An Investigation into Foot Health Status in Diabetes Mellitus Patients

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Abstract

Introduction: Diabetic foot is one of the most severe complications of diabetes mellitus. Next to this the symptoms severity appear with foot complication. The foot complication further may cause amputation and hospitalization at a greater rate. Foot complication become a big hazard on public health due to its bad impact on the patients and their families. Thus, foot pain overall gives a negative impact on quality of life. For this reason, foot status must be checked periodically. The foot health related quality of life impairment is mostly seen in patients having foot pain. The foot health status questionnaire is an instrument which has a high validity and reliability about foot health
AIM: The aim is to investigate the foot health status in patients with diabetes mellitus.
Material and Method: 51 subjects (30 male and 21 female) aged between 45- 70 years were included in this study each participant was assessed if they satisfy the inclusion criteria or not. And the participant was asked to fill the scale depending on the foot pain intensity. Also, the pain intensity is marked on the NPRS scale.
Result: There are lower values of each domain in females as compared to males except for social capacity and statically no significant difference was seen in general health. Also, it was seen that there were lower values of domain seen in participant diagnosed for more than 10 years. The p value for age recorded was 0.178 while that for years of diagnosis was 0.034 and for gender was 0.377.
Conclusion: Our study concluded that the foot health is very important and it should be checked periodically and especially in females those who are diagnosed with diabetes for 10 years This study findings showed that all the domains of the foot were having lower values in females than males in the general population having type 2 diabetes. Also, it was concluded that females are having more prevalence in foot pain than males. But there was no significant difference found in the general foot domain which was equal in both the groups.

1. Introduction

The foot pain in normal population can become a prime cause of disability when it is seen along with co-morbidities. Foot pain and its effect on disability is very high among older adults[1]. Foot pain causes change in the biomechanical function of the foot thus leading to dysfunction in ambulation [2]. From previous studies foot pain has been shown to have a great impact in locomotory disabilities [1]. In general population, the prevalence of foot pain ranges between 61.3%-79% [3]. People think that foot pain will not cure and it is a consequence of age[2]. In older people, the prevalence of foot pain in women is more than men[4]. A negative impact of foot pain is usually seen on quality of life[5]. Foot pain is usually seen as an unpleasent sensory and emotional incidence and there is an increased risk of fall in older people due to foot pain[6]. The most common site of disabling foot pain is seen in midfoot arch (25.6%), 1st metatarsal head (20.2%), great toe (15.9%),heel pain (15.5 %)[7]. The most complex musculoskeletal system in the body is the FOOT [8]. The foot plays an important weight bearing activities. The foot helps in shock absorption adapts itself on uneven surfaces helps in locomotion [2].
Foot pain is classified into physiological foot pain – which is caused as an acute response of injury. Pathological foot pain – which is caused due to any underlying pathology. Further this pathological foot pain is divided into Neuropathic pain – is the pain that is caused due to affection to the peripheral or

