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RESEARCH ARTICLE

LIFESTYLE MODIFICATIONS AMONG ELDERLY POPULATION WITH TYPE 2 DIABETES IN RURAL PUNJAB: A BASELINE ASSESSMENT AND PLANNING FOR DIABETES COUNSELLING TRIALS.

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Abstract

Background: Diabetes mellitus (T2DM) is a global public health problem with drastic increase in the number (above 382 million) leading to diabetes epidemic.[1] Studies have recently confirmed rising prevalence rates among marginalized populations in rural India which has been ignored since long[2]. Moreover several cultural, socioeconomic and changing lifestyles appear to contribute to diabetes in rural regions of Northern India, highlighting the need to empower elderly to pursue health and well being on their own terms.

Aim: The study was conducted to assess the baseline lifestyle modification among elderly population with diabetes mellitus type 2 patients residing in rural areas of district Ludhiana in order to plan for diabetic counselling trials.

Methods: A study was conducted on 243 elderly subjects (>60 years) with diabetes mellitus type 2 living in selected village from Block Dehlon, district Ludhiana. Cluster random sampling technique was adopted to select the samples from villages. The data was collected by face to face interview method with the help of self structured checklist to assess lifestyle modifications on physical activity, diet, alcohol, smoking, stress management, personal care, treatment and health learning along with anthropometric measurements and blood glucose levels. Data collected by self report and bio-physiological methods.

Results: Findings revealed that most of the elderly diabetics (67.13±6.82 years) were female, married, educated upto matric. Mean age of onset of DM type 2 was in 53.74±9.52 years with 13.06±7.41years of duration and treatment. 93.1% of the subjects presented with diabetes related complications with predominance of cardiovascular and retinopathy. Most of the subjects were overweight and at high risk of WC and WHR. Mean FBS (166.25±8.56), RBS (265.8±78.38***)*** and Hb1Ac (7.98±0.79) were above normal range. Most subjects were following average 108(44.4%) to below average 100 (44.1%) lifestyle modification. Exercises were the least adopted

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lifestyle modification second by dietary. There was a significant association of lifestyle modification with age, educational status, duration of illness, lifestyle pattern and BMI at p<0.05. Lifestyle modification showed a significant effect on RBS (p=0.03) and occurance of diabetes related complications (p=0.00).

Conclusion & recommendations: Elderly rural population suffering from diabetes has average to below average lifestyle modification. Good lifestyle modication improved anthropometric and blood sugar levels. Therefore community based interventions can encourage better lifestyle modification that could help in controlling sugar levels and hence reducing the number of complications among them.

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Introduction:-

Diabees mellitus is a global public health problem of epidemic proportions, and its incidence is on the rise, further becoming a leading cause of death in most countries. It is caused by relative lack of insulin that is insufficient to overcome insulin resistance.[1] High levels of blood glucose are only one component of pathologic process & clinical manifestation of Diabetes Mellitus. The most common form of DM Type 2 affects 90% to 95% of people who have diabetes & is usually diagnosed after age 40 [2-3] .

The **International Diabetes Federation**[4] has quoted 382 million people with diabetes in the year 2013, a number surpassing its earlier predictions. More than 80% of the people with diabetes live in Asia, with almost one-half in China and India combined. The last three decades have witnessed a drastic and rapid rise in number of people suffering from diabetes, especially type 2, particularly a peak rise in developing countries, where more than 80% of the diabetics live. Type 2 diabetes has been estimated to rise in South Asia by greater than 150% during first three decades of this century (2000-2035). The main reasons of this sudden rise are considered to be ageing, urbanization and current lifestyle pattern. Adverse changes in the enviornment and sudden rise in the technology and advancement could also contribute in many developing countries.[5]

