Original Research Article

Investing in the transition to renewables: understanding the infodemic on climate change among undergraduates of the faculty of environmental sciences in a Nigerian university

Abstract

Background: A close interlink exists between the health of man and his environment Therefore, committing to sustainable practices, building thriving communities, securing future growth potentials and strategies on adaption to related global challenges, remain key.

Objective: To assess the knowledge and perception of climate change among undergraduate students of the faculty of environmental sciences in a university in Nigeria.

Materials and Methods: This was a survey of 337 undergraduates selected via multistage sampling technique. Data were obtained using self- administered semi-structured questionnaires, and analysed using statistical package for social sciences software version 22. Statistical significance was done using Chi-square test at p value ≤ 0.05.

Results: Three hundred and twenty town (%) respondents reported awareness of climate change and cited their sources of information on climate change as 270 () Social media, 258() Television, 226 () School, etc. Only (12.6%) out of 350 respondents had good level of knowledge on climate change. The level of knowledge of climate change among respondents significantly vary with r age-(p= 0.0000), cum gender (p= 0.0000

Conclusions: This study found apparently high awareness on climate change. The level of knowledge on climate change was poor and varies significantly with age and gender. We recommend comprehensive but, need- based environmental education to sustain awareness,

impart knowledge, improve perception and equip these students with requisite interventions strategies to handle challenges linked to climate change

Keywords: *Climate change, university students; Nigeria, knowledge, perception*

1. Introduction

The United States Environmental Protection Agency, states that climate change refers to any significant variations in measures of average weather conditions of a place lasting for a prolonged period of time usually decades and more [1]. Climate change is a socio- demographic, socio- economic, environmental and ecological challenge resulting from poorly checked accelerating globalization [2,3,4]. Climate variability impacts on the actions, inactions, environment, and natural resources that sustain humans [5]. These variations should differentially determine and drive prevention.

Humans- more especially, through the greenhouse gas (GHG) emissions continuously and uncontrollably generated into the atmosphere- remain the commonest cause of the earth's fast changing climate [6]. Not less than 97% of authorities and relevant stakeholders in climate science, endorses a consensus stance that humans remain the lead drivers of this global crisis. The Intergovernmental Panel on Climate Change (IPCC) links a greater part of the observed rise in global average surface temperature from 1951 to 2010, to rise in concentrations of anthropogenic forcing together. [7].

Air pollutants, - carbon dioxide (CO_2), GHGs from the burning of fossil fuels, coal, oil, and gas in generating electricity, heat, and aiding transportation, impact directly [6] Also, forms of forest degradation such as deforestation, fires, agriculture (livestock production, fertilizer use) and road

construction generate air pollutants. But this group, rather than escape into space, last for centuries in the atmosphere, trap the heat and cause an indirect impact - recent rise in the global average temperature near the earth's surface (Global warming) [3]. As temperatures and CO_2 levels rise, the resultant impact synergises with existing impacts through (natural and human) pathways, exerting Cumulative) impact on the earth's climate [2,3,8]. Health, environmental and other impacts of climate change can result from direct effect of weather events, such as stress, record floods, raging storms, deadly heat and drought, domestic water supply shortages, and/or indirect effects such as mental disorders from displacement and malnutrition from food insecurity [9,10,11. Also, emerging and re-emerging diseases for instance, from spread of disease vectors (e.g. altitudinal extension of malaria transmission). According to the World Health Organization, the impact of recent climate change has already lead to loss of 150,000 human lives and about five million Disability Adjusted Life Years (DALYs) globally [12]. The resultant global burden of diseases is still likely to increase to an all-time high of about 250,000 additional deaths per year" between 2030 and 2050. {3] According to the United Nations Framework Convention on Climate Change in 2007 and several studies, while application of fossil based synthetic fertilizers contributes significantly to GHG emissions [7,13 , its supply, barely meets the resultant food demand, leading to persisting food insecurity[3,7,[

Man' actions and inactions aim at managing the environment and natural resources. In this quest, they generate climate change crises, constituting one of the biggest global health threats to sustainable development. [15, 16,17]. About 13 million deaths can be prevented annually by making our environment healthier [12]. Yet the inability of populations in many developing countries to make adaption changes to mitigate the effect of climate change [2,3], renders them

particularly vulnerable [3,14] In Nigeria, energy production from non- renewable sources, increased from 146.3 million tons of oil equivalent (Mtoe) to 239.77 Mtoe and CO_2 emission, from 28.06 Mt to 85.09 Mt between 1990 and 2016 respectively [18]].

