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Assessment of Lifestyle Practices, Medication Adherence and Cardiovascular Complications of Metabolic Syndrome in Geriatric Inpatients at Tertiary Care Hospital

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ABSTRACT

Background: Metabolic syndrome is the major risk factor for cardiovascular diseases. The combination of proper education, good lifestyle practices, and medication adherence helps to improve good therapeutic effect and quality of life. And also, prevent cardiovascular complications.

Objective: To assess the lifestyle practices and cardiovascular complications of metabolic syndrome in geriatric patients. And also, to evaluate the medication adherence and barriers for non-compliance.

Methodology: This was a hospital based cross-sectional study conducted for a duration of one year. Totally, 650 of both male and female patients of age above 65 were enrolled. Ethical approval was obtained from MIMS, Mandya. The patients who are having at least three components from the diagnostic criteria of South Asians were included. Details such as demographics, lifestyle practices, occupation, physical activity, medication adherence, and cardiovascular complications were collected and subjected to statistical analysis.

Results: Among 650 patients**,** 344 (53%) male patients are more admitted to the hospital. There is a relationship between age, education, economic status, and area of residence with respect to metabolic syndrome. The good lifestyle practices, such as a protein and fat diet, are seen in 165 (25.6%) patients. The maximum number of patients consume 521 (80.3%) of 3 times coffee/day as a bad habit. Physical activity was seen in 216 (33.5%) patients. Medication adherence was found to be 58.9% of patients, and forgetfulness was the main barrier to non-adherence in 34 (27%) patients. Among cardiovascular complications, the majority are suffering from coronary artery diseases 104 (35%).

Conclusion: Our study concludes that male patients were more prevalent, and age, income, education, and residence also influence the development of metabolic syndrome. Lifestyle practices and medication adherence both are essential to achieving good therapeutic effect and preventing cardiovascular complications in geriatric patients.

Keywords: *Geriatrics, Cardiovascular Diseases, Lifestyle, Metabolic syndrome, Physical activity.*

1. INTRODUCTION

Geriatrics is defined as a person who is aged greater than 65 years [1]. Aging is an irreversible physiological process that leads to the gradual deterioration of tissue and cellular functions, increasing the susceptibility to metabolic disorders. Diabetes mellitus and obesity among older adults pose a major health challenge to global public health [2]. Metabolic syndrome (MetS) is a worldwide pandemic and complex disorder [3]. It is a combination of interconnected cardiovascular risk factors such as hypertension, hyperglycaemia, dyslipidaemia, and central obesity [4]. The prevalence of MetS in India was found to be 28.6%, and 1.4 billion people, has a very high-risk burden of hypertension, diabetes mellitus, and abdominal obesity relative to the rest of the world, thereby predisposing most of the geriatric population to MetS [5].

Based on South Asian criteria, the Mets is diagnosed if the person consists of at least 3 out of 5 components, such as fasting blood glucose level (mg/dl) > 100, waist circumference (cm) > 87 in males or >82 in females, blood pressure (mm of Hg) > 130/85, triglyceride (mg/dl) > 150 and high-density lipoprotein(mg/dl) < 40 in males or < 50 in females. Proper criteria are important for accurate differentiation of patients with MetS [6]. In MetS, the lifestyle modification includes smoking cessation, weight control, moderate alcohol consumption, physical activity, exercise, and diet control [7]. The dietary pattern should be increasing intake of unsaturated fat, legumes, cereals, fruits, vegetables, nuts, fish, and low dairy products [8].