According to the official **WHO** [6] data, India tops the list of the countries with highest number of diabetics. In the year 2014, 8.3% of the world's adult population suffered from diabetes (International Diabetes federation, 2014) with low income countries topping the list. India's prevalence of Diabetes is 7.8% and in certain areas upto 18% prevalence rates have been quoted with many having hidden undiagnosed diabetes who are rapidly dying with its complications.[7]

In CSIR-NEERI, India, It was observed that from total 585 elderly people, 178 had T2DM (30.42%- Prevalence). The sex ratio of Diabetic males to females was almost equal (1:0.97). Obesity was present in 114 people (64%). High prevalence of hypertension was found in Diabetic elderly population (80%). The prevalence rates were quite higher as compared to other studies. The contributing factors may be urban living, with high prevalence of central obesity and Asian ethnicity, moreover all diabetics presented with persistent values of Systolic BP > 130 mm of Hg and Diastolic values of BP > 80mm of Hg as Hypertensives. This is real world urban diabetes prevalence, also associated hypertension and central obesity prevalence.[8]

Diabetes mellitus type 2 has been typically considered a disease of the urban affluent but the incidence has become a serious concern among the marginalized population of rural area and it is contributing rapidly to widening health gaps[9]. A review of studies in rural India found that prevalence increased from 1.9% in 1994 to upwards of 12% in 2009.[10]. In addition, rural prevalence rates of impaired glucose tolerance (IGT, a form of pre-diabetes) range from 5.5% to 7.2% [10]. Such figures are concerning, especially considering 72.2% of the Indian population lives in rural areas characterized by poverty, isolation, and poor access to health services[12]. More than half of patients with DM are unaware of their condition; thus, planning strategies for and early diagnosis would be helpful for the high risk populations [11]

Glucose intolerance increases progressively with increasing age. The prevalence of type 2 increased from 16% to 23% between 1995 and 2004 in US [13]**.** It is predictable that among adults over 65 years of age 22% to 33% of them

will be diagnosed with diabetes in next 20 years and elderly present with postprandial hyperglycemia as a characteristic feature due to decrease in beta cell compensating capacity with advancing age, leading to insulin resistance.[14] Therefore, the prevelance even may vary due to screening tests conducted among elderly often making them undiagnosed for long until complications appear[15].

In diabetic elderly over 75 years of age have a higher risk of developing multiple complications than early age group.[16] ***Li Y*** The burden of treatment of older diabetic patients on country economy is high. Higher incidence rates of lower- extremity amputation, MI, visual impairments and end stage renal disease have been found among elderly.[13] Also, there is sufficient evidence to prove that Diabetes Mellitus (DM) is strongly linked to sudden cardiac death.[17]

The prevalence of Indian elderly population diagnosed with diabetes mellitus type 2 is steeply growing since past few years **[18].** The developing countries of Asia and west pacific regions have estimated narrowing in urban-rural difference in diabetes prevalence. The man reason being the advancing culture of western lifestyle and associated behavioural change in rural areas. In India, more than 50% of the national population with diabetes resides in rural areas. Recent studies from India [19]. A study reported that across multiple surveys, there was evidence of a fivefold rise in the prevalence of diabetes from 1985 to 2010 in rural populations of developing countries.[20]

The rural Indian elderly have been inactive oweing to health constrains and have an access to increased carbohydrate diet. Moreover self activity has reduced leading to sedentary lifestlyle. These lifestyle changes have led to the recent surge in diabetes prevalence superimposed by genetic susceptibility.[21]. There also has been a sudden transition in various degrees of nutrition and dietary habits with increase intake of carbohydrates, animal fats, meat and reduced intake of dietary fibre and vegetables in most of the Asian countries.[21,22]

Physical inactivity is an important risk factor for T2DM in most populations[23, 24]. Due to advancement and increase in urbanization, there has been a reduction in physical activities, especially in occupational sector and sedentary behavior has taken front seat with zero activity. This has set an alarming situation and now the aim should be to focus people to indulge in physical activity and reduce sedentary behavior in large-scale community diabetes prevention initiatives in Asia and the Pacific.[25]