central nervous system. Inflammatory pain – usually the 5 cardinal signs of inflammation are seen this causing activation of nociceptors leading to pain. Chronic foot pain- it is the pain that is seen for more than 3 months is categorized under chronic pain. The foot pain aetiology is due to either short duration low high magnitude 2 long duration low magnitude stress or due to repetitive moderate magnitude[7].
There is association of disabling foot pain with arthritis, diabetes and stroke [7]. Diabetic patients have foot pain very often and this pain is mostly neglected by the patients further leading complications of diabetic foot[9]. Other problems related to foot pain are decrease ability to perform activities of daily living increase falls problems in gait and balance [3].
The foot pain usually increases with increasing age and female gender. Type 2 diabetes mellitus is more commonly seen in India with the more prevalence in women and is linked with family history , age, obesity and lack of exercises [11]There are several complications associated with damage to the eyes, kidneys, nerves, heart, and blood vessels. Also it have a relation between micro and macroangiopathic involvement which further causes complications related to stroke, retinopathy, neuropathy, and plantar fasciitis and foot pain[11]
A group of metabolic disorder with the symptom of hyperglycaemia is diabetes mellitus [11.] The pathophysiology behind type 2 diabetes starts with insulin resistance which causes hyperinsulinemia. There is a compensated insulin resistance that causes β cells failure which is boosted by the genetical factor and various acquired condition gives rise to increased hepatic glucose output and induce type 2 diabetes mellitus[12].
Furthermore, diabetic foot is one of the most severe complications of diabetes mellitus. Next to this the symptoms severity appear with foot complication. The foot complication further may cause amputation and hospitalization at a greater rate [13]. Further there are degenerative changes that occur in the foot as age advances. This creates foot positions like hammer toe or clawing of toes whereby limits the joint mobility and furthermore induces increase in the planter pressure which land up into pain. Muscle atrophy causes change in gait biomechanics resulting in alteration in planter pressure leading to further pain in foot [14]long with the internal problems the external factors also causes foot pain due to inappropriate footwear[7].
In addition to this, foot complication become a big hazard on public health due to its bad impact on the patients and their families[11].Thus, foot pain overall gives a negative impact on quality of life. For this reason, foot status must be checked periodically especially in diabetes mellitus population because of serious foot complication. 24% people above the age of 45 years have foot pain that increases with age.(3)
The foot health related quality of life impairment is mostly seen in patients having foot pain [(15)]. The pain is measured using the numerical pain rating scale which has high validity and reliability. This scale is very easy to administer and understand. and this scale has a total of 11 points. the ICC value is 0.95. 0 indicates no pain at all and 10 indicates maximum pain.[17]
The foot health status questionnaire is an instrument which has a high validity and reliability about foot health.[18] The coefficient reliability value ICC = 0.74-0.92. It was firstly used only in assessing post operative foot health status but now it has been validated in different foot conditions. This questionnaire is very easy to administer and complete, and it has high validity in measuring foot status and also it is used in diabetic population as an outcome measure. This is a trusty questionnaire[17]. It comprises 3 sections. Assessing the foot health, foot pain, footwear, general foot health.

1. Methodology

The present was conducted at MGM Hospital, Aurangabad, following an observational study design. A convenient sampling technique was employed to recruit participants. The sample size was calculated using the formula: n=([Z1])2×{P(1−P)}/d2n = ([Z_{1}])^2 \times \{P(1-P)\} / d^2n=([Z1])2×{P(1−P)}/d2, where the assumed population proportion (P) was 0.12, the confidence level was set at 95% (Z = 1.96), and the absolute precision (d) was 0.09, resulting in a minimum required sample size of 51 participants. The materials used for the study included a consent form, a Foot Health Status Questionnaire, the Numerical Pain Rating Scale (NPRS), and a data collection sheet. Participants were included in the study based on the following criteria: individuals diagnosed with type 2 diabetes mellitus for 8–10 years, experiencing foot pain, aged between 45 and 70 years, willing to participate, and who provided informed consent.
Exclusion criteria comprised individuals unwilling to participate, those who had undergone any lower limb surgery, individuals with a history of lower limb fractures, those on psychotropic or chemotropic medications, and patients with other conditions affecting balance and gait, such as Parkinson's disease.

Procedure –
Institutional Ethics Committee (IEC) and informed consent from the participants, the patients were screened in accordance with predetermined inclusion and exclusion criteria. The sociodemographic information of study-eligible participants' such as age, gender, occupation, and education was gathered. 51 participants were included in the study. The location and character of the pain in the foot were recorded, including specific diagnoses like midfoot pain, forefoot pain, heel pain, plantar fasciitis, and formation of bone spurs. Intensity of pain was measured by administering outcome measure on Numerical Pain Rating Scale (NPRS). The scale was described to all the participants, and a score of 0 to 10 was used, with 0 referring to no pain and 10 referring to the worst conceivable pain. Secondly, the participants were requested to fill out the Foot Health Status Questionnaire (FHSQ), a validated measure of foot health. FHSQ is made up of 13 items categorized into four distinct domains and yields a comprehensive overall assessment of the outcomes of foot-related health.[19]

