



Association between osteoarthritis of knee joint with gender, diabetes and work related diseases in middle aged and old aged population - A survey

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ABSTRACT

Osteoarthritis is a common musculoskeletal disorder where thinning of cartilage fibers occurs in the joints which causes stiffness, pain, and impairment. Diabetes is a metabolic disorder where the blood sugar level is not maintained properly at normal range. Knee joint osteoarthritis is one of the commonest arthritis. Age is said to be an essential risk factor for diabetes and arthritis. A well-structured set of self-evaluable questionnaires were circulated among the south Indian population. The data was collected by the survey planet link, the questions were verified by the institutional review board and the data was collected and analyzed. The variables were randomized to reduce bias. The data collected were manipulated and statistically analyzed. The awareness level and the suggestions regarding the relation between age, gender, diabetes, and knee joint arthritis were questioned and the opinions discussed. It was found that about 61.9% of the population suffers from osteoarthritic conditions. 46.4% of the population are sure and 43.3% population somewhat believe that onset of osteoarthritis is due to their diabetic condition. About 25.8% sure and 34% somewhat agree with the other risk factors of osteoarthritis. 43.3% of the population strongly agrees, 23.7% agree that obesity is a risk factor for both diabetes and osteoarthritis. About 47.4% of the populations are sure about the association between osteoarthritis and diabetes. The response shows that there is a relation between osteoarthritis and diabetes. So further studies should be made over the relation between diabetes and knee joint osteoarthritis among the middle and old aged population and the mechanism behind it and spread awareness about the same.

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INTRODUCTION

Osteoarthritis is a common musculoskeletal disorder where thinning of cartilage fibers in the joints happens which causes rubbing of bones which causes stiffness, pain, and impairment. This arthritis is classified into primary and secondary osteoarthritis (Johnson, 2020). Primary is further divided into localized- hand, hip, knee, spine; generalized- small, large joints, mixed, spine, and erosive osteoarthritis. Secondary can be due to congenital and developmental disorders, post-surgery,

endocrine or metabolic disorders like diabetes, Wilson's diseases, etc. rheumatological or neurological condition (Sekar, 2019). There are various etiological factors like sex, obesity, genetics, cigarette smoking, local factors, etc. though there are many etiology known, there are some alterations in genetics, cytokines, mechanical trauma which results in characteristics changes in the articular disc of joints in osteoarthritis pathogenesis. Knee joint osteoarthritis is a large joint primary disorder which is the most common affected one. It often occurs in association with hand osteoarthritis, especially in women.

The principal sites involved are medial tibiofemoral and patellofemoral compartment (Rathi *et al.*, 2014). Diabetes is a metabolic disorder due to hyperglycemic condition or improper secretion of insulin, or both. The chronic hyperglycemia is associated with long term complication affecting eyes, kidneys, nerves (Subashri and Thenmozhi, 2016). As the most prevalent disease in the world, diabetes has been associated with several secondary clinical manifestations and conditions such as osteoarthritis, poor tissue healing process, renal damage, etc.

The diabetic condition is classified into various types like type-1 result of pancreatic beta cell destruction which results in various autoimmune processes where the etiology of the destruction is still unknown, type-2 result of insulin deficiency due to a secretory defect, gestational diabetes-glucose intolerance during pregnancy, others common non-specific types are also present (Thejeswar and Thenmozhi, 2015). Pre-diabetics are the term where the individuals are at high risk of developing diabetes and its complication and guidance prevent the onset of the disorder (Goldenberg and Punthakee, 2013). Osteoarthritis is a major disability seen in elderly population and developing countries. There are various drugs to suppress pain and stiffness, yet knee placement surgeries are known to be much more efficient. Diabetes causes intense thirst, frequent urination, weight gain, fatigue, poor wound healing, numbness.

In analysis of association between knee osteoarthritis and risk factors in Korea, revealed that old age greater or equal to 65 years, female sex, hypertension, less exercise, low educational were the risk factors (Lee, 2019). There are various tests to diagnose diabetes like A1C test, FPG test, OGTT test. There are various complications such as heart problems, mental health, hearing loss, ketoacidosis, neuropathy, PAD, HHNS, stroke, infections, etc., (Lal, 2016). Type-1 diabetes is insulin dependent, occurs commonly in teenage more than old age but not as com-

mon as type 2. Arthritis prevalence rate increases as the age increases which leads to more proneness of occurrence in the middle and old aged population.

Women have high prevalence rate more than men at all ages, they are high rate of disabilities and medical services for women due to their higher prevalence (Verbrugge, 1995). Osteoarthritis is very painful, though there are various treatments to suppress pain but there is no proper medication to halt the progression of disease due to lack of effective biomarkers, diagnostics for OA and no information regarding long term effectiveness of the medications (Wittenauer *et al.*, 2013).

Hyperglycemia is directly linked with osteoarthritis which is seen as a common link in older adults which is caused due to metabolic and physical impairments (Piva, 2015). Osteoarthritis is a multifactorial condition where age is a major risk factor. Age changes increase the susceptibility by creating imbalance between anabolic and catabolic activities (Anderson and Loeser, 2010).