Medication adherence is defined as the extent to which patients adhere to the recommendations of the treatment given by physician [9]. Medication adherence plays an important role in the treatment of chronic diseases such as hypertension, diabetes mellitus, and dyslipidaemia. Otherwise, leads to decreased therapeutic efficacy and leads to cardiovascular complications [7]. Factors associated with poor adherence were cognitive impairment, cost of drugs, polypharmacy, lack of interest, side effects, lack of knowledge, and also depend on care takers [10]. Several prospective study results revealed that metabolic syndrome is linked to a 1.5-fold increase in all-cause death and a two – fold increase in cardiovascular diseases [11]. Each risk components of MetS are an independent risk factor for cardiovascular disease and the combination of these will increase the rates, and severity of cardiovascular diseases. The conditions are microvascular dysfunction, coronary atherosclerosis, cardiac dysfunction, myocardial infarction, and heart failure [12,13].

All the components of metabolic syndrome are directly linked to the lifestyle practices. The proper healthy lifestyle practices and medication adherence are effective way for the treatment and increase the therapeutic outcomes in MetS patients. It, also prevents the cardiovascular complications. So, our study is to assess the lifestyle practices and cardiovascular complications of metabolic syndrome in geriatric patients. And also, to evaluate the medication adherence and barriers for non-compliance.

2. METHODOLOGY

Study Design

This was a prospective cross-sectional study. This study was conducted in inpatients who are admitted in general medicine department and receiving treatment for metabolic syndrome at tertiary care hospital, Mandya Institute of Medical Sciences, Karnataka. This study was conducted for a duration of 1 year from May 2022 to April 2023. We preferred convenience sampling method for conducting this study.

Sample Size:

The sample size was calculated by using the Cochran' s formula for cross-sectional studies.

Formula = Z^2 p (1-p) /e^2

Z = 1.96 for 5% error, Population proportion (p) =30%,[5] 1-p = 70% and margin of error (e) = 5%.

Calculation = $1.96 \times 0.3(1-0.3) / (0.05)^2 = 322$ for 6 months. 322 x 2 = 644.

This formula gave a minimum of sample size of 644, and 650 patients were subsequently recruited during the study period.

Inclusion Criteria:

- Both genders and age > 65 years.
- Patients who are admitted and had ≥3 components of the metabolic syndrome according to South Asian / Indian criteria.
- Patients who gave informed consent.

Exclusion Criteria:

- Patients who are admitted to the intensive care unit.
- Patients who are discharged against medical advice.

Method of Data Collection (study tools):

The information of patients was obtained based on the questionnaires in the pre-designed and semi- structured data collection form. The below information was collected,

- Patient demographic details like name, age, gender, IP number and education status.
- Diagnosis and social history of the patients were collected.
- The lifestyle practices information was collected by using self-prepared questionnaires.
- Information regarding medication adherence was obtained by self-prepared assessment scales and barriers for non-adherence also obtained by interview method.

- The lifestyle assessment scales and medication adherence scale questionaries was validated by the clinicians.
- Details about cardiovascular complications of metabolic syndrome was obtained from case sheets.
- For diagnosis of metabolic syndrome South Asian/Indian criteria was used. For this criterion, fasting blood glucose level, high-density lipoprotein and triglyceride test was performed by lab technician using a standard procedure. Fasting blood sample was collected for these lab tests. The blood pressure checkup was performed by using sphygmomanometer. Anthropometric waist circumference measure was done by wrapping the tape around the widest part of the patient's stomach, across the belly button. This measurement was repeated three times for consistent results.

Ethical clearance and informed consent

Ethical approval was obtained from the institutional ethics committee of the Mandya Institute of Medical Sciences, Mandya, Karnataka. The reference number of approval letter is MIMS/IEC/569. Study population who are provided a voluntary written informed consent form were only included in our research study.

Statistical Analysis

The collected data was analysed using IBM 16 software. Descriptive statistics including, percentages, and frequency was calculated. Chi-square test (x^2) was applied to check the relationship between the general components and number of risk factor components. For this test the confidence interval was 95% with 5% error.

3. RESULTS

In this Cross-sectional study, a total of 650 participants were enrolled in our study based on South Asian criteria for diagnosing metabolic syndrome in geriatric patients. The detailed demographic details, lifestyle practices, medication adherence, reasons for non-adherence and cardiovascular compilations of metabolic syndrome details were collected and subjected to statistical analysis.