Concerns about climate change have driven a transition in energy regime to renewable (or CO_2 – neutral) alternatives such as solar, wind and tidal sites [3,16,19] . Deriving from the plan of actions of the COP 24 summit at Glasgow 2021, climate change issues such as Climate financing and Climate loss payment, Climate adaptation, Climate activism, Climate social media activism, disasters, impact, green course Climate loss opportunity, Green/ Climate washing, Sustainable Development, Energy transition, are now mainstream. Despite the strong scientific evidence on the negative impact on humans, there is dearth of research on awareness and knowledge on this topic among the study group. The findings of this study are expected to contribute to future scientific studies, fill the literature gaps and equip future Climate action leaders in planning and proactivity for future `public and professional challenges. It is apt to determine the knowledge and perceptions of climate change among undergraduates of the faculty of environmental sciences in a university in Nigeria.

2. Materials and methods

2.1 Study Design This was a cross-sectional descriptive study conducted in February 2021 to August, 2021

2.2 Description of Study Area: The study was carried out in the faculty of environmental sciences, Imo State University Owerri located in Owerri Municipal, one of the three local government areas (LGA) that constitute Owerri the Capital of Imo State in South East Nigeria.

The LGA had an area of 8km2 and a population of 127,213 ([20). The University was established in 1981 and had its re-establishment at the present Lake Nwaebere Campus formally approved by the National Universities Commission in 1992. It has a population of about 15,000 undergraduates and offers series of post-graduate and undergraduate courses in 11 faculties and 63 departments [21]. The faculty offers courses in eight departments namely: Architecture, Building, Estate management, Quantity surveying, Fine and applied arts, Geography, Environmental management, and Urban and regional planning [21].

2.3 Study Participants: The study subjects were recruited from undergraduate students in all the departments in the faculty of environmental sciences of the Imo State University, Owerri.

2.3.1 Selection criteria

2.3.1.1 Inclusion criteria: Students enrolled in an undergraduate regular program at the faculty of environmental sciences at the Imo State University, Owerri and for at least one year.

2.3.1.2 Exclusion criteria: Such students of the faculty, who were absent from school during the study period. Or who were present but declined full informed consent.

2.4 Variable definition and measurement: These comprise: a) socio-demographic variables of respondents such as age, gender, religion, etc., b) awareness, c) level of knowledge; d) perception and e) factors affecting knowledge of climate change. Knowledge and perception are the dependent variables.

2.5 Data Sources and Measurement Frequencies of the variables were determined by univariate analysis, while bivariate analysis, using chi-square test was employed in testing whether or not an association existed between variables.

2.6 Bias

This study is based on self- reporting practices and thus the data are subject to reporting errors.

2.7 Study Size

2.7.1 Sample size determination

The sample size was determined using the sample size formula for cross sectional studies in populations greater than 10,000 (Cochran) stated thus: [22] :$n=Z^2pq/d^2$, where n= minimum sample size; Z=standard normal deviate at 95% confidence interval set at 1.96; p=prevalence in a previous study; q=1 –p; d=degree of precision (0.05); Therefore, prevalence of knowledge of climate change among undergraduate students of the Faculty of Environmental Sciences, Imo State University which is 0.5, as no such studies has been conducted in the study area, m=384 [23] . Since the formula above implies when population is more than 10,000, for population less than 10,000, we applied the formula [23], nf= n/1+n/N, where, nf = The desired sample size when the population is less than 10,000, n = The desired sample size when the population is more than 10,000, The target study population, N is 1,230), [21 , nf = 293. Assuming 20% of the sample size was added to cover for attrition, the estimated sample size was approximately 366 students.