A proactive approach to treating T2D is recommended: Therapy needs to be individualized with early consideration of combination therapy and ongoing reinforcement of lifestyle modification messages[26]**.** Lifestyle factors holds similar importance as in adult type 2 diabetes. Individuals who are obese (especially central), who consume diets that are high in saturated fat and low in complex carbohydrates, or who are inactive are more likely to develop diabetes as they age. Moreover, the physiological changes that develop with aging make it more difficult to manage diabetes as compared to the young age group. As a result, there are many unanswered questions about the management of diabetes treatment in elderly patients.[26]

Lifestyle modifications are the cornerstone of diabetes management and include a prescription for healthy eating, regular exercise, stress management, and avoidance of tobacco. Majority of diabetics are controlled with diet alone. Elderly may have difficulty following diet formulas and difficult for the elderly to follow an exercise regime due to associated osteoarthritis, cardiovascular, respiratory and neurological disorders. Counseling should be provided on all elderly diabetic patient lifestyle changes (exercise, diet, behavioral changes, and weight loss in patients who need it). In elderly diabetic group response to a study on lifestyle changes (low fat diet and 150 min/wk exercise) were found to be higher than the young diabetic age group according to the **diabetes protection program (DPP).** [27]

Even moderate weight loss in combination with increased activity can improve insulin sensitivity and glycemic control in patients with type 2 diabetes and prevent the development of type 2 diabetes in high-risk persons (ie, those with impaired glucose tolerance) More action is required to understand the drivers of the epidemic to provide a rationale for prevention strategies to address the rising global public health "tsunami." Unless drastic steps are taken through national prevention programs to curb the escalating trends in all of the countries, the social, economic, and health care challenges are likely to be insurmountable.[5]

While the above discussed datas are in anyway not representing the results similar to rural India as a whole, they certainly provide a rough estimate of diabetes and its management in the study area. Since much of rural India is likely to provide a huge burden of diabetes that will occur in rural India in the coming few decades specifically

among the elderly. The generation of new evidence about detection and management strategies suited to resource poor setting is an urgent public health priority for India. [28]

The easiest and the most economical way to have a healthy diabetic elderly population is to emphasize lifestyle modification at all levels. All it requires is positive attitude which needs to be reminded at frequent intervals. Using data from various studies the study was taken up with the aim to assess the lifestyle modifications among the elderly participants diagnosed with DM type 2 resididng in rural areas of North India.

Materials and methods:-

The present study was conducted on 243 elderly subjects (>60 years) with diabetes mellitus type 2 living in selected village from Block Dehlon, district Ludhiana. The study was conducted in field practice area of Rural Health and Training centre (RHTC) located at village Pohir, block Dehlon, district Ludhiana, Punjab, India. The target population consisted of DM Type 2 elderly patients aged more than 60 years diagnosed for more than 1 year, residing in the selected rural area. The subjects were selected by Cluster random sampling technique in which all the elderly population with DM type-2 residing in the same village meeting inclusion and exclusion criteria were selected from the selected villages/clusters.

The data was collected by face to face Interview method with the help of self structured tools in the form of a checklist: The tool was developed after an extensive review of literature, guidance of the experts in the fields of Nursing and endocrinology and an informal observation in the area concerned. Personal data information & check list was prepared to collect data regarding the effect of lifestyle modifications on glycemic control among patients diagnosed with DM type 2. The tool consisted of three parts namely Tool 1: Socio-bio-demographic characteristics of subjects, Tool 2A. Clinical profile and diabetic history of subjects, 2 B. Physiological Parameters (BMI, WC, WHR, BP), biochemical variables (FBS, RBS, Hb1Ac) and blood pressures. Tool 3: Lifestyle modifications checklist based on 40 dichotomous questions about five major components i.e. physical activity (n=4), diet (n=11), alcohol (n=1), smoking (n=1), stress management (n=5), personal care (n=8), treatment (n=9) and health learning (n=1). Level of Lifestyle modification was assessed as per the scoring of each subject and categorized into good (>75% score), average (50-75%), below average (30-50%) and poor (<30%).