General characteristics among the geriatric patients who are suffering from metabolic syndrome were collected and subjected to a chi-square test at 95% confidence interval with $p<0.05$ (Table 1). This test is applied to check the relationship between general characteristics and metabolic components. Among the patients, 344 (53%) were male and 306 (47%) were female patients admitted to the hospital. The p-value was found to be 0.4, and the results are not statistically significant. Among patients, 313 (48.2%) patients were belonged to the age group 65-74 years, 210 (32.3%) patients were in the age group 75-84 years and 127 (19.5%) patients were in the age group >85 years. The p-value was found to be 0.00, and the results are statistically significant. The educational status of the patients shows that 555 (85.4%) were uneducated and 95 (14.6%) patients were educated. The p-value was found to be 0.00, and the results are statistically significant. Economic status among the patients shows that 459 (70.7%) of patients monthly income was found to be <15,000 rupees and 191 (29.3%) of patients monthly income was found to be >15,000 rupees. The p-value was found to be 0.00, and the results are statistically significant. In the area of residence 362 (55.6%) patients from rural areas and 288 (44.4%) were from urban areas. The p-value was found to be 0.02, and the results are statistically significant.

Table 1: General Characteristics among Metabolic syndrome Patients

Characteristics	Category	3 Risk Components N (%)	4 Risk Components N (%)	5 Risk Components N (%)	Total N (%)	*P*
Gender	Male	234(36)	68(10.5)	42(6.5)	344 (53)	0.4
	Female	204(31.3)	58(9)	44(6.7)	306 (47)	
Age	65-74 years	246(37.9)	39(6)	28(4.3)	313(48.2)	0.00*
	75-84 years	110(17)	64(9.8)	36(5.5)	210(32.3)	
	> 85 years	82(12.6)	23(3.5)	22(3.4)	127(19.5)	
Education	Educated	58(8.9)	24(3.7)	13(2)	95(14.6)	0.00*
	Un educated	380(58.5)	102(15.7)	73(11.2)	555(85.4)	
	<15,000 rupees	53(8.1)	72(11)	66(10.2)	191(29.3)	

Economic status	> 15,000 rupees	385(59.3)	54(8.4)	20(3)	459(70.7)	0.00*
Area of Residence	Rural	274(42.1)	49(7.5)	39(6)	362(55.6)	0.02*
	Urban	164(25.3)	77(11.9)	47(7.2)	288(44.4)	

Good habit practices were assessed by self-prepared questionnaires, and scoring was given based on their practices **(Table 2)**. Among the patients, 86 (13.2%) patients are choosing the food that achieves optimal blood sugar levels, 133 (20.4%) patients were rarely, 158 (24.9%) patients were sometimes, and 273 (41.5%) were not. Dietary recommendations were followed by 114 (17.5%) patients, 196 (30.1%) patients were rarely, 187 (28.7%) patients were sometimes, and 153 (23.7%) patients were not. A salt restriction diet was followed by 181 (27.8%) patients, 152 (23.5%) patients were rarely, 123 (18.9%) patients were sometimes, and 194 (29.8%) patients were not. Only 90 (13.8%) of patients were consuming all vegetables and fruits, which are rich in potassium, magnesium, and fibre, 206 (31.6%) patients were rarely, 212 (32.8%) patients were sometimes, and 142 (21.8%) patients were not. The less consumption of low-fat or fat-free dairy products is seen in 49 (7.5%) patients, rarely in 86 (13.2%) patients, 189 (29%) patients were sometimes and 326 (50.3%) patients were not. Intake of food that is rich in omega-3 fatty acids is observed in 41 (6.30%) patients, 129 (19.9%) patients were rarely, 142 (21.8%) patients were sometimes, and 338 (52%) patients are not. Consumption of beans, nuts, and seeds, which contain fiber and unsaturated healthy fats, is seen in 165 (25.6%) patients, rarely in 284 (43.6%) patients, 116 (17.8%) patients were sometimes, and 85 (13%) patients were not.