2.7.2 Sampling technique

Multistage sampling technique was used to select the study participants. In the first stage, stratified sampling technique was used to group the faculty into eight departments. Proportionate allocation of the sample size of 352 into 44 students per department was done. This kind of sampling procedure can guarantee the representation of each of the eight groups and also their subgroups (the number of 1^{st}, 2^{nd}, 3^{rd} and 4^{th} year's student of a given programme year) to ensure that the subjects were sampled proportionally. In the second stage, stratified sampling technique was used to further split each department into four [4] levels. Proportionate allocation of the 44 students into 11 per level was done. In the third stage, the class register was used as the sampling

frame and 11 participants were selected from each level, by simple random sampling technique using a table of random numbers (i.e. eleven students per level, 44 prepatent and 352 in total (the faculty)). In order to select the individual students who participated in the study, the students' identity (ID) numbers were entered into a computer software programme (Random Number Generator Software) which generated at random the required number of students from each programme and within a study year. The students whose ID numbers were selected by the computer programme were invited to participate in the study.

2.8 Data Collection Technique

Data collection in this study was done using pretested, semi- structured questionnaires developed from review of relevant literatures [,2,,3,7,16,19]. All questions were written in English language and pre-tested on similar set of respondents in Madonna University Elele, Nigeria. This was done, for assessing the content reliability, validity, appropriateness of format and comprehensibility of the questions, wording and time needed to fill the questionnaire. Thereafter the instruments were reviewed by colleagues, necessary adjustments and corrections were affected before administering the questionnaire to the study participants. The edited questionnaires were distributed by our trained investigators to the classrooms of the selected groups of students. They were asked to complete the questionnaires independently and returned the questionnaires to a collection box when they left the classrooms. Designated places for collection per department were provided at ease and convenience of participants. To ensure data quality, training of data collection team and field monitoring of data collection were done. Post data collection team meeting was held daily to share experiences, submit completed forms, and solve field problems.

2.9 Quantitative Variables

Continuous variables were displayed as means ±standard deviation (SD).

2.10 Statistical Methods

The data were edited and entered into the computer, cleaned, with range and consistency checks. Descriptive and analytical statistics of the data were carried out using International Business Machine/statistical package for social sciences (IBM/ SPSS) Windows version 22.0 [24.. Descriptive data were presented as simple frequencies and percentages. Tests of statistical significance were carried out using Chi square tests and p values < 0.05 were considered significant. A p-value of <0.05 was considered to indicate a statistically significant difference. Data transformation and grading: Knowledge was measured by adapting the scoring system by 25,26]. Individual responses of all knowledge assessments were re-coded thus: Twenty five (25) knowledge items (in five stems): {Causes of climate change [5]; Forces that contribute to climate change [5]; Manifestations of climate change [5]: Whose responsibility is it to tackle climate change [5]: Measures to tackle climate change [5], For each correct answer a score of one point was given and a score of zero point for incorrect answers (maximum of five (5) points per stem question, as multiple response were allowed. The mean of respondents' scores was taken as cut-off point in identifying respondents with poor, fair and good knowledge of climate change. Respondents scoring below the mean (<50%) were classified as having **poor** knowledge about climate change, while those who scored above the mean (51%-100%) were regarded as **fair** knowledge, if they scored (51%- 70%) and **good** knowledge, if they scored (71%- 100%). The five-point Likert scale of the perception assessment was transformed with the following options: (strongly agree, agree, *indifferent* (i.e. neither agree nor disagree), disagree and strongly disagree).

3. Results

Table 1 shows the socio- demographic characteristics of respondents. Three hundred and seventy questionnaires were distributed, 337 were returned and were analysed giving a response rate of 91.1%. The modal age group 123 (30.46%) was 20- 30 years, while only eight (2.4%) was in the age group $\geq$ 36 years. Majority, 244 (72.4%) were females, 35 (10.4 %) were currently married, 313 (92.9%) were Christians and 308 (91.4%) were of the Ibo ethnic extraction.

Table 2 shows the awareness, and knowledge of climate change among respondents. Three hundred and twenty- two (95.5%) respondents reported awareness of climate change. The sources of information on climate change reported by the 322 respondents that have heard of climate change were 270 (83.9%) from social media, 256 (79.5%) from television, 226(70.2%). Two hundred and thirty two (723%) of these 322 respondents reported that the understanding of climate change, The commonly reported Causes of climate change were Deforestation, overgrazing and bush burning, by 258 (80.1%), Outdoor smoking (gas flaring, automobile), by 219 (68%); Indoor smoking, by 218 (67.7%). The reported forces that contribute to climate change, include: Burning of fossil fuels, coal, oil, and gas in generating Heat and aiding transportation, by 266 (80.7%) and 172 (53.4%)) respectively. Manifestations of climate change reported include: Deadly heat and uncontrollable wildfires, by 234 (72.1%), and Record flood by 181 (56.2%). The respondent's views on whose responsibility it is to tackle climate change were captured thus: International Organizations by 289 (89.8%), Environmental Agencies by 242 (75.2%), Private Sector/ Individuals, by 239 (74.2%), while Planting of tress by 249 (77.3%) and Use of renewable energy cum Avoidance of burning waste by 223 (69.3%) respectively were the most commonly reported Measures to tackle climate change

