these findings, a study from Brazil found a higher prevalence in physically active

(13.8%) adolescents.[30]This variation in prevalence may be due to the difference in the duration of physical activity taken in the study. This study had a limit of 1 hr/day for low physical activity, but other comparable studies had 1/2 hr/day. Also, it shows that physical inactivity is increasing gradually among the adolescent population.

The prevalence of elevated blood pressure was more among obese adolescents in both urban and urban slum group. There was positive relation observed between BMI and hypertension. This could be related to sedentary lifestyle, improper eating habits, increase in fat content of diet and decreased physical activities.

In Urban and urban slum area,the prevalence of elevated blood pressure was higher among adolescents with positive family history of hypertension.This suggests that, there is a genetic role to play in the development of hypertension. Familial tendency for developing high blood pressure is well known.[31,32]

Non-inclusion of private schools, children out of schools of same age group and restriction to a small town, are some of the limitations of the study. Dietary and salt intake recall bias may also be present. Accurate collection of data from addictions may not be accurate as it was questionnaire based.

This was the first study to document prevalence of hypertension and prehypertension and also knowledge about hypertension among adolescents of the Karad region. The high yield of hypertension and pre-hypertension in the present study justifies the need for such studies in school children and incorporation of study in the existing school health programs for creating awareness. Creating education about lifestyle, dietary habits, physical activity among children and parents is a need of the hour. Further larger multi-centric community based studies are needed to assess the burden of hypertension among adolescents.

Conclusion

This study revealed a relatively high prevalence rate of elevated blood pressure among adolescents in the study area, and identified age, lifestyle and behavioural factors and level of education as associated socio-demographic risk factors. This makes the adolescents vulnerable to cardiovascular risk in adulthood. Implementation of surveillance programs for early detection and creating awareness about lifestyle habits is the need of the hour.

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Table 1: Distribution of the study population

	Urban (n)	**Urban slum (n)**	**Total no**
Knowledge about hypertension			
Poor	70	80	150
Satisfactory	117	165	282
Good	123	65	188
Dietary Pattern			
Vegetarian diet	92	21	113
Mixed diet	218	289	507
Added salt intake			
No	201	231	432
Yes	109	79	188
Sleep duration at night			
Adequate	198	222	420
Inadequate	112	88	200
Addictions			
No	300	296	596
Yes	10	14	24
Physical activity			
Active	218	189	407
Inactive	92	121	213
Body mass index			

Underweight	28	101	129
Healthy weight	147	111	258
Overweight	74	49	123
Obese	61	49	110
Family H/o Hypertension			
Yes	121	113	234
No	189	197	386
Level of Education			
Primary School	117	103	220
Middle School	116	100	216
High School	46	51	97
Post-High School	31	56	87
Religion			
Hindu	266	276	542
Muslim	39	19	58
Others	5	15	20
Type of Family			
Nuclear	172	120	292
Joint	54	74	128
Three Generation	73	107	180
Broken	11	9	20
Socio-economic Status			
Class I	47	9	56
Class II	70	16	86

Class III	105	34	139
Class IV	57	103	160
Class V	31	148	179
Prevalence of elevated blood pressure			
Normal	252	264	516
Pre-hypertension	34	29	63
Hypertension	24	17	41

Table 2: Comparison of various factors and elevated blood pressure among the study adolescents

Elevated Blood Pressure					
Urban (n)			**Urban Slum (n)**		
	Pre-HTN	**HTN**	**Pre-HTN**	**HTN**	**Chi. Sq (χ)**
Age group					
10-13 years	9	6	6	5	0.768 *p*= (0.680)
14-15 years	10	8	8	2	2.533 *p*= (0.281)
16-18 years	15	10	15	10	1.331 *p*= (0.514)
Total (100.0)	34	24	29	17	
Education					
Primary school	5	6	4	2	1.626 *p*= (0.443)
Middle school	15	7	6	4	3.597 *p*= (0.165)
High school	8	6	11	3	1.582 *p*= (0.453)
Post high school	6	5	8	8	0.502 *p*= (0.777)