Table 2: Distribution of Patients Based on Good Habit Practices

SL. No	Questions	Score			
		0 N (%)	1 N (%)	2 N (%)	3 N (%)
1	The food you choose to eat makes it easy to achieve optimal blood sugar levels.	273(41.5)	133(20.4)	158(24.9)	86(13.2)
2	Are you strictly following the dietary recommendations given by your doctor.	153(23.7)	196(30.1)	187(28.7)	114(17.5)
3	Are you following salt restriction diet.	194(29.8)	152(23.5)	123(18.9)	181(27.8)
4	Are you including all vegetables and fruits rich in potassium, magnesium and fibre.	142(21.8)	206(31.6)	212(32.8)	90(13.8)
5	whether you consume low-fat or fat-free dairy products.	326(50.3)	86(13.2)	189(29.0)	49(7.5)
6	Are you taking food which rich in omega-3 fatty acids.	338(52)	129(19.9)	142(21.8)	41(6.30)
7	whether are you consuming beans, nuts, and seeds, which contain fiber and unsaturated healthy fats.	85(13)	284(43.6)	116(17.8)	165(25.6)

Patient bad habit practices were assessed by using self-prepared questionnaires, and scoring was given based on their practices **(Table 3)**. Occasional intake of sweets was assessed among patients in those 98 (15%) patients not having, 283 (43.8%) patients are rarely having, 193 (29.6%) patients sometimes having and 76 (11.6%) of patients having. The food contains saturated fat with trans-fat that are not consumed by 203 (31.2%) patients, 83 (12.7%) are rarely, 238 (36.8%) are sometimes, and 126 (19.3%) patients are consuming. Intake of junk food at least one time per week was assessed, and 486 (74.7%) patients are not, 98 (15%) rarely, 54 (8.5%) patients were sometimes, and 12 (1.8%) patients are consuming. Alcohol consumption 3 times/week was assessed in that 452 (69.5%) patients were non-alcoholic, 68 (10.6%) patients were rare, 37

(5.6%) patients were sometimes, and 93 (14.3%) were alcoholics. Smoking habits of the patient details were collected, and results showed that 392 (60) of patients are non-smokers, 28 (4.7%) patients are rare, 96 (14.7%) patients are sometimes, and 134 (20.6%) patients are smokers. Consumption of coffee 3 times/ day details was obtained in that 27 (4.1%) patients are not having coffee, 13 (2%) patients are rarely, 89 (13.6%) patients are sometimes, and 521 (80.3%) patients are consuming coffee 3 times/day. Among patients, 463 (71.2%) patients wake up early in the morning, 48 (7.5%) patients are rarely awake, 56 (8.6%) patients are sometimes awake, and 83 (12.7%) patients wakeup late in the morning.

Table 3: Details of Patients Based on Bad Habit Practices

SL. No	Questions	Score			
		0 N (%)	1 N (%)	2 N (%)	3 N (%)
1	Occasionally do you have lots of sweets or other foods rich in carbohydrates	98(15)	283(43.8)	193(29.6)	76(11.6)
2	Are you consuming food contains saturated fat with trans-fat.	203(31.2)	83(12.7)	238(36.8)	126(19.3)
3	Habits of intake of junk food at least 1 times/week like masala poori, gobi Manchurian etc.	486(74.7)	98(15)	54(8.5)	12(1.8)
4	Social habits like alcohol consumption 3 times/ week.	452(69.5)	68(10.6)	37(5.6)	93(14.3)
5	Daily smoking habits like cigarettes, cigars, bidis, and kreteks etc.	392(60)	28(4.7)	96(14.7))	134(20.6)
6	Are you consuming more than 3 times of coffee /day.	27(4.1)	13(2)	89(13.6)	521(80.3)
7	Do you wake up late in the morning.	463(71.2)	48(7.5)	56(8.6)	83(12.7)

