Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/20203
DOI URL: http://dx.doi.org/10.21474/IJAR01/20203

RESEARCH ARTICLE

STUDY OF FACTORS AFFECTING SARCOPENIA IN TYPE 2 DIABETES MELLITUS

Ravi K.[1], Sidharth Raghu[2] and Naval Kishor[3]

1. Professor, Department of General Medicine, Bangalore Medical College and Research Institute.
2. Post Graduate, Department of General Medicine, Bangalore Medical College and Research Institute.
3. Post Graduate, Department of General Medicine, Bangalore Medical College and Research Institute.

Manuscript Info

Manuscript History
Received: 08 November 2024
Final Accepted: 14 December 2024
Published: January 2025

Key words:-
Sarcopenia, Type 2 Diabetes Mellitus, Risk Factors

Abstract

Patients with type 2 diabetesmellitus frequently developed sarcopenia, a chronic complication, and prior research produced conflicting findings regarding the incidence and risk factors of sarcopenia in T2DM.

Objectives: Thisstudy aims to determine frequency of sarcopenia in patients with Type 2 Diabetes Mellitus and to determine factors affecting sarcopenia in patients with Type 2 Diabetes Mellitus

Methods: After applying the inclusion and exclusion criteria, 151 T2DM patients were included in the cross sectional study that was carried out in hospitals attached to Bangalore Medical College and Research Institute. The patient's baseline information was documented in a predefined format and patients were screened for presence of sarcopeniausing SARC-F (sluggishness, assistance in walking, rising from a chair, climb stairs, falls) score. Different groups were compared using chi square/ ANOVA /t-test according to the type of data. All the parameters were compared between patients with and without sarcopenia. P value < 0.05 was considered statistically significant. R version 4.1.2 statistical software was used for the statistical analyses.

Results: The study included 151 T2DM patients in total. Sarcopenia was common among T2DM patients, with 38% prevalence. Elderly age, female gender, chronic hyperglycemia (higher HbA1c), and hypertension were all significant risk factors for sarcopenia.

Conclusion: Patients with T2DM often experienced sarcopenia. Significant risk factors for Sarcopenia included advanced age, female gender, hypertension, chronic hyperglycemia, and a diet low in nutrients.

Introduction:-

Type 2 diabetes mellitus (T2DM) is one of the most widespread metabolic diseases. Due to T2DM's rising prevalence globally, which is exploding in low-income countries and having a significant negative impact on quality of life and longevity, the diagnosis, prevention, and treatment of the condition face significant challenges[1]. The number of elderly people with T2DM has dramatically increased in recent years [2,3] as ageing is a risk factor for the disease and better healthcare has helped to reduce mortality across the diabetic population as well. Sarcopenia, a

Corresponding Author:- Naval Kishor
Address:- Post Graduate, Department of General Medicine, Bangalore Medical College and Research Institute.

degenerative skeletal muscle disorder associated with ageing, has been listed as one of these complications that has recently been seen in the elderly population with T2DM[4]. .

Although sarcopenia is well understood, its current status in clinical practice is still not clear. This discrepancy is solely attributable to the fact that the definition of sarcopenia requires a thorough evaluation of muscle strength, mass, quality, and performance[5].

There is growing interest about sarcopenia being a chronic complication of type 2 DM, and if studied it can highlight the importance of screening starting from middle age. Restoring physical capacity through musculoskeletal rehabilitation makes sarcopenia eminently reversible, and hence an early diagnosis can result in interventions that allow better quality of life. Against this background, the current study is being conducted to evaluate the prevalence of sarcopenia and determine factors affecting sarcopenia in patients with Type 2 Diabetes Mellitus

Methodology:-

Materials and Methods:-

Study design:

Cross sectional study of 150 patients admitted in department of general medicine, Bangalore medical college and research institute

Inclusion criteria:

1. Patients willing to give valid written informed consent
2. Aged 18 years and above
3. Patients with Type 2 DM diagnosed as per ADA Guidelines 2019 for minimum 5 years duration.

Exclusion criteria:

1. Patients not willing to give consent.
2. Patients below 18 years of age
3. Patients with co morbidities known to affect muscle mass and strength
4. Professional athletes
5. Medications – hormonal or nutritional supplements
6. Immobilized or disabled

Methodology:-

After obtaining approval and clearance from the institutional ethics committee patients fulfilling inclusion criteria were screened for sarcopenia by SARC-F questionnaire and hand-grip strength. Patients with a low SARC-F score (<4) or reduced hand grip strength were suspected to have sarcopenia. The diagnosis was confirmed by reduced SMI.