Aging is seen as a major risk factor for osteoarthritis in diabetic conditions but no accurate relations established (Pratha and Thenmozhi, 2016). The relation between gender manifestations and knee osteoarthritis with the radiographic grades is not well known. It is very essential to know the major risk factors of diabetes which is a progressing major problem in India (Menon and Thenmozhi, 2016). The susceptibility of diabetic patients to the onset of osteoarthritis should be studied. The gender and osteoarthritis manifestations and radiographic grades should be found. Still there are many areas in osteoarthritis, which need to be explored in detail for their pathophysiology and other secondary diseases associated with it.

Previously our institution has conducted and published several somatometric studies and anthropometric studies (Nandhini *et al.*, 2018). The current study has sprouted from these areas of research which stimulated to carry out survey studies on common prevalent diseases in the society. The curiosity in doing all these studies lies on the basis that, to add knowledge to the existing literature and data on the disease concerned and also the interest in the society and its well-being. Several research studies related to forensic and medico-legal implications (Samuel and Thenmozhi, 2015) have also been previously taken up by our institution.

Our college has also done pioneering research on various in vivo animal studies (Seppan *et al.*, 2018) and survey based studies. The present study has emerged from these multidisciplinary areas of research, which gave the interest to carry out

research on epidemiological surveys. This study aims to determine the association between gender, diabetes and work related damage with osteoarthritis of knee joints in the old and middle aged male and female population and spread awareness about the same.

MATERIALS AND METHODS

The present study was conducted among middle and old age people of the south Indian population. The research approval was obtained from the institutional review board. This study primarily involves two people comprising the principle investigator and the guide. The present study was a survey, conducted among a sample size of 100 participants selected by simple random sampling method. Measures were taken to minimize the bias by randomization of all variables. The internal validity of the study is the pretested questionnaire whereas the external validity was homogenization and replication of experiments and cross verification with the existing studies.

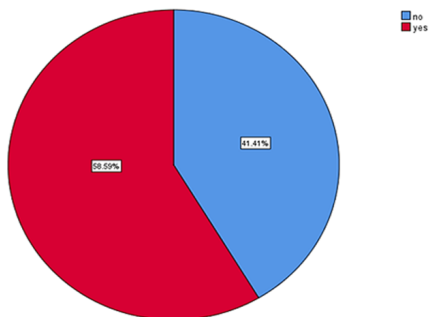


Figure 1: Pie chart representing the maintenance of regular blood sugar level

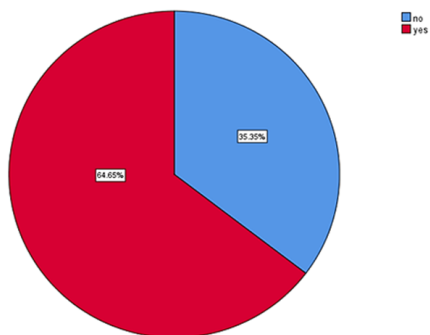


Figure 2: Pie chart representing the awareness over the importance of balanced blood sugar level

A well-structured, self-evaluable questionnaire was created with 17 close ended questions and conducted among 100 participants. The questions were validated by the faculty members of the institution. The questions were uploaded in a survey planet link

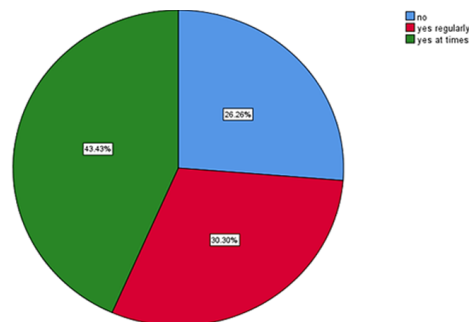


Figure 3: Pie chart representing the dietary plans for diabetes to prevent its occurrence

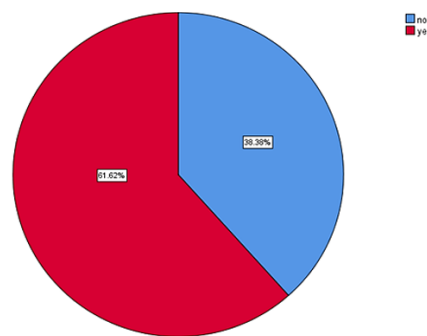


Figure 4: Pie chart representing the awareness over the symptoms of diabetes

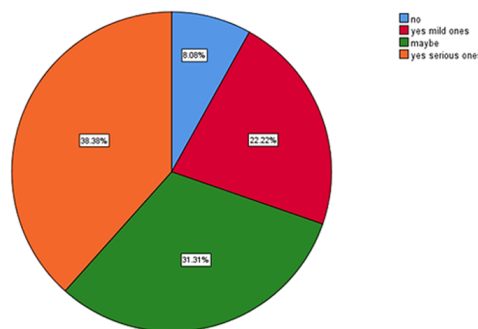


Figure 5: Pie chart representing the awareness of diabetes as a hereditary disease and its precaution