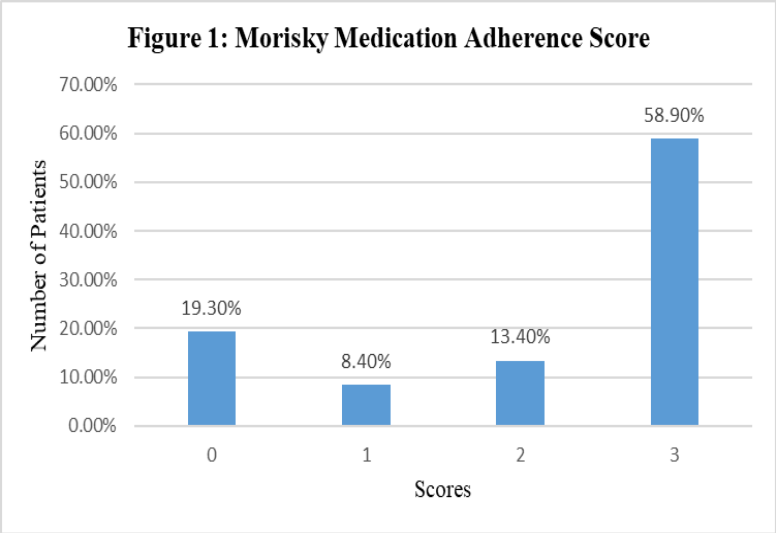
Patient physical activity and occupation data was assessed by using self-prepared questionnaires, and scoring was given based on their activities **(Table 4)**. The patients involved in physical activity were found to be 216 (33.5%), 193 (29.6%) patients are rarely, 165 (25.3%) patients are sometimes, and 76 (11.6%) patients are not involved in any activity. Among the patients, 186 (28.6%) are involved in cleaning and gardening work, 177 (27.4%) patients are rarely involved, 139 (21.3%) patients are sometimes involved and 148 (22.7%) patients are not involved. Only 44 (6.7%) patients occupation/jobs involve physical activities, 163 (25%) patients are rarely, 71 (10.9%) patients are sometimes and 372 (57.4%) patients are not. Patient environment details were assessed in that 542 (83.5%) patients were free from pollutants, 52 (8%) were rarely, 65 (10%) patients are sometimes and 25 (3.8%) patients were exposed to pollutants. Income of patients was assessed, results show that only 78 (12%) patients have sufficient income to purchase healthy foods, 85 (13%) patients are rarely, 65 (10%) patients are sometimes, and 422 (65%) patients are not getting sufficient income.

Table 4: Distribution of Patients Based on Physical Activity and Occupation

SL. No	Questions	Score			
		0 N (%)	1 N (%)	2 N (%)	3 N (%)
1	Are you doing regular physical activity such as walking and exercise.	76(11.6)	193(29.6)	165(25.3)	216(33.5)
2	Are you involving in any cleaning and gardening work in your home.	148(22.7)	177(27.4)	139(21.3)	186(28.6)
3	Your occupation / job involves physical activities.	372(57.4)	163(25)	71(10.9)	44(6.7)

4	Your environment is free from pollution / chemical hazards.	25(3.8)	52(8)	31(4.7)	542(83.5)
5	Your income is sufficient to purchase healthy foods.	422(65)	85(13)	65(10)	78(12)

The Morisky medication adherence scale was used to assess the medication adherence in the patients suffering from metabolic syndrome components **(Figure 1)**. Among them, 126 (19.3%) patients scored 0 it represents the patients are non-adherent, 54 (8.4%) and 87 (13.4%) patients scored 1 and 2 it shows they are moderately adherent and 383 (58.9%) patients scored 3 and it represents the patients adhere to the prescribed medications.