Table 3 highlights the level of knowledge on climate change by respondents. Only 90 (26.7%) out of 337 respondents had good level of knowledge on Climate change

Table 4 shows the Perception of climate change among respondents. The following reported strongly agree to issues on climate change and thus: Pattern of the general weather condition is changing by 187 (55.5%): Human activities contribute to climate change by 190 (56.7%): Climate change is a sign of end times by 16 (4.8%) and Climate change as a matter of global concern by 216 (64.1%)

Table 5 shows the factors affecting the level of knowledge on climate change among respondents. There were statistically significant associations between the level of knowledge on climate change among respondents and their age- <25 and> ($\chi 2$= 21.237, p= 0.0000), cum gender ($\chi 2$= 27.747, p= 0.0000)

4. Discussion

This cross-sectional descriptive study determines the knowledge and perceptions of climate change among undergraduates of the faculty of environmental sciences in a university in Nigeria, This study gauges the environmental awareness and empowerment of this group (agents of change), as a prelude to their potentials towards sustainable development and management of infodemics on climate change as the global environment agenda, turns towards investing in the transition to renewables

This study determines the knowledge of climate change among participants studied. From the findings, 95.5% of participants report awareness of climate change. Thus, high awareness can be expected among health sciences students who were more highly educated than the general

population in the other Sub-Saharan study. This finding of high awareness of climate change concurs with that of similar surveys in Adamawa, Nigeria [27] and University, Ile Ife, Nigeria [28]). Bell in New York in 2012, corroborated that sustainability is key in creating a safer world for the present and future generations [29].

The findings, of the index study on awareness of climate change, reports the key sources of information on climate change as social media and television. Previous studies had findings that are consistent with that of the index survey [30, 31, 32, 33, 34]. They documented that more than 50% of participants reported that they get information on climate change from print and electronic mass media. In another study, students appear far more informed about climate change, usually from the Internet and international media, than the level of climate change education they were taught in university [35]. This finding is nonetheless in contrast to that of a study done in Turkey [35]. However, this variation could be attributed to differences in methodologies such as sampling and data collection procedures.

The findings of the index study reveals that majority of participants in the survey reports understanding of climate change, This finding is however, in tandem with a study done in Nigeria, where most participants reported awareness of climate change. [36] This high awareness of climate change in the present study, is corroborated by its report that 723% of participants understands what climate change means.

The current research finds that the level of knowledge on climate change by participants, was only 26.7%. This is despite the high awareness that the present study reports. This emphasises

the need for management of infodemics associated with climate change. There is need for proper check and censor of sources of information available to these participants. However, participants in another study in Nigeria, had reported good level of knowledge on Climate change [36]. The differences between the findings of the index and reference studies could be attributed to differences in methodologies such as sampling and data collection procedures. This warrants a recommendation for further studies with adjustment in methodologies

From the current research on the perception of climate change, proportion of participants who reports strongly agree to issues on climate change, falls within a range of 4.8%- 64.1%. Previous studies documented that participants who understand the concept of climate change were very concerned about preventing public health consequences of climate change and the possible impacts on all sectors of the economy. [33,36,37] In the index survey, 723% of participants understands what climate change means. This emphasises the place of effective behaviour change communication.