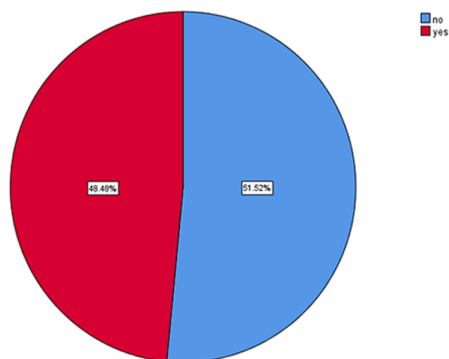


Figure 6: Pie chart representing the diabetic patients of the population

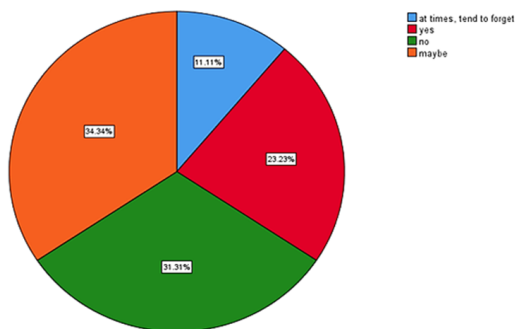


Figure 7: Pie chart representing medications for diabetic patients

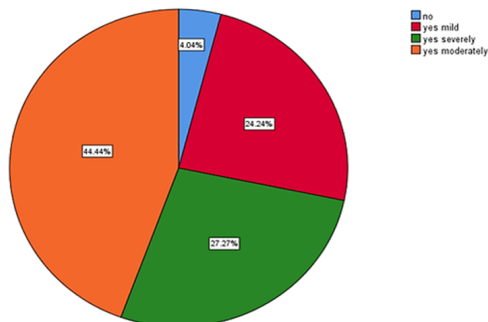


Figure 11: Pie chart representing the awareness over the chronic effects of type-1 diabetes

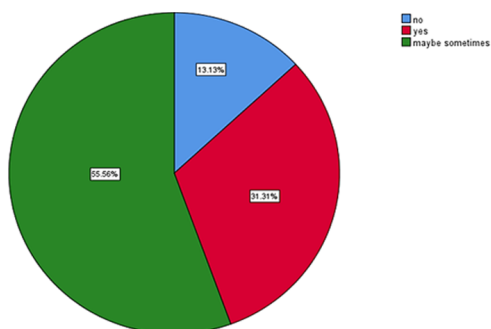


Figure 8: Pie chart representing responses of 'change in dosage of medications on their own'

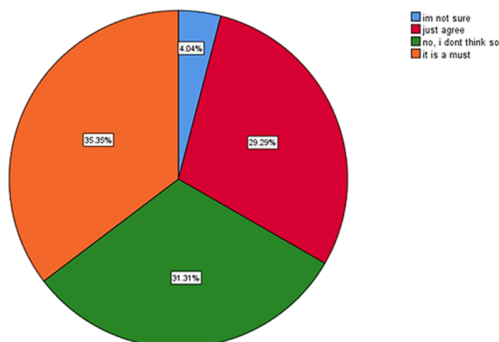


Figure 12: Pie chart representing the importance of doctor's consultations in diabetic conditions

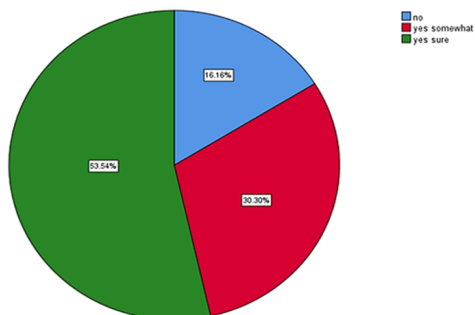


Figure 9: Pie chart representing the awareness over the side effects of anti-diabetic drugs

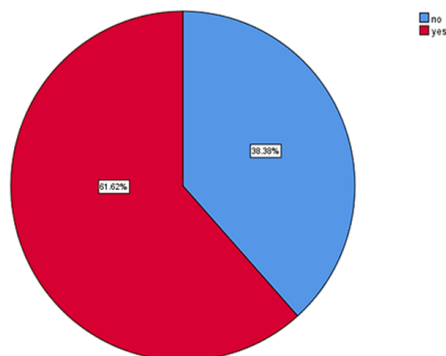


Figure 13: Pie chart representing the osteoarthritic conditions of the population

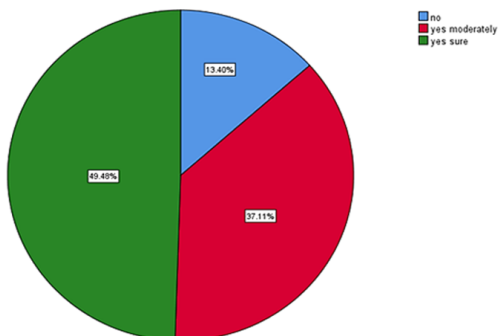


Figure 10: Pie chart representing the agreement to age as a risk factor to diabetes