The Tools were validated by subject experts and reliability was also computed after pilot study conducted on 10% of the total subjects. Desired modifications were done in the tools after pilot study. . The reliability of the tool was computed by using split half method using Spearman's Brown prophecy formula where r=0.8, therefore tool was realiable. Data was collected by face to face interview and bio-physiological methods. Ethical approval for this study was obtained from the Institutional Ethics Committee of DMC & Hospital, Ludhiana. Informed consent was obstained from all the subjects.

Analytical Approach:-

Analysis of the data was done in accordance with the objectives of the study. Calculations were carried out with the help of Microsoft excel and SPSS. The data has been analyzed using both descriptive and inferential statistics Descriptive analysis used were frequency distribution, measures of central tendency (Mean), measures of dispersion (Standard deviation). Inferntial statistics used were both parametric test using t-test and ANOVA test and non parametric test using chi square test were applied to find out the statistical significance.

Results:-

Socio-bio-demographic variables

Subjects studied were distributed and matched into various categories. The findings were as follows:

Table I depicts that majority of the elderly diabetic subjects in age group of 60-70 years with mean age 67.14± 6.83 with females (55.9%) in ratio with men (44.1%). Most of the subjects were married (86%), educated upto matric (33.8%), homemaker (55.9%) and belonging to Sikh religion (94.2%). 94.2% of the subjects stayed in joint family. Majority of 68.7% were enjoying sedentary lifestyle and 66.2% subjects were vegetarian. More than half of the subjects (55.7%) belonged to middle class III.

Clinical Profile:-

Table II depicts that 44.03% of the subjects had onset of DM type 2 in the age group of 45-60 years with ***53.81± 9.52*** mean age of onset and 56.7% having >10 years in duration of present illness (***13.06±7.41)*** with 53.9% of subjects having duration of treatment of >10 years (***12.64±7.68***). 73.6% subjects had past medical illness and 49% of the population had family history of diabetes mellitus type 2 (Fig 1) with 47% of them having mother as the predominant relation with family history of diabetes.

Table III reveals the baseline clinical parameters of elderly subjects with DM type 2 residing in rural area. Mean height (163.25± 8.56) and mean weight (74.87±16.03) was calculated to find out the mean BMI (27.95±5.49) which showed that most of the patients were overweight. WC (1.05±13.34) and WHR (0.95±0.06) were falling in high risk category for the subjects. The mean glycemic values showed the above normal range values for FBS (156.01±33.70), RBS (243.77±63.73) and Hb1Ac (7.74± 0.53). The mean Systolic (138.93±13.58) and diastolic blood pressure (83.14±8.06) were slightly higher than normal.

Lifestyle pattern:-

Table IV depicts the baseline lifestyle pattern of elderly population with diabetes mellitus type 2. Out of 243 total subjects 44.4% of the subjects were following average lifestyle modifications followed by 41.2% below average. 2.9% of the elderly were only following good lifestyle modification with mean lifestyle modification 20.16 ± 4.34 at 50.6% mean percentage. Therefore only 50 percent of the lifestyle was modified to combat with diabetes which was mosly average to below average.

Table V depicts that most of the subjects were getting there treatment for diabetes regularly (64.1%) followed by health learning (59%) and personal care (57.33%). all the subjects were non smokers and 94% were not consuming alcohol. The least modified components were physical activity (29%) followed by stress management (32.4%) and Dietary modifications (41.6%) (Fig2)

Table VI reveals the mean distribution of lifestyle modification as per physical activity performed per week. The subjects were walking an average of 0.63±0.84 km per day for atleast 2.25 days per week and 12.32±14.65 minutes per day. The findings revealed that the subjects were not making much modifications on the physical activity and the main reason could be physical disability like age related changes causing osteoarthritis, joint pain.