The hand grip strength was measured in kilogram (kg) using the hand grip dynamometer.. Total Body Skeletal Muscle Mass in kg was estimated by Bioelectrical Impedance Analysis (BIA) Equipment.

Skeletal Muscle Mass Index (SMI) in kg/m^2 was calculated by dividing skeletal muscle mass in kg by square of height (in metre). Sarcopenia was diagnosed based on the guidelines of European Working Group on Sarcopenia in Older People 2 (EWGSOP2)

The correlation between grip strength and SMI with duration of Type 2 DM was studied and possible factors affecting sarcopenia was determined

Results:-

151 patients with Type 2 Diabetes Mellitus who matched the inclusion and exclusion criteria were included in the study.

Among 151 patients included in our study, gender distribution was as follows –
54.30% (n=82) patients were males and 45.70% (n=69) patients were females

Table 1:- Gender distribution.

Gender	Number of patients	Percentage of patients
Male	82	54.30
Female	69	45.70

The mean age with standard deviation of total 151 patients was calculated to be 61.49±7.27 years with minimum age of 48 years and maximum age of 74 years. Mean (along with SD) age of male and female population was found to be 62.32±6.81 and 60.51±7.75 years respectively

Table 2:- Age wise distribution of patients.

Parameter	Total (n=151)	Male(n=82)	Female(n=69)	P- value
Age (years), Mean ± SD	61.49±7.27	62.32±6.81	60.51±7.75	1.288
≤ 50years	12(7.95%)	5(6.1%)	7(10.14%)	0.5762
50-55 years	24(15.89%)	10(12.2%)	14(20.29%)	
56-60 years	32(21.19%)	17(20.73%)	15(21.74%)	
61-65 years	36(23.84%)	22(26.83%)	14(20.29%)	
65-70 years	30(19.87%)	17(20.73%)	13(18.84%)	
≥70 years	17(11.26%)	11(13.41%)	6(8.7%)	

Efficacy outcomes of patients were evaluated in terms of Hand grip strength in kilogram (kg) and Skeletal muscle mass index (SMI) in kg/m^2 (Table 3). The mean hand grip strength and SMI of study population was calculated to be 22.49±7.15 kg and 6.12±1.02 kg/m^2 respectively (Table 3). The mean value of hand grip for male and female patients was respectively 28.55±3.82 kg and 15.29±3.16kg. The mean value of SMI for male and female patients was 6.84±0.65 kg/m^2 and 5.25±0.66 kg/m^2 respectively. The comparison between male and female patients had shown significant difference (p value <0.0001)

Table 3:- Distribution of hand grip and SMI.

Parameter	Total (n=151)	Male(n=82)	Female(n=69)	P- value*
Hand grip, Mean ± SD	22.49±7.15	28.55±3.82	15.29±3.16	**<0.0001**
SMI, Mean ± SD	6.12±1.02	6.84±0.65	5.25±0.66	**<0.0001**

*statistically significant if p value < 0.05 for t-test

It was found that overall 58(38.41%) with T2DM had sarcopenia (Table 4). There was significantly higher prevalence (35(50.72%)) of sarcopenia observed in female patients (p value =0.0043).

Table 4:- Frequency of sarcopenia based on gender.

Outcome	Total	Male	Female	P value*
Sarcopenia	58(38.41%)	23(28.05%)	35(50.72%)	**0.0043**
Non- sarcopenia	93(61.59%)	59(71.95%)	34(49.28%)	

The mean age of patients with sarcopenia (64.84±6.86 years) was significantly higher than patients without sarcopenia (59.40±6.77 years) (p value <0.0001) which is clear in Figure 16. Prevalence of sarcopenia based on age group is showcased in Table 5. 2(3.45%), 7(12.07%), 8(13.79%), 9(15.52%), 19(32.76%) and 13(22.41%) patients with sarcopenia were belonged to the age groups of ≤ 50, 50-55, 56-60, 61-65 , and 65-70 and ≥70 years

Table 5:- Frequency of sarcopenia based on age group.