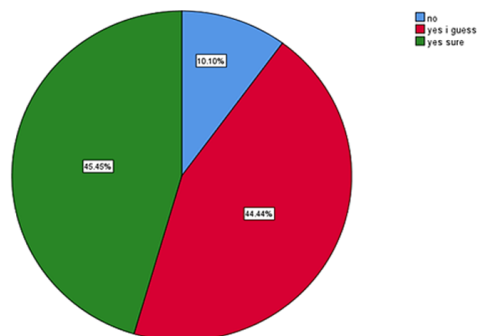


Figure 14: Pie chart representing diabetes as a factor for osteoarthritic condition

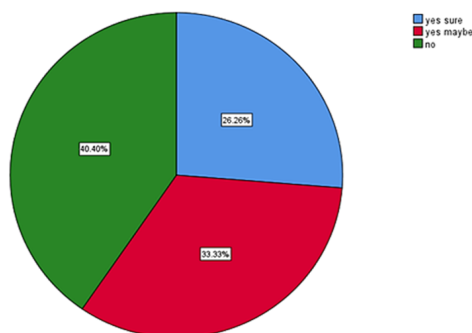


Figure 15: Pie chart representing the awareness over major risk factors for arthritic conditions

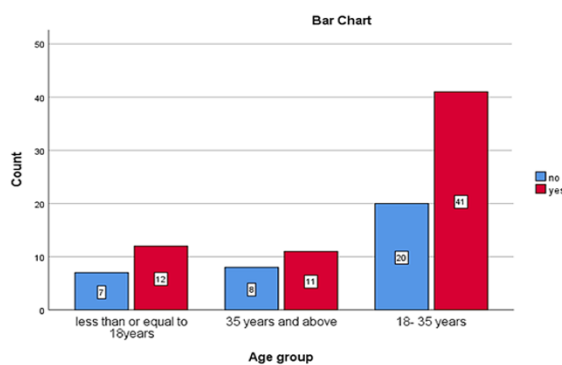


Figure 19: Bar graph representing association between age and awareness over the balance in blood sugar level

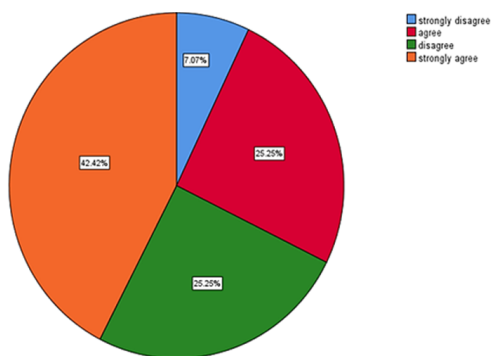


Figure 16: Pie chart representing the agreement to obesity as a factor for both diabetes and arthritic condition

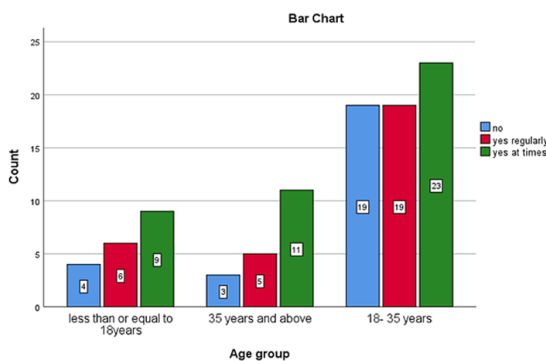


Figure 20: Bar graph representing association between age and importance of dietary plans of diabetic conditions

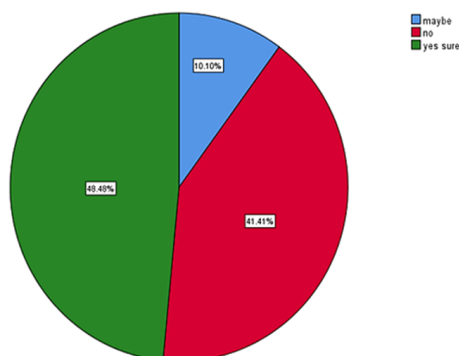


Figure 17: Pie chart representing the association between arthritis and diabetes

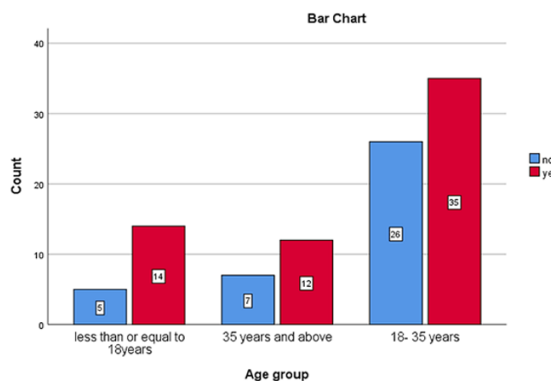


Figure 21: Bar graph representing association between age and awareness over the symptoms of diabetes

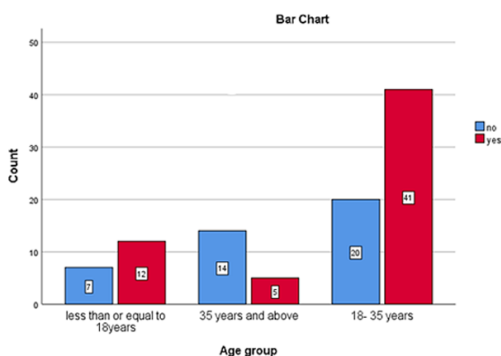


Figure 18: Bar graph representing association between age and maintenance of blood sugar level

and data was collected. The data was incorporated, analyzed and computed up to an excel sheet. The method of representation of the results was by pie charts and bar diagrams. The statistical test used was descriptive statistics with frequency distribution and statistical software used was SPSS. In this present study, the dependent variables comprise of age, obesity, sex whereas the independent variables comprise of educational qualification, occupation.