2. Results

A total of 51 participants were included in the study, of which 30 were male and 21 were female. The Body Mass Index (BMI) and years since diagnosis were recorded for all participants. Statistical analysis was conducted using IBM SPSS Statistics version 25.0. The Shapiro-Wilk test was applied to assess the normality of the data distribution for all continuous variables. Based on the Shapiro-Wilk test, most of the variables showed p-values less than 0.05, indicating that the data for these variables were not normally distributed. This suggests the need for non-parametric statistical tests for further analysis in subsequent phases of the study.
The analysis revealed that variables such as age, BMI, years since diagnosis, CAT scores, NPRS, foot pain, foot function, foot health, shoe wear, physical activity, social capacity, and vigor were statistically significant ($p < 0.05$) in terms of distribution. The findings highlight the importance of accounting for these variables in physiotherapy evaluation and intervention planning. The use of IBM SPSS and the Shapiro-Wilk test provides robust insight into the nature of the data, guiding appropriate statistical modeling in future analyses.

Table1: shows normative data Normality test using Shapiro-Wilk

Variable	z-value	p-value
AGE	0.943	0.017
BMI	0.551	0.001
YEARS DIAGNOSIS	0.853	0.001
CAT	0.595	0.001
NPRS	0.837	0.001
FOOT PAIN	0.910	0.001
FOOT FUNCTION	0.910	0.001
FOOT HEALTH	0.910	0.001
SHOE WEAR	0.910	0.001
PHYSICAL ACTIVITY	0.461	0.001
SOCIAL CAPACITY	0.509	0.001
VIGOR	0.774	0.001

TOTAL	0.950	0.033

3. Discussion

The study was conducted to evaluate the foot health status in patients with diabetes mellitus. This was done by using the foot health status questionnaire. As foot problems are frequently observed in general especially in the rural population the objective of the study aims at evaluating the foot health in rural population of Marathwada region using FSHQ. This study showed that the prevalence of foot health affection is more in females than male and those who are diagnosed for 10 years and all the domains like the foot health, foot function, shoe wear, physical activity are all affected in females in the people of Aurangabad district. This study showed that females are affected for every domain of foot health and it must be taken into consideration and proper curative and preventive measures should be undertaken for the same especially during the initial days of diagnosis.

It is used to assess the effects of footwear and orthotic interventions, and foot health in the community, as well as in various podiatric clinical populations. Foot health is a very important aspect of patient having diabetes as there is the high prevalence of growth of foot ulcer and amputation [4]. Thus this is also concluded from the study that foot health should be periodically checked and especially in those who are diagnosed with diabetes for at least 10 years.as wound healing is delayed in diabetes patients there is a high risk of patients getting ulcers and or gangrene. Thus, periodical check-up and proper care and various measures should be taken. And the scale used in this study is one of this basic assessment tool for the above-mentioned objective. Thus, a co-relation is found between foot problems and this scale by this study.

Diabetic foot problems are considered as a major public health problem as stated by al Rubean et al. which showed that 62.68% patients with diabetic foot and the risk factor of reporting 1285 patients which increases with age, duration of diabetes and male gender [6]. According to our study, the prevalence of foot pain is more in females than in males

According to the study done by Palomo-López et al shows lower scores while assessing quality of life related to foot health. A study done by Patricia palomo et al showed that there was a specific foot impact on quality-of-life dimension when compared with people having type 1 and type 2 diabetes. Thus more focus was showed on diabetic foot and podiatric care so as to reduce foot problems and amputation[6].Thus our study makes this questionnaire as a measuring and prognostic tool to assess the foot health to reduce the worsening of the foot.