Association of Lifestyle modification with socio bio demographic variables:-

Table VII depicts the association of Lifestyle modifications taken up by the elderly population with selected socio demographic variable. Lifestyle modification scores were significantly better with subjects in 60-70 years of age (p=0.01), educated subjects (p=0.00), Sikh religion (p=0.04), joint family (p=0.006) and those who were at moderate level of lifestyle pattern (activity) (p=0.000).

Table VIII depicts the association of Lifestyle modifications with selected clinical profile and physical parameters. Lifestyle modification scores were significantly better with subjects who have <5 years of treatment duration (p=0.008), subjects with history from past illness (p=0.00), overweight subjects (p=0.006).

Association of Lifestyle modification with glycemic values:-

The results show that the elderly subjects who were following good lifestyle modifications showed better control over fasting blood glucose (FBS) levels (p=0.08) (Fig 3) and random blood glucose levels (RBS) (p=0.03) (Fig 4)

Discussion:-

Elderly population (>60 years) diagnosed with diabetes mellitus residing in rural area of district Ludhiana, Punjab were studied for the baseline assessment of lifestyle modifications, where most of the studies in western studies have reported adult in their sample. Type 2 diabetes mellitus is considered a chronic metabolic disorder throughout the world. Ageing is considered a major risk factor (ADA standards of medical care). **April Bigelow** quoted saying that over the next 10 years, it is estimated to have largest increase in diabetic elderly will be those >75 years old.[28]

In the present study most of the elderly subjects were in age group of 60-70 years with mean age 67.14± 6.83 with 1:0.78 female (55.9%) to male (44.1%) ratio. 68.7% were having sedentary lifestyle and 66.2% were vegetarian. One third of the subjects were educated upto matric, 55.7% belonged to middle class III. A study reported by **Shanley Chong** shows similar findings on adults >45 years depicting the incidence of DM increases with aging with

average age 61.8±10.5 years. With female diabetics more than half (54.5%), one third had not completed high school education.[29] Similar results were quoted by **Archana Jain** the prevalence rate of T2DM in elderly population was 30.42% and equal numbers of both the sexes are affected, the ratio being-(1:0.97).[8] Another study by **Steven R Gerbert** reported that number of elderly diabetics is steadily growing and is currently estimated at 13%. Half of the currently affected individuals are > 60 years of age, with the highest prevalence found in those > 80 years of age. Furthermore, there will be a shift in demography over the next few decades of the geriatric population will be ≥ 75 years of age.[30]

The present study revealed that 44.03% of the subjects had onset of DM type 2 in the age group of 45-60 years with ***53.81± 9.52*** mean and 56.7% having >10 years in duration of present illness (***13.06±7.41)*** with 53.9% of subjects having duration of treatment of >10 years (***12.64±7.68***). Similar reviews were reported by **Seema Abhijeet** conveying an upsurge in number of early-onset diabetes cases responsible for the development of various diabetic complications due to longer disease duration[31]. A study by **Vishvanathan** reported A total of 6168 subjects with diabetes (95.8% type 2), mean age 51.9 ± 12.4 years and mean duration of diabetes, 6.9 ± 6.4 years and reported that diabetes control in individuals worsens with longer duration of the disease (9.9±5.5 years)[32]. Another multicentric study by **Archana jain** reported mean duration of diabetes, 6.9 ± 6.4 years[8]. The findings were also supported by **Chaudhary et al. (2010)[33]** conducted a study on evaluation of lifestyle modifications in diabetic patients, the researcher concluded that most (72.5%) subjects were having duration of diabetes from less than 10 years and 44.4% subjects had no family history of diabetes.