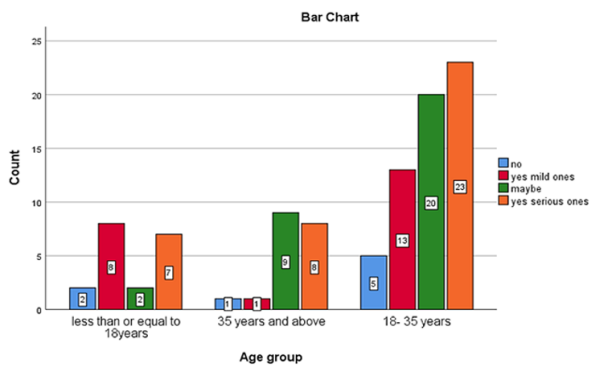


Figure 22: Bar graph representing association between age and diabetes as a hereditary disorder and its precautions

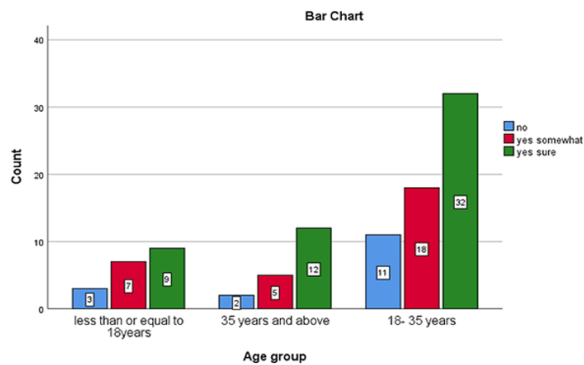


Figure 26: Bar graph representing association between age and awareness over the side effects of anti-diabetic drugs

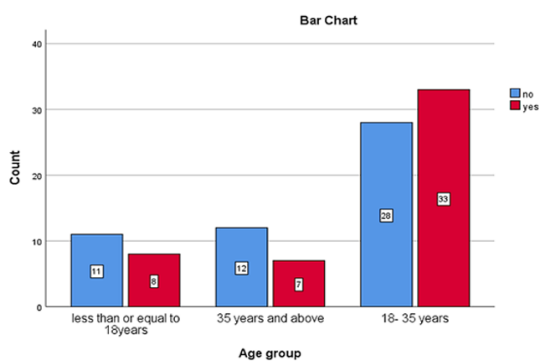


Figure 23: Bar graph representing association between age and diabetic condition

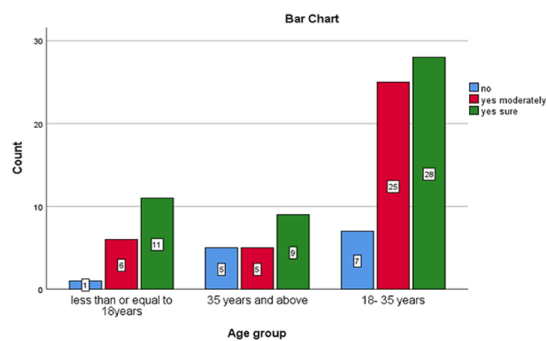


Figure 27: Bar graph representing association between age group and age as a factor for diabetes

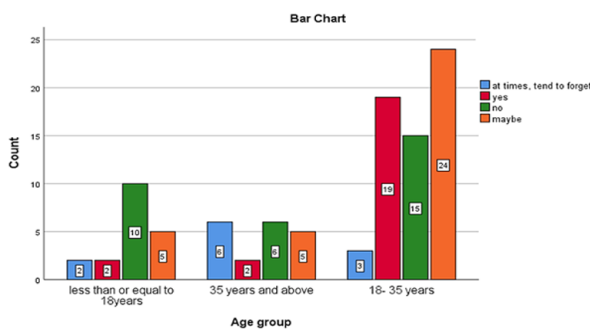


Figure 24: Bar graph representing association between age and diabetic medications

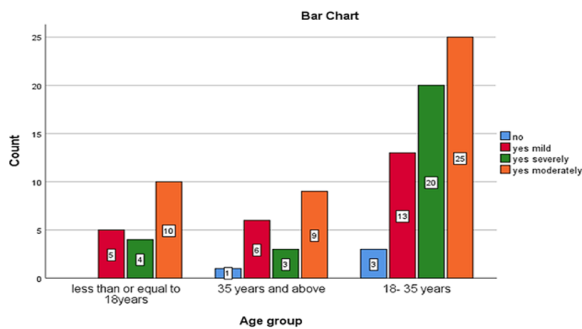


Figure 28: Bar graph representing association between age and chronic effects of diabetes