Total	34	24	29	17	
Diet					
Vegetarian	4	3	6	2	14.685 *p*= (0.000)
Mixed	30	21	23	15	9.039 *p*= (0.010)
Total (100.0)	34	24	29	17	
Added Salt Intake					
No	9	4	8	4	0.338 *p*= (0.844)
Yes	25	20	21	13	0.367 *p*= (0.832)
Total (100.0)	34	24	29	17	
Sleep duration					
Adequate	8	6	10	4	0.722 *p*= (0.697)
Inadequate	26	18	19	13	0.179 *p*= (0.914)
Total (100.0)	34	24	29	17	
Addiction					
Yes	3	2	3	3	0.232 *p*= (0.890)
No	31	22	26	14	2.351 *p*= (0.308)
Total (100.0)	34	24	29	17	
Physical Activity					
Active	6	7	18	4	8.021 *p*= (0.018)
Inactive	28	17	21	13	9.705 *p*= (0.007)
Total (100.0)	34	24	29	17	
BMI					
Under-weight	3	1	4	2	2.247 *p*= (0.325)

Healthy weight	4	4	4	2	0.388 *p*= (0.823)
Overweight	10	6	7	4	0.015 *p*= (0.992)
Obese	17	13	14	9	0.149 *p*= (0.928)
Total (100.0)	34	24	29	17	
Family H/o HTN					
Yes	24	18	20	11	1.838 *p*= (0.399)
No	10	6	9	6	0.115 *p*= (0.944)
Total (100.0)	34	24	29	17	

Figure1: Urban Area- Age and Gender wise distribution
Figure 2: Urban Slum Area- Age and Genderwise distribution

Image: 1

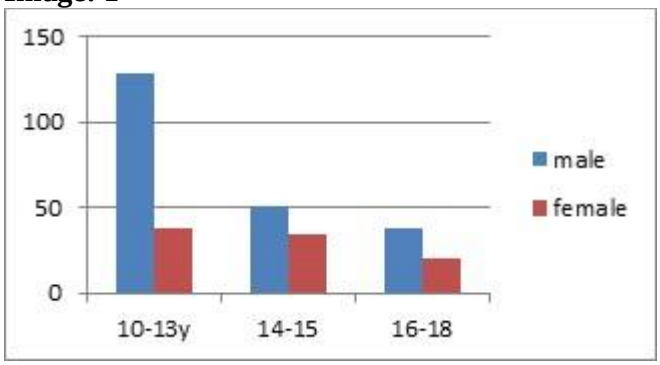
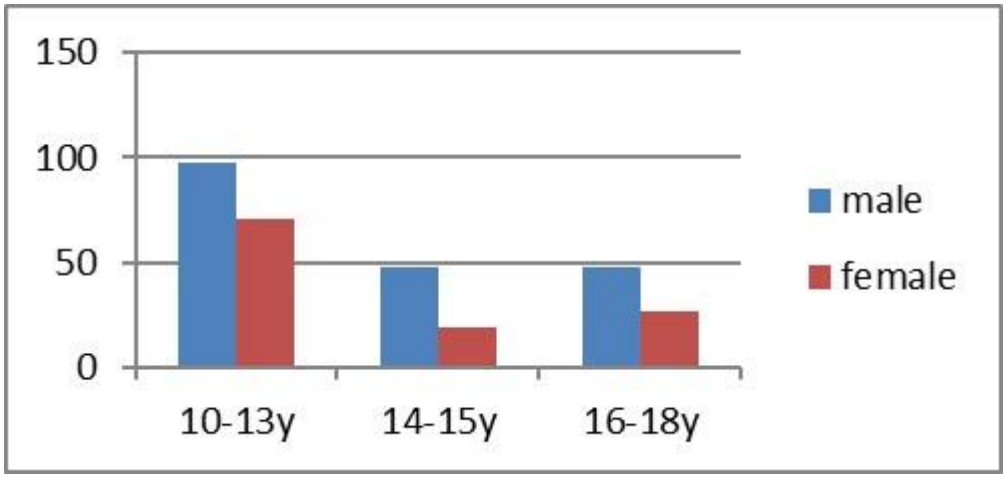


Image: 2


150
100
50
0
10-13y
14-15y
16-18y
male
female