Among 650 patients, 126 patients are non-adherent to the prescribed medications **(Table 5)**. The reasons for medication non-adherence were assessed, it shows that 34 (27%) patients are forget to take medication, 18 (14.3%) patients are a lack of knowledge, 10 (8%) patients are experiencing side effects, 6 (4.7%) patients because of polypharmacy, 8 (6.4%) patients have financial problems, 31 (24.6%) patients depend on care takers, and 19 (15%) patients show negligence to take prescribed medications.

SI No	Reasons	Number of Patients (%)
1	Forgetfulness	34(27)
2	Lack of knowledge	18(14.3)
3	Side effects	10(8)
4	Polypharmacy	6(4.7)
5	Financial problems	8(6.4)
6	Depends on caretakers	31(24.6)
7	Negligence	19(15)

Table 5: Reasons for Non-adherence in Geriatric Patients.

Among 650 metabolic syndrome patients, 297 patients are having cardiovascular complications **(Table 6)**. The results show that 104 (35%) patients are having coronary artery disease, 48 (16.2%) patients are having peripheral artery disease, 56 (18.8%) patients are having stroke, 23 (7.7%) patients are having arrhythmias and 66 (22.3%) patients are having ischemic heart disease.

Sl. No	Complications	Number of Patients (%)
1	Coronary artery disease	104(35)
2	Peripheral artery disease	48(16.2)
3	Stroke	56(18.8)
4	Arrythmias	23(7.7)
5	Ischemic heart disease	66(22.3)

Table 6: Cardiovascular Complications of Metabolic Syndrome

4. DISCUSSION

Geriatric population are more susceptible group for the development of cardiovascular diseases which leads to increase morbidity and mortality rate. The patients having metabolic syndrome having 2-3-fold greater risk rate for the development of cardiovascular diseases. We applied chi-square test to check the association between general characteristics and components of metabolic syndrome. In gender wise distribution, 344 (53%) male patients are more prevalent than females 306 (47%) patients in the development of metabolic syndrome. The p-value was found to be 0.4, it shows that no association between gender and components. The results are similar to that of the study conducted by Kuan Zung [14]. In age wise categorization, 313(48.2%) patients are belonging to age group 65 to 75 years are more admitted in hospital compare to other age group. Because as the age increases the patient mortality and severity also increases. So, maximum patient needs intensive care than general ward. The results are same according to the study conducted by Chul Younng Bae [15]. Among the patients, 555 (85.4%) were un educated and 95 (14.6%) patients were educated. It shows that education plays an important role in decreasing the disease prevalence. Maximum number of patients earning < 15,000 rupees per month 459 (70.7%) and 191 (29.3%) patient monthly income was >15,000 rupees. The economic income is essential for proper diet and medication adherence. The p-value of age, education, economic status with respect to metabolic components was found to be 0.00, it shows that there is a relationship between variables and results are statistically significant. These results are similar to that of the study conducted by Liza A Hoveling [16]. Rural population of 362 (55.6%) patients admitting more compared to urban population 288 (44.4%). It shows that rural people are more prevalent in the development of metabolic syndrome than urban population. The p-value was found to be 0.02, it shows that there is a relationship between area of residence and metabolic components and results are statistically significant. These results are similar to the study conducted by Grzegorz Jozef Nowicki [17].

The good lifestyle practices in patients suffering from metabolic syndrome were assessed by using questionaries. Among the patients, only 86 (13.2) patients are choosing the food which helps to maintain blood glucose level, 114 (17.5%) patients following the dietary recommendations given by physician, 181 (27.8%) patients following the salt restriction diet, 90 (13.8%) of patients were consuming all vegetables and fruits which are rich in potassium, magnesium and fibre, 49 (7.5%) patients consuming of low-fat or fat-free dairy products, 41(6.30%) patients intaking of food which rich in omega-3 fatty acids and 165 (25.6%) patients are consuming of beans, nuts, and seeds, which contain fiber and unsaturated healthy fats. It shows that healthy lifestyle practices are not following by the patients suffering from metabolic syndrome. High carbohydrate has the relationship according to the study by Sufyan Bakuri Suara [18]. The fruits/vegetables consumptions decrease the incidence of development of metabolic syndrome according to the study by Jeffrey J Van Wormer [19].