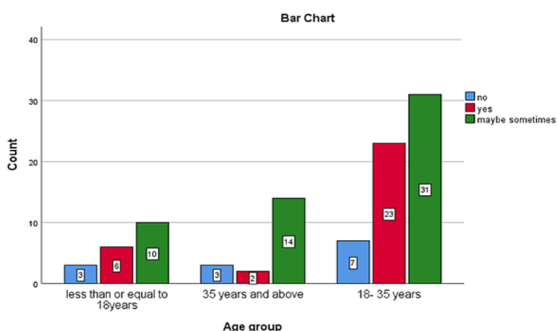


Figure 25: Bar graph representing association between age and change in dosage of anti-diabetic drugs

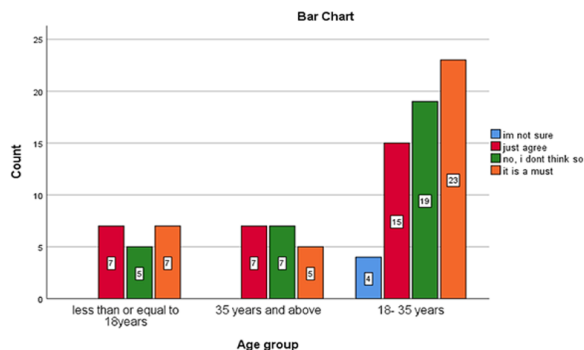


Figure 29: Bar graph representing association between age and importance of doctors' consultation to suppress the diabetic condition

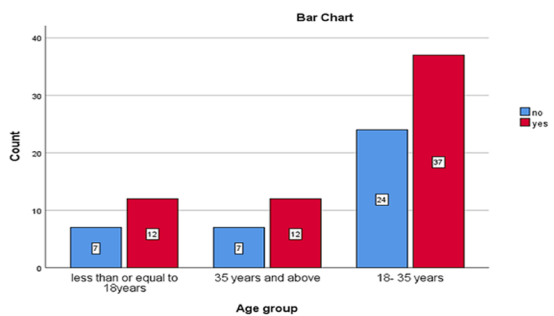


Figure 30: Bar graph representing association between age and osteoarthritis

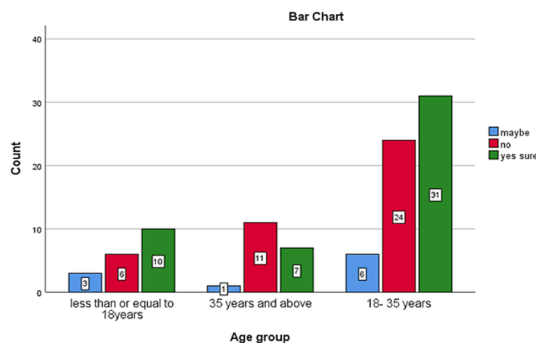


Figure 34: Bar graph representing association between age and association between osteoarthritis, diabetes

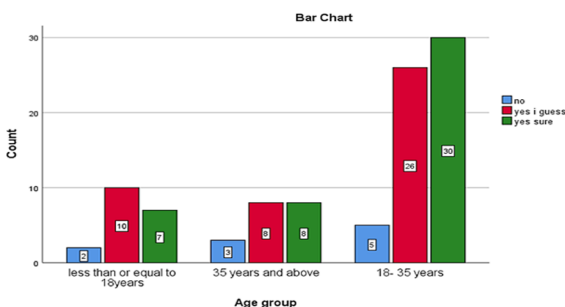


Figure 31: Bar graph representing association between age and diabetes as a factor for osteoarthritis

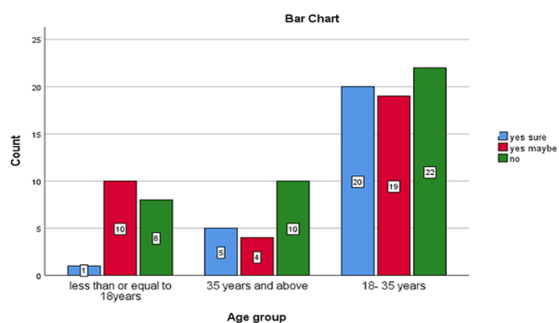


Figure 32: Bar graph representing association between age and risk factors of osteoarthritis

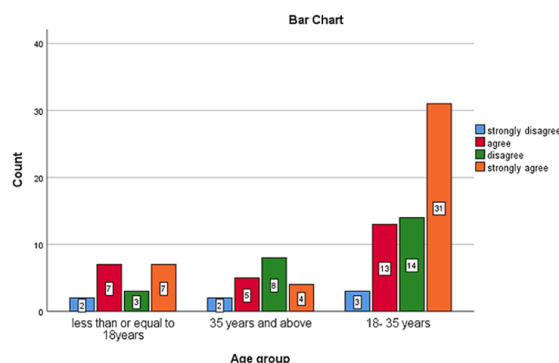


Figure 33: Bar graph representing association between age and obesity as a factor for diabetes and osteoarthritis

The data were statistically analyzed for any association using chi-square test.