A study done by Daniel lopez et al. showed that the prevalence in foot pain is higher in females than in males. Also, this study proved that have a negative impact on quality of life related to foot health. Also no significant change was observed in general health.A similar result was found in our study where the general health had no significant change in both gender[3]. Gender differences were seen in previous studies which assessed FHSQ scores in patients with foot problems. Women find it difficult to maintain the glycemic and lipid control due to their lifestyle thus becoming more susceptible to worsening the foot health and ultimately the quality of life. Thus, more affection is seen in females than males

A study done by Martin J.Thomas et al. showed minimal gender differences but there was association with high BMI, impaired physical and mental health. According to our study there was significant change seen in females then males when taking BMI into consideration. There are also differences within the conditions “Diabetes Control” and “Overweight according to BMI” [3]. As the age of diagnosis of diabetes and the average age of menopause in women coincide, this causing a major affection of foot health in women’s than males. As there is reduction in the calcium level of the bones and many physiological changes in the body and also diabetes makes them prone for affection of foot
health. Also, there are many hormonal imbalances taking place in women after menopause contributing in a gender difference in the foot health. There is reduction in estragon level causing planter fasciitis, reduction in estragon affects collagen production. Also, other effects like increase in weight, improper posture causes changes in weight distribution leading to further foot problems.

Foot problems impair the QoL related to foot and general health—and specifically, women with foot problems present a negative QoL impact related to foot and general health with respect to men, except in the overall health and social capacity domains, which appear to be linked to the presence of foot conditions and the aging process. According to recent study specific foot problems, such as hallux valgus, calcaneal apophysitis, foot arch height, heel pain, or onychomycosis have been shown to reduce the QoL related to foot health [4].

The results of the present study confirm that women present lower scores in those domains related to foot pain, foot function, shoewear, social function, and vigour. Women experience greater challenges than men in activities of daily living and in the work environment due to foot problems, which makes

walking difficult and impacts on their health in general. Women with FP showed significantly lower scores in the domains of foot pain, foot function, footwear, general foot health, physical activity and vigour [3]. As the occurrence of diabetes and menopause is usually during the similar age and thus women being on a higher radar of getting affected than male. Also, it is seen that more affection is seen in women's who are diagnosed for 10 years than those who are diagnosed for more than 10 years. Thus the study states that more care should be taken during the initial stage of diagnosis of diabetes.

According to the present study the NPRS score ranges between 4 and 5 on the scale. Thus the study suggests that though the foot function, foot health, etc domain are affected and show very low foot health but the pain intensity ranges between mild to moderate. And the frequency of having foot pain in the FSHQ scale domain wise showed the value 12. Lower values were seen in women in every domain except for social capacity which was higher when compared with male population. When all the domains were compared on the basis of years of diagnosis higher values were seen in participants who were diagnosed with diabetes for more than 10 years, except the general health domain which was equal in both the groups. Also, the sociodemographic data like age, gender and years of diagnosis also showed higher values whose years of diagnosis are more than 10 years which is statistically significant. Also, this is useful in creating awareness scale as this is easily administered and easy to understand.

The present research has a series of limitations. One of them is the number of the total sample since it was determined through convenience sampling, which is not representative of the population. On the other hand, the sample focused on residents and did not take into account the possible influence generated by cultural differences of foreign participant subjects. Lastly, the sample has been divided according to different criteria (age, sex, BMI, and years of diagnosis), the number of participants is reduced. This leads to a reduction in statistical power

Another limitation of the present study is that the sample size was very small so the affected domains cannot be assessed effectively. Also, the distribution by gender was not equal. So, the sociodemographic data should be precisely and accurately distributed.

4. Conclusion

Our study concluded that the foot health is very important and it should be checked periodically and especially in females those who are diagnosed with diabetes for 10 years. This study findings showed that all the domains of the foot were having lower values in females than males in the general population having type 2 diabetes. Also, it was concluded that females are having more prevalence in foot pain than males. But there was no significant difference found in the general foot domain which was equal in both the groups.

Limitaions

1. Sample size was too small to conclude the result effectively 2. The sample was collected in only a small region. Various other regions having cultural, atmospheric changes should also be considered to get a more précised result.
3. It should be corelated with the use of foot scan as it is a self-administered scale which becomes the prime and major limitation of the study.

Future Scope

Foot scan and the corelation of this scale can become of paramount importance for the podiatrist as well the patient in improving their foot health and prevent the foot from deformities, ulcers and ultimately amputation.

5. References

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