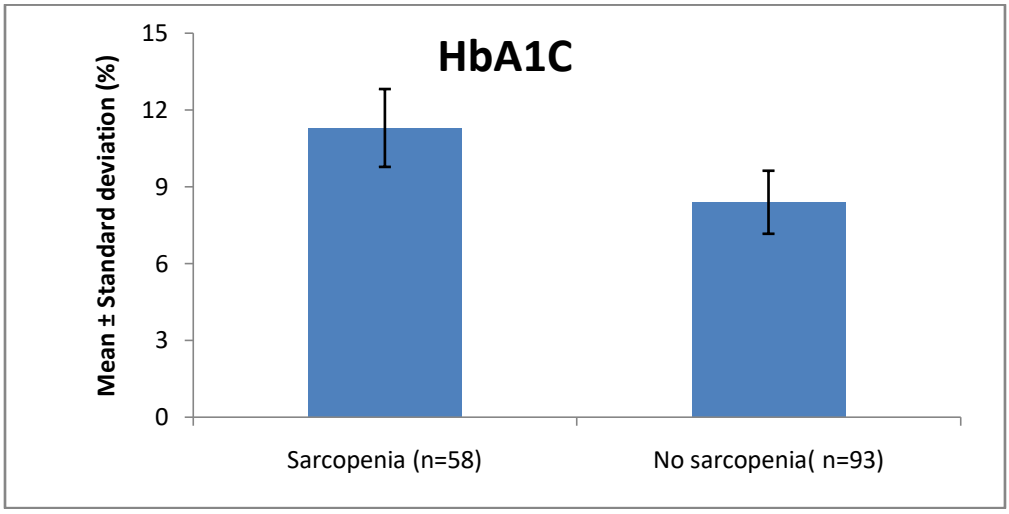
Parameter	Sarcopenia (n=58)	No sarcopenia(n=93)	P- value*
Age (years), Mean ± SD	64.84±6.86	59.40±6.77	**<0.0001**
≤ 45 years	2(3.45%)	10(10.75%)	**0.000064**
46-50 years	7(12.07%)	17(18.28%)	
51-55 years	8(13.79%)	24(25.81%)	
56-60 years	9(15.52%)	27(29.03%)	
61-65 years	19(32.76%)	11(11.83%)	
66-70 years	13(22.41%)	4(4.3%)	

Prevalence of sarcopenia based on presence of other comorbidity is shown in Table 6. 14(24.14%), 31(53.45%), 11(18.97%) and 2(3.45%) patients with sarcopenia had no comorbidity, HTN, HTN with other comorbidity and other than HTN respectively (Figure 18). Comparison between T2DM patients with and without sarcopenia for comorbidity has shown that higher prevalence of sarcopenia was seen in patients with HTN alone as well as HTN with other comorbidity (P vale =0.000026)

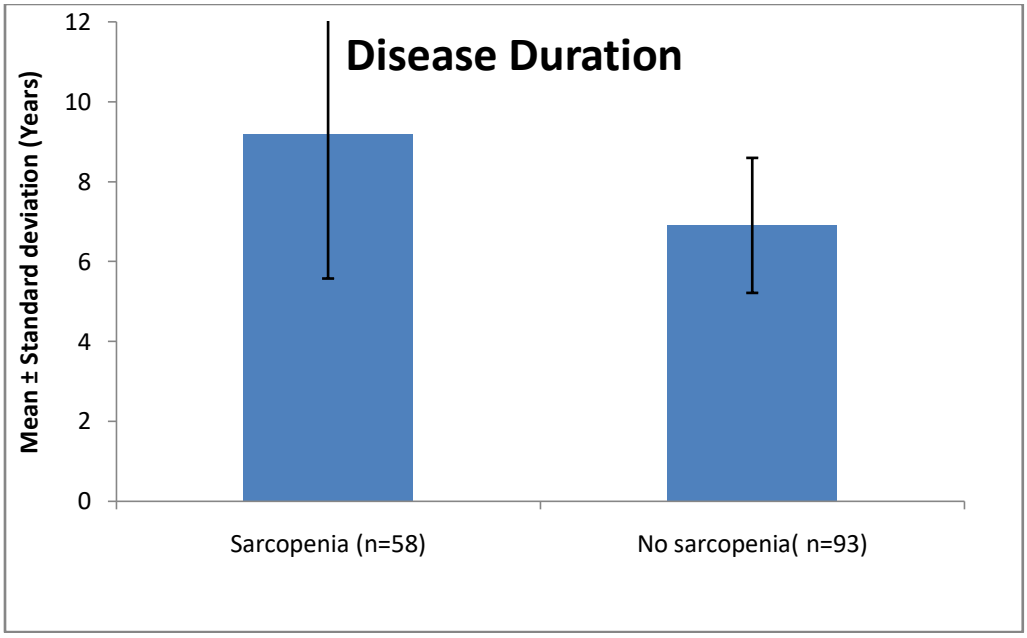
Table 6:- Association between comorbidities parameter and Sarcopenia.