The present study depicted 73.6% subjects had past medical illness and half of the population had family history of diabetes mellitus type 2 with 47% having mother as the predominant relation with family history of diabetes. A study by **Susan Hariri (2006)[34]** reported that there was a graded increase in diabetes prevalence with increasing family history-based risk. These findings also support previous studies demonstrating that family history is a strong and independent risk factor for diabetes (Harrison TA et al 2013, O'Rahilly etal 2005, Newell AM, 2004, Arsalanian SA 2005). However, familial risk must be evaluated in the context of other known or suspected risk factors. These findings indicate that a high familial risk may increase diabetes risk in males, young, and the lean.

It is well known that obesity is an important cause of increasing insulin resistance and prevalence of diabetes in the Indian population. In the present study the baseline clinical parameters of elderly subjects revealed the mean weight (74.87±16.03) showed the mean BMI (27.95±5.49) as overweight. WC (1.05±13.34) and WHR (0.95±0.06) was also falling in high risk category for the subjects. **Sue Kirkman (2012)[39]** Older-age–onset diabetes is more common in non-Hispanic whites and is characterized by lower mean A1C and lower likelihood of insulin use than is middle-age–onset diabetes. BMI on average is 3 to 5 units lower in rural compared to urban areas in India. In one large study by **Shah B (2010)[40]**, prevalence of obesity (BMI>25) was 3 times higher and diabetes was 2 times higher in urban India compared to rural India. **Bansal P et al.** (2014)[41] revealed that more than half (55.7%) of diabetic subjects were obese, 24.7% had normal B.M.I, 15.7% were overweight and only 3.9% were underweight. **Misra A. et.al**. (2009)[42] reported higher BMI (26.5 ± 4.5kg/m2) in this study. Furthermore, waist circumference (WC), which is a better predictor of diabetes and obesity-related cardiovascular risk factors than BMI, was also high (than the cut-off proposed for the Indian population).

The present study showed the mean glycemic values above normal range values for FBS (156.01±33.70), RBS (243.77±63.73) and Hb1Ac (7.74± 0.53). The mean Systolic (138.93±13.58) and diastolic blood pressure (83.14±8.06) were slightly higher than normal. A study by Vishvanathan reported subjects with diabetes (95.8% type 2), mean age 51.9 ± 12.4 years and mean duration of diabetes, 6.9 ± 6.4 years were included. Mean HbA1c was 8.9 ± 2.1% and the mean fasting (FPG), post prandial (PPG) and random (RBG) plasma glucose levels were 148 ± 50 mg/dl 205 ± 66 mg/dl and 193 ± 68mg/dl respectively. The **DiabCare-Asia-India (2001)[43]** reported poor glycaemic control in over 50% of the study population with mean HbA1c (8.9 ± 2.8%) that is almost 2% higher than the ADA recommended target. **Selvin E** (2006)[44] reported that age-related DM is characterized by lower A1C and the use of less insulin, with frequent occurrence in non-Hispanic whites.

The present study showed that 93.82% prevalence of Diabetes related complications among elderly diabetics. Most common complication reported was (84.2%) retinopathy followed by 72.4% of the subjects suffering with cardiovascular diseases and neuropathy ranked third in the occurance of complications. 35.3% subjects reported

hypoglycemia and only 4.93% of the subjects reported diabetic foot. **Selvin E** (2006)[44] reported patients over 75 years of age have a higher risk of developing multiple complications than the age group of 65-74. He also reported a comparison of adults with diabetes diagnosed in middle age, the retinopathy story is more prominent in late-onset diabetic cases, and interestingly there is no difference in prevalence of cardiovascular disease (CVD) or peripheral neuropathy according to age at onset. **Li Y(2012)[16]** in a study on diabetic adults reported an increased development risk of lower extremity amputation, myocardial infarction (MI), impaired vision and end-stage renal disease. Patients over 75 years of age have a higher risk of developing multiple complications than the age group of 65-74.