The current survey finds there were associations between the level of knowledge on climate change among participants and their age- <25 and > 25 cum gender. The results were similar to the finding in another elsewhere, that the level of knowledge of the concept under discuss varies and this depends on their ages and gender [28]. On age factor, it has been reported elsewhere that the general knowledge of climate change was higher among the older than younger students [33,38,] Concerning gender, the finding of the index study is consistent with those of several studies that reported slightly higher level of knowledge on climate change in females than male, although these differences were statistically not significant [33,38]. Similarly, a review by Roehr

[39], concluded that women generally recognize climate change as a more severe threat than men. These reports on gendered differences may be attributed to the relatively higher social responsibility of women than men in their communities, which increases their understanding of climate change [40]]. Moreover, women not only had relatively good knowledge of climate change but also the capability to change their environment [41] .This pattern of female awareness and their potential contribution to reducing climate change and mitigating impacts is contrary to the common perception that African females are unaware of environmental issues and lack the know how to deal with them. There is thus a need for the active participation of women in debates on mitigation and adaptation to climate change policy that needs to be recognized by policy makers.

Limitations: These include use of cross-sectional design and the fact that self-reported practice may not match actual behaviours. We did not include focus group discussions in this study to further explore the perceptions of the study participants. This could have given the study participants the opportunity to freely express themselves.

Conclusions

The following major findings are obvious from this study. First, there is high awareness, the key sources of information on climate change are social media and television. A majority of participants in the survey have an understanding of climate change. Secondly, the level of knowledge on climate change is poor. The proportion of participants who very concerned about preventing the possible impacts of climate change varies. Also, there are some significant differences in the level of knowledge of climate change and this depends on age and gender.

The above findings justify the need for sustained awareness, improved enlightenment on climate change and quality Climate Literacy as education is an essential component and drive for responding to climate issues and (age and gender) /related concepts

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Consent: As per international standard or university standard, the participants' written full informed consent for the conduct and publication of this study has been collected and preserved. Study participants were assured of confidentiality and that they were free to refuse or withdraw from the study at any time without any penalty. The study's aim and objectives were explained to each participant prior to interview

Ethical approval. The study has been examined and approved by the Madonna University ethical committee through the Head Department of Community Medicine. Permission to conduct and publish the study was sought and obtained from the relevant authorities at the Imo State University, Owerri. All authors hereby declare that the study has been performed as per University standard, or international ethical standards laid down in the 1964 Declaration of Helsinki.

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Tables

Table 1. Socio- demographic characteristics of respondents

Characteristics	Frequency (N=337)	Percentage (%)
Age at last birthday (in years)		
16-20	28	8.3
21-25	16	49
26-30	123	36.4
31-35	13	3.9
>36	8	2.4
Gender		
Male	93	27.6
Female	244	72.4
Marital status		
Currently married	**35**	**10.4**
Currently unmarried	**302**	**89.6**
Never married	291	86.4
Co- habiting	5	1.5
Widowed	4	1.2
Widow	*4*	*1.2*
Widower	*0*	*0*
Separated	1	0.3
Divorced	1	0.3
Religion		
Christianity	313	92.9
Islam	21	6.2
African Traditional Religion	3	0.9
Ethnicity		
Ibo	308	91.4
Hausa.	8	2.4
Yoruba.	14	4.1

Others*	7	2.1

** Others- Edo, Urhobo, Igala, Ijaw*

Table 2. Awareness and knowledge of climate change among respondent

Variables	**Frequency (N=337)**	**Percentage (%)**
Have heard of climate change		
Yes	322	95.5
No	15	4.5
Total	337	100
Sources of information on climate change (n=322)*		
Social media	270	83.9
Television	256	79.5
School	226	70.2
Radio	121	37.6
Print media	100	31.1
Seminars/workshops/ conferences	61	18.9
Billboards/ posters	52	16.1
Textbooks	16	5
Understanding of climate change (n=322)*		
Significant change in general weather conditions of a place over many years.		
Yes	232	72
No	90	28
Causes of climate change (n=322)*		
Deforestation, overgrazing and Bush burning	258	80.1
Outdoor smoking (gas flaring, automobile)	219	68
Indoor smoking	218	67.7
Population explosion	166	51.6
Rapid urbanization	122	37.9
Forces that contribute to climate change (n=322)*		
Burning of fossil fuels, coal, oil, and gas in generating		
Heat	266	80.7
Aiding transportation	172	53.4
and Electricity	137	42.5
forest degradation	170	52.8
Fire	170	52.8
Manifestations of climate change (n=322)*		