Parameter	Sarcopenia (n=58)	No sarcopenia(n=93)	P- value
NIL	14(24.14%)	56(60.22%)	**0.000026**
HTN	31(53.45%)	27(29.03%)	
HTN and other comorbidity	11(18.97%)	4(4.3%)	
Other than HTN	2(3.45%)	6(6.45%)	

The mean HbA1C and disease duration was found to be higher in sarcopenic patients compared to non sarcopenic patients



Distribution of HbA1C for sarcopenia and non sarcopenia patients



Distribution of disease duration for sarcopenia and non sarcopenia patients

Discussion:-

Sarcopenia is a term used to describe the age-related loss of skeletal muscle mass and function, and it has been linked to T2DM as both a cause and a result[6]. Sarcopenia may contribute to the development and progression of T2DM through altered glucose disposal caused by low muscle mass, as well as increased localised inflammation caused by the accumulation of inter- and intramuscular adipose tissue[7]. So in order to understand this bidirectional relationship between T2DM and sarcopenia, the current study titled "study of factors affecting sarcopenia in type 2 diabetes mellitus" was conducted

In the current study, frequency of sarcopenia in 151 T2DM patients was found to be 38.41%. In the current study the assessment of sarcopenia was done by using SARC-F (sluggishness, assistance in walking, rising from a chair, climb stairs, falls) score (Table 14).Sarcopenia is more common in people with type 2 diabetes than in people who don't have diabetes. A recent meta-analysis of 6526 participants (1832 with T2DM and 4694 controls, with 1159 cases of sarcopenia) revealed that the prevalence of sarcopenia is significantly higher in T2DM than in non-diabetic individuals (OR 1.55; 95% CI 1.25-1.91; p 0.001) and the prevalence of sarcopenia ranged from 5% to 50% [97]. Veronese et al., also reported in their meta-analysis that the prevalence of sarcopenia in T2DM was 28.4% vs. 18.7% in the control group (OR 1.63; 95% CI 1.20-2.22; p = 0.002)[52].

In our study, 82 (54.30%) and 69 (45.70%) of the 151 patients were male and female, respectively. Female patients had a significantly higher frequency of sarcopenia (35 out of 58 (60.34%)) (p value =0.0043).

In the current study, patients with sarcopenia had a significantly higher mean age (64.84±6.86 years) than patients without sarcopenia (59.40±6.77years) (p value<0.0001). Almost 70% of patients were aged between 60 to 82 years. Based on numerous studies, it is understood that age is a significant factor associated with sarcopenia and T2DM patients. Similarly Cui et al., found that the prevalence of sarcopenia in T2DM rises steadily with age (17.4% in the 65–69 age group, 28.1% in the 70–74 age group, 52.4% in the 75–80 age group, and 60% in the age groups above 80 years)[9].

In the present study mean duration of diabetes in patients with sarcopenia was 9.17±3.60 years. This was significantly higher than that of patients without sarcopenia (6.90±1.69 years). Our study finding is in consistent with some of the studies which that reported sarcopenia is more common the longer a person has had diabetes[8]. In particular, the study by Cui et al. demonstrated that, when participants were divided into groups based on the length of their diabetes, sarcopenia prevalence was found to be 27.6%, 21.8%, and 52.6%, respectively, in the groups with diabetes durations of less than 10, between 10 and 20, and greater than 20 years[9].

In the current study, comorbidity was found to have significant effect on T2DM patients with sarcopenia. Frequency of sarcopenia without any comorbidity was found to be 24.14%. Patients with sarcopenia had HTN, HTN with other comorbidity, and other than HTN in 31 (53.45%), 11 (18.97%), and 2 (3.45%), respectively. According to a report, systemic arterial hypertension affects 50% of patients at the time of T2DM diagnosis and is twice as common in diabetics as it is in the general population[10-12]. Contrary to our findings, some studies claim that having high blood pressure reduces the risk of developing sarcopenia, indicating that the disease itself may not be the cause of muscle wasting but rather its management with beta-blockers or renin-angiotensin-aldosterone inhibitors