Another similar study by **Vishvanathan Mohan et al. (2014)[32]** reported diabetic complications increased with mean duration of diabetes in years and maximum number of diabetic complications was observed with a greater duration of diabetes. **Mohan V. Venkatraman** (2010)[45] reported that patients with diabetes are known to have a two to four times increased risk for developing cardiovascular disease and CVD has been reported to occur two to three decades earlier in these patients as compared to the non-diabetic population. **Shahram Basity (2014)[46]** reported about diabetics from Iran reported 58% of the diabetics suffers from multiple complaints, 41% are suffering from B.P followed by 23% with Knee pain.

Present study revealed that 44.4% of the subjects were following average lifestyle modifications followed by 41.2% below average. 2.9% of the elderly were only following good lifestyle modification with mean lifestyle modification 20.16 ± 4.34 at 50.6% mean percentage. The least modified components were physical activity (29%) followed by stress management (32.4%) and Dietary modifications (41.6%). A study conducted by **Maina et al.** (2011)[47] on the contrary the study results revealed that 41% and 59% had good and bad practices in relation to diabetes prevention respectively. Another similar study conducted by **Ikombele, Botomwito (2011)**[48]revealed that 97.7% of subjects had bad practices, 1.4% had good practices and only 0.9% had very good practices.

Physical activity considerably helps lowering the blood sugar levels. The **ADA guidelines** recommended physical activity for elderly is considered to be moderate exercises like brisk walking for atleast 3-5 days per week for atleast 150 minutes per week (Colberg SR et al 2016). The subjects were walking an average of 0.63±0.84 km per day for atleast 2.25 days per week (i.e. 1.41 km per week) and 12.32±14.65 minutes per day. Another study reported similar finding that physical activity taken up by subjects in the study were walking for mean 12.87 min per week. Another study reported that response to the lifestyle changes (low fat diet and 150 min/wk exercise) by the elderly diabetic group were found to be higher than the young diabetic age group according to the **Diabetes Protection Program (DPP).**

J Kishore reported that 61.2% in rural area said that they do exercise. Out of which 68.3% in rural area use to do exercise daily. As per dietary practices, 83.6% replied about following diabetic diet. Out of which 51.7% used to follow DM diet always.

In present study the 60-70 years of age (p=0.01), educated subjects (p=0.00), Sikh religion (p=0.04), joint family (p=0.006) and those who were at moderate level of lifestyle pattern (activity) (p=0.000) were significantly associated with Lifestyle modifications scores. A similar study conducted by **Chaudhary, et al. (2010)[33]** reported the association of lifestyle modifications with gender (p=0.002), education (p=0.038) and medication (p=0.004) but. One more study conducted by **Ansari (2009)[49]** revealed that there was no significant interaction of Lifestyle modification with between age, BMI, gender and total physical activity. In the ADVANCE trial, there was no increased risk of mortality in the strict glucose control group after 5 years of follow-up. Furthermore, there was no statistically significant decrease in cardiovascular risks in the group receiving intensive treatment, however, a significant decrease in the incidence of nephropathy was found.[49]

In the present study subjects who had <5 years of treatment duration (p=0.008), history of past illness (p=0.00), no DM complication (p=0.000) and overweight subjects (p=0.006) had a significant association with Lifestyle modification scores. **Norris SL (2002)[50]** reported Changes in glycated hemoglobin level generally corresponded to changes in weight and were not substantial when between-group differences were examined. The **UK Prospective Diabetes Study (UKPDS)[51],** provided valuable evidence of the benefits of glycemic control on microvascular complications on middle-aged patients with newly diagnosed type 2 diabetes. Microvascular benefits persisted during the post-trial follow-up period, and statistically significant reductions in both mortality and MI's emerged, referred to as the "legacy effect" of early glycemic control. **Hollman RR et al (2008)[52]**

The present study shows that the elderly subjects who were following good lifestyle modifications showed better control over fasting blood glucose (FBS) levels (p=0.08) and random blood glucose levels (RBS) (p=0.03) and no significant association with Hb1Ac. **Park JS** [53] found that type 2 diabetes comprehensive lifestyle modification program may lead to clinical improvement in glycemic control and reduce the stress response. Similarly supported by **Sone H et al 2002**[54] showing that **t**he effect of lifestyle modification on improving the glycemic controls of type 2 DM patients was small but significant in three years after initiation of the lifestyle modification intervention.