RESULTS AND DISCUSSION

In the present study, about 57.7% of the population agrees that they check and maintain their blood sugar regularly. About 41% of the 18-35 years aged population agreed regarding check-up and maintained it Figure 1, where 58.59% (red) agree, whereas 41.41% (blue) don't agree.

Previously, 51% of the population has tested their blood sugar level regularly (David, 2010). About 63.9% of the population was aware of the importance of balance of blood sugar level which may instead cause diabetes Figure 2, where 64.65% (red) are aware and 35.35% (blue) aren't aware.

In a similar study, 80% of the population was aware of the importance (Harris, 2007). The 29.9% population always, 44.3% of the population sometimes took up dietary plans to prevent the onset of diabetes Figure 3, 30.30% (red) take up regularly, 43.43% (green) take up at times, and 26.26% (blue) don't take up.

Similar findings in previous studies were 53.6% population went on counseling sessions regarding diets for diabetes (David, 2010). 75% of the population had knowledge regarding the food choices on diabetic conditions.

61.9% of the population was aware of the symptoms for diabetes Figure 4, 61.62% (red) are aware whereas 38.38% (blue) aren't aware.

Similar findings were 54% of the population was aware of the symptoms. About 39.2% population seriously whereas 22.7% mildly take precautions to prevent onset of diabetes as it is a hereditary disorder Figure 5, Among all, 38.38% (orange) seriously take up precautions was the majority.

Similarly, 63% diabetic, 78% non-diabetic popula-

tions had a family history of diabetes (Konduru *et al.*, 2017).

In the survey study, it was found that about 48.5% of the population was diabetic Figure 6, where 48.48% (red) are diabetic and 51.52% (blue) are not diabetic.

Similarly, in earlier studies 58% population was diabetic. 22.7% of the population always, 11.3% mostly makes efforts to take medication properly Figure 7, 23.23% (red) agree, 34.34% (orange) maybe, 11.11% (blue) at times tend to forget, 31.31% (green) don't take properly.

Previously, 45% of the population took up oral and intravenous medications (Harris, 2007). Only 13.14% of the populations don't change the dosage of their prescribed medications on their own Figure 8, 31.31% (red) agree, 55.56% (green) sometimes, 13.13% (blue) never by themselves.

Similarly, 95% of the population was aware of the dosage but only 45% of the population used medications. About 53.6% sure, 30.9% of the population was somewhat aware of the side effects of anti-diabetic drugs Figure 9, where 53.54% (green) surely, 30.30% (red) somewhat aware, 16.16% (blue) aren't aware.

Similarly, 19.5% complained about side effects of drugs (Chaturvedi, 2018).

From the data it was observed that, 49.5% of the population are sure, 37.1% just agree that age is a major risk factor for diabetes. Previously, the prevalence of diabetes increased as age increased Figure 10, 49.48% (green) responded agree, 37.11% (red) moderately agree and 13.40% (blue) don't agree this.

27.8% severely, 43.3% moderately and 24.7% mildly aware of the future effects of diabetes Figure 11, where 24.24% mildly, 44.44% moderately, 27.27% severely aware whereas 4.04% aren't aware.

In a previous study, 32% was diabetic and 50% was non-diabetic population and they are aware of the complication of diabetes (Konduru *et al.*, 2017). About 34% of the population thinks it's a must, 29.9% of the population just agrees with the importance of doctor consultations Figure 12, 35.35% (orange) think it's a must, 29.29% (red) just agree and 31.31% (green) don't think so.

About 61.9% of the population suffers from osteoarthritic problems Figure 13, where 61.62% (red) are osteoarthritic whereas 38.38% (blue) are not having osteoarthritis.

Similarly, 37.6% of the population has an over-

all prevalence of osteoarthritis (Nieves-Plaza *et al.*, 2013).

About 46.4% of the population agreed, 43.3% population somewhat agree arthritis may be due to their diabetic condition Figure 14, where 44.44% guess, 45.45% sure, 10.10% don't think diabetes as a factor for the onset of osteoarthritis.

Similarly, 49% of the diabetic population has prevalence to OA. About 25.8% populations sure, 34% somewhat aware of the other risk factors of OA Figure 15, where 26.26% (blue) sure, 33.33% (red) somewhat aware and 40.40% (green) aren't aware.

Similarly, 26.5% population supports these findings in an earlier study (Kannan and Thenmozhi, 2016). 43.3% of the population strongly agrees, 23.7% of the population just agree that obesity is a factor for osteoarthritis and diabetes Figure 16, Among all, 42.42% (orange) strongly agree was the majority of responses.

Similarly, 33% population supports this finding. 45% of the population supported these findings. About 47.4% of the population is sure about the association between osteoarthritis and diabetes Figure 17, 48.48% (green) surely, 10.10% somewhat (blue), 41.41% don't believe (red).

Similarly, 49% of the population supports the findings (Choudhari and Thenmozhi, 2016).

41% of the participants of the 18-35 years aged population maintained constant blood sugar level and the chi-square analysis between age and maintenance of blood sugar was statistically significant, $p=0.007$, $p<0.05$ Figure 18, Chi-square test showing $p=0.007$ ($p<0.05$) indicating statistically significant.