Deadly heat and uncontrollable wildfires	234	72.1
Record flood	181	56.2
Raging storms	168	52.2
Droughts	154	47,8
Diseases, allergies, death of humans, species endangerment and loss of biodiversity	111	34.5
Whose responsibility is it to tackle climate change (n=322)*		
International Organizations	289	89.8
Environmental Agencies	242	75.2
Private Sector / Individuals	239	74.2
Government	148	46
Non- governmental Organizations	112	34.8
Measures to tackle climate change (n=322)*		
Planting of tress	249	77.3
Use of renewable energy	223	69.3
Avoidance of burning waste	223	69.3
Recycling waste	187	58.1
Use of regulated public transport than Private cars to conserve energy	100	31.1

***multiple response**

Table 3. The level of knowledge on climate change among respondents

Overall Knowledge Grade	**Frequency (N=337)**	**Percentage (%)**
Poor		
Poor (Have heard of climate change	*90*	*26.7*
Poor (Have not heard of climate change	*15*	*4.5*
Poor (Subtotal)	105	31.2
Fair	142	42.1
Good	90	26.7
Total	**337**	**100**

Table 4. Perception of climate change among respondents

Perception of climate change	**Frequency (N) N=337**	**Percentage (%)**
Pattern of the general weather condition is changing		
Strongly agree	187	55.5
Agree	141	41.8
Indifferent	7	2.1
Disagree	1	0.3
Strongly disagree	1	0.3
Human activities contribute to climate change		
Strongly agree	190	56.7
Agree	139	41.2
Indifferent	6	1.8
Disagree	1	0.3
Strongly disagree	1	0.3
Natural processes contribute to climate change		
Strongly agree	120	35.6
Agree	133	39.5
Indifferent	47	14
Disagree	33	9.8
Strongly disagree	4	1.2
Climate change is a potential long-term threat to generations		
Strongly agree	177	52.5
Agree	114	33.8
Indifferent	12	3.6
Disagree	9	2.7
Strongly disagree	25	7.4
Climate change is a sign of end times		
Strongly agree	16	4.8
Agree	12	3.6
Indifferent	88	26.1
Disagree	146	43.3
Strongly disagree	77	22.9
Climate change is a matter of global concern		
Strongly agree	216	64.1
Agree	114	33.8
Indifferent	5	1.5
Disagree	1	0.3
Strongly disagree	1	0.3

**Multiple responses*

Table 5. The factors affecting the level of knowledge of climate change among respondents

	Overall knowledge Grade Frequency (n)/percentage (%)				Test statistic	p value
Variables	**Poor (%)**	**Fair (%)**	**Good (%)**	**Total (%)**	**(χ2)**	
Age at last birthday (in years)						
<25	74 (21.9)	89 (26/4)	33 (9.8)	193 (57.3)		
≥25	31 (9.2)	53 (15.7)	57 (16.9)	144 (42.7)	21.237	0.0000*
Total	105 (31.2)	142 (42.1)	90 (26.7)	**337 (100)**		
Gender						
Male	21 (6.2)	28 (8.3)	44 (13.1)	93 (27.6)		
Female	84 (24.9)	114 (33.8)	46 (13.6)	244 (72.4)	27.747	0.0000*
Total	105 (31.2)	142 (42.1)	90 (26.7)	**337 (100)**		
Marital status						
Currently married	12 (3.6)	17 (5)	6 (1.8)	35 (10.4)		
Currently unmarried	93 (27.6)	125 (37.1)	84 (24.9)	302 (89.6)	1.812	0.1773
Total	105 (31.2)	142 (42.1)	90 (26.7)	**337 (100)**		
Religion						
Christianity	94 (27.9)	131 (38.9)	87 (25.8)	302 (89.6)		
Non- Christianity	11 (3.2)	11(3.2)	3 (0.9)	46 (13.4)	2.975	0.0845
Total	105 (31.2)	142 (42.1)	90 (26.7)	**337 (100)**		
Ethnicity						
Ibo	98 (29.1)	141(41.8)	70 (20.8)	309 (91.7)		
Non- Ibos	7 (2.1)	1(0.3)	20 (5.9)	28 (8.3)	f=0.7796	0.3228
Total	105 (31.2)	142 (42.1)	90 (26.7)	**337 (100)**		

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** Statistically significant association = p≤ff0.05, χ2- Chi square test. f- fishers- exact test*