Conclusion:-

According to the current study, the frequency of sarcopenia in T2DM patients is 38.41%. Our study found a strong link between and female T2DM patients, old age, impaired insulin sensitivity, chronic hyperglycemia, subclinical inflammation, diet and disease duration. In conclusion, the increased frequency of sarcopenia in the elderly population with T2DM and its significant impact on their quality of life, affecting physical and psychosocial health, makes it a major public health issue. Major research gaps in this area include the relationship of sarcopenia with relevant features of T2DM and its treatment, as well as the possibility of preventing it through appropriate lifestyle interventions. Clinically, it is critical to improve physicians' and nutritionists' ability to detect sarcopenia and its risk factors in T2DM patients, particularly in the elderly. This would allow for the implementation of appropriate therapeutic strategies centred on adequate energy intake and regular physical activity.

References:-

1. Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A.A., Ogurtsova, K., et al. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Research and Clinical Practice 157, 107843. 10.1016/j.diabres.2019.107843.
2. Ogurtsova, K., da Rocha Fernandes, J.D., Huang, Y., Linnenkamp, U., Guariguata, L., Cho, N.H., Cavan, D., Shaw, J.E., and Makaroff, L.E. (2017). IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Research and Clinical Practice 128, 40–50. 10.1016/j.diabres.2017.03.024.
3. Umegaki, H. (2016). Sarcopenia and frailty in older patients with diabetes mellitus: Sarcopenia and frailty in DM. GeriatrGerontolInt16, 293–299. 10.1111/ggi.12688.
4. Liccini, A.P., and Malmstrom, T.K. (2016). Frailty and Sarcopenia as Predictors of Adverse Health Outcomes in Persons With Diabetes Mellitus. Journal of the American Medical Directors Association 17, 846–851. 10.1016/j.jamda.2016.07.007.
5. Izzo, A., Massimino, E., Riccardi, G., and Della Pepa, G. (2021). A Narrative Review on Sarcopenia in Type 2 Diabetes Mellitus: Prevalence and Associated Factors. Nutrients 13, 183. 10.3390/nu13010183.
6. Santilli, V., Bernetti, A., Mangone, M., and Paoloni, M. (2014). Clinical definition of sarcopenia. Clin Cases Miner Bone Metab11, 177–180.
7. Mesinovic, J., Zengin, A., De Courten, B., Ebeling, P.R., and Scott, D. (2019). Sarcopenia and type 2 diabetes mellitus: a bidirectional relationship. DMSO Volume 12, 1057–1072. 10.2147/DMSO.S186600.
8. Mori, H., Kuroda, A., Ishizu, M., Ohishi, M., Takashi, Y., Otsuka, Y., Taniguchi, S., Tamaki, M., Kurahashi, K., Yoshida, S., et al. (2019). Association of accumulated advanced glycation end-products with a high prevalence of sarcopenia and dynapenia in patients with type 2 diabetes. J Diabetes Investig10, 1332–1340. 10.1111/jdi.13014.
9. Cui, M., Gang, X., Wang, G., Xiao, X., Li, Z., Jiang, Z., and Wang, G. (2020). A cross-sectional study: Associations between sarcopenia and clinical characteristics of patients with type 2 diabetes. Medicine 99, e18708. 10.1097/MD.0000000000018708.
10. Baek, S.J., Nam, G.E., Han, K.D., Choi, S.W., Jung, S.W., Bok, A.R., Kim, Y.H., Lee, K.S., Han, B.D., and Kim, D.H. (2014). Sarcopenia and sarcopenic obesity and their association with dyslipidemia in Korean elderly men: the 2008–2010 Korea National Health and Nutrition Examination Survey. J Endocrinol Invest 37, 247–260. 10.1007/s40618-013-0011-3.
11. Sanada, K., Iemitsu, M., Murakami, H., Gando, Y., Kawano, H., Kawakami, R., Tabata, I., and Miyachi, M. (2012). Adverse effects of coexistence of sarcopenia and metabolic syndrome in Japanese women. Eur J ClinNutr66, 1093–1098. 10.1038/ejcn.2012.43.
12. Scheen, A.J. (2016). Effects of reducing blood pressure on cardiovascular outcomes and mortality in patients with type 2 diabetes: Focus on SGLT2 inhibitors and EMPA-REG OUTCOME. Diabetes Research and Clinical Practice 121, 204–214. 10.1016/j.diabres.2016.09.016.