(Keerthana and Thenmozhi, 2016). 41% of the participants belonging 18-35 years of age were aware of the balance in blood sugar level and the chi square analysis between age and awareness over the balance of blood sugar level is statistically not significant, $p=0.751$, $p>0.05$ Figure 19, Chi-square test, $p=0.751$ ($p>0.05$) indicating statistically not significant.

19% of the participants of 18-35 years of age group had reported that they regularly follow their dietary plans. Chi-square analysis between age and importance of dietary plans was statistically not significant, $p=0.539$, $p>0.05$ Figure 20, Chi-square test, $p=0.539$ ($p>0.05$) indicating statistically not significant.

35% of the participants of the age group 18-35 years, were aware of the symptoms of diabetes, chi square analysis between age and awareness of the symptoms of diabetes was statistically not significant, $p=0.438$, $p>0.05$ Figure 21, Chi-square test,

$p=0.438$ ($p>0.05$) indicating statistically not significant.

(Hafeez and Thenmozhi, 2016). 23% of participants of age group 18-35 years had reported to take serious precautions against diabetes as a hereditary disorder. Chi-square analysis between age and precautions against diabetes as hereditary disorder was statistically not significant, $p=0.105$, $p>0.05$ Figure 22, Chi-square test, $p=0.105$ ($p>0.05$) indicating statistically not significant.

33% of the participants belonging to the age group 18-35 years suffered from diabetes, chi square analysis between age and presence of diabetes was statistically significant, $p=0.04$, $p<0.05$ Figure 23, Chi-square test, $p=0.04$ ($p<0.05$) indicating statistically significant.

19% of the participants belonging to the age group 18-35 years tend to take their medications regularly. Chi-square analysis between age and regular intake of diabetic medication is statistically significant, $p=0.005$, $p>0.05$ Figure 24, Chi-square test, $p=0.005$ ($p<0.05$) indicating statistically significant.

(Krishna and Babu, 2016). 7% of the participants of age group 18-35 years have reported that they never change their dosage of medications on their own. Chi-square analysis between age and change of dosage in diabetic medication was statistically not significant, $p=0.272$, $p>0.05$ Figure 25, Chi-square test, $p=0.272$ ($p>0.05$) indicating statistically not significant.

32% of the participants of 18-35 years of age group were aware of the side effects of anti-diabetic drugs, chi square analysis between age and awareness over side effects of anti-diabetic drugs was statistically not significant, $p=0.850$, $p>0.05$ Figure 26.

28% of the participants of the age group 18-35 years agreed that age is a risk factor for onset of diabetes. Chi-square analysis between age and age as a risk factor for diabetes was statistically not significant, $p=0.294$, $p>0.05$ Figure 27.

20% of the participants of the age group 18-35 years were completely aware of the chronic effects of diabetes, chi square analysis between age and awareness over the chronic effects of diabetes were statistically not significant, $p=0.679$, $p>0.05$ Figure 28, (Sriram et al., 2015).

23% of the participants of the 18-35 years of age group agreed that a doctor's consultation is essential to suppress diabetes. Chi-square analysis between age and importance of doctor consultation to suppress diabetic condition was statistically not significant, $p=0.599$, $p>0.05$ Figure 29.

37% of the participants of the age group 18-35 years suffer from the osteoarthritic condition, chi square analysis between age and osteoarthritis was statistically not significant, $p=0.969$, $p>0.05$ Figure 30.

30% of the participants of age group 18-35 years agreed that diabetes is a factor for onset of osteoarthritis, chi square analysis between age and diabetes as a factor for osteoarthritis was statistically not significant, $p=0.785$, $p>0.05$ Figure 31.

20% of the participants of age group 18-35 years were aware of the risk factors of osteoarthritis, chi square analysis between age and awareness over risk factors of osteoarthritis was statistically not significant, $p=0.083$, $p>0.05$ Figure 32.

31% of the participants of age group 18-35 years strongly agreed that obesity is a risk factor for both diabetes and osteoarthritis, chi square analysis between age and obesity as a risk factor was statistically not significant, $p=0.199$, $p>0.05$ Figure 33.

31% of the participants of age group 18-35 years agreed that there was an association between osteoarthritis and diabetes, chi square analysis between age and association of osteoarthritis and diabetes was statistically not significant, $p=0.482$, $p>0.05$ Figure 34.

Thus this study proves as evidence and adds consensus to the association between gender, age, diabetes and knee joint osteoarthritis which can be studied for further studies. The study has some limitations such as, the small sample size, homogenous population restricted to specific geographic location, focuses more on the level of awareness than the clinical evidence.

CONCLUSION

Osteoarthritis is one of the commonest forms of arthritis which has an association with diabetes which is one of the growing problems in India. Awareness should be spread about the need of proper lifestyle adjustments to reduce complications and occurrence of disorders in the future. The importance of regular health checkups, proper diagnosis and lifestyle adjustments for diabetes should be focused and awareness regarding risk factors and complications of osteoarthritis and its prevalence rate should be spread to diabetic and non-diabetic populations as well for all age groups.

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Conflict of interest

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