The bad lifestyle practices were assessed. In the occasional intake of sweets, 98 (15%) patients not having sweet, the food contains saturated fat with trans-fat are not consumed by 203(31.2%) patients. Intake of junk food at least one time per week were assessed and 486 (74.7%) patients are not taking junk food. Among patients, 452 (69.5%) patients were non-alcoholic and 392 (60%) of patients are non-smokers. This is because here we included both male and female gender. The females show nil of alcoholic and smoking. Only, 27 (4.1%) patients are not having coffee 3 times/ day. In sleeping pattern 463 (71.2%) patients wake up early in the morning. Physical activity and occupation related questionaries to assess the activity and income. Among the patients, 216 (33.5%) patients are involving in physical activity, 186 (28.6%) patients are involving in cleaning and gardening work, 44 (6.7%) patients occupation / job involves physical activities, 542 (83.5%) patients were free from pollutants and only 78 (12%) patients are having sufficient income to purchase healthy foods. According to the study conducted by Soo Kyung Park [20] there is a relationship between physical activity and metabolic components. The results shows that majority of patients are involving in physical activities and earning less income.

Morisky medication adherence scale questionaries was used to assess the medication adherence in the patients suffering from metabolic syndrome components. Among them, 383 (58.9%) patients score was 3 and it represents the patients are adhere to the prescribed medications. The 0 score was observed in 126 (19.3%) patients it shows they are non-adherent. The moderate adherence was seen in 54 (8.4%) and 87 (13.4%) patients. The adherence can be improved by patient education and preventing the barriers. Non-adherence having relationship to develop metabolic syndrome and it was same by research done

by Megan Sarah Mathew [21]. Among 650 patients, 126 patients are non-adherent to the prescribed medications. The main reasons for medication non-adherence were found to be cognitive impairment seen in 34 (27%) patients and 31(24.6%) patients depend on care takers. In geriatrics patients, cognitive impairment is common disorder due to neurodegenerative disorders and normal aging. The adherence also depends on care takers during complex regimen and cognitive decline. The results are similar to that of the study conducted by Kirsi Kvarnstrom [22].

Among 650 metabolic syndrome patients, 297 patients are having cardiovascular complications, the results show that 104 (35%) patients are having coronary artery disease, 48 (16.2%) patients are having peripheral artery disease, 56 (18.8%) patients are having stroke, 23 (7.7%) patients are having arrythmias and 66 (22.3%) patients are having ischaemic heart disease. The complications are more in metabolic syndrome patients this is because it is a cluster of risk factors like abdominal obesity, high blood pressure, hyperglycaemia and dyslipidaemia. The results are similar to that of the study conducted by Nima Motamed [23].

5. CONCLUSION

Our study concludes that males are more prevalent for development of metabolic syndrome than females. Majority of patients belong to age group 65-74 years and uneducated. Hospital admission was seen in patients are from rural areas and monthly income was < 15,000 per month. Chi-square result showed that there is relationship between general characteristics and metabolic components. Heathy Life style practices are seen less among the patients. Medication adherence plays an important role in achieving therapeutic effects and prevent cardiovascular complications. So, both healthy lifestyle practices and medication adherence are important in the manage metabolic syndrome and prevent cardiovascular complications in geriatric patients. This can be achieved by patient counseling, providing education, intervention programs, identifying and resolving barriers involved in it.

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Conflict of Interest

The authors declare no conflict of interest.

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