Park JS[8] reported higher lifestyle modification scores, flexibility, grip strength, back lift strength and quality of life among elderly with type 2 diabetes. However no difference in body fat percentiles, blood sugar and serum cholesterol between experimental groups (recieving health promotion program) that control group.

Another study by **Mau MK et al., 2010**[11] supporting the results say 6 months of intensive life style modification interventions on metabolic parameters in patients with DM Type 2would result in significant reduction in fasting blood glucose, random blood glucose, BMI, systolic blood pressure**.**

Conclusion & Recommendations:-

It was concluded that lifestyle modification among elderly population with diabetes mellitus type 2 residing in rural area were following average to below average lifestyle modification. Modifications on the physical activity was very limited with walking an average of less km per day for atleast 2.25 days per week and less than 13 minutes per day. Lifestyle modification scores were significantly associated with age, educated subjects , Sikh religion , joint family and those who were at moderate level of lifestyle pattern, those <5 years of treatment, history for past illness, subjects with no DM complication , overweight subjects. The subjects following good lifestyle modifications showed better control over fasting and random blood glucose levels ($p<0.05$).

Therefore, it is recommended to provide an individualized face-to-face counselling sessions at regular intervals to bring lifestyle modifications in order to manage diabetes effectively to lead a complication free health life ahead and nurses can contribute effectively. The study can be further carried out to assess the effect of face to face counseling sessions on lifestyle modifications and health seeking behaviour among DM type 2 elderly population.

Table I:- Socio demographic profile of elderly with DM type 2 residing in rural area

N=243

Variables	*Total f (%)*
Age (years) [1]	
60-70	*162 (66.7)*
70-80	*061 (25.1)*
>80	*020 (08.2)*
Gender	
Male	*107 (44.8)*
Female	*136 (55.9)*
Marital status	
Married	*209 (86.0)*
Widow/Widower	*034(14.0)*
Education Status	
Illiterate	*47 (19.4)*
Primary	*75 (30.9)*
Matric	*82 (33.8)*
Secondary	*10 (04.2)*
Graduation & above	*28 (11.5)*
Occupation	
Agriculture	*51 (20.9)*
Business	*09 (03.7)*
Homemaker	*136 (55.9)*
Retired	*23 (09.4)*
Nil	*26(10.6)*

Religion	
Sikh	*229 (94.2)*
Hindu	*14 (05.7)*
Type of Family	
Nuclear	*63 25.9)*
Joint	*174 (71.6)*
Extended	*06 (02.4)*
Lifestyle Pattern	
Sedentary	*167 (68.7)*
Moderate	*76 (31.2)*
Heavy worker	*0*
Dietary pattern	
Vegetarian	*161 (66.2)*
Non-vegetarian	*76 (31.2)*
Eggetarian	*06 (02.4)*

Mean Age: 67.14±6.83

Table II:-Frequency percentage distribution of elderly population with diabetes mellitus type 2 as per baseline health information

N=243

Variables	*f (%)*	*Mean ±SD*
Present history of DM type 2		
Age of onset(in yrs)		
30-45	63 (25.92)	
45-60	107 (44.03)	*53.81±9.52*
>60	73 (30.03)	
Duration of illness (in yrs)		
1-5	27 (11.11)	
5-10	77 (31.68)	*13.06±7.41*
>10	138 (56.79)	
Duration of Treatment(in yrs)		
No treatment	06 (2.46)	
<5	24 (9.87)	*12.64±7.68*
5-10	82(33.74)	
>10	131 (53.9)	
History of present illness		
Yes	183 (75.30)	-
No	60 (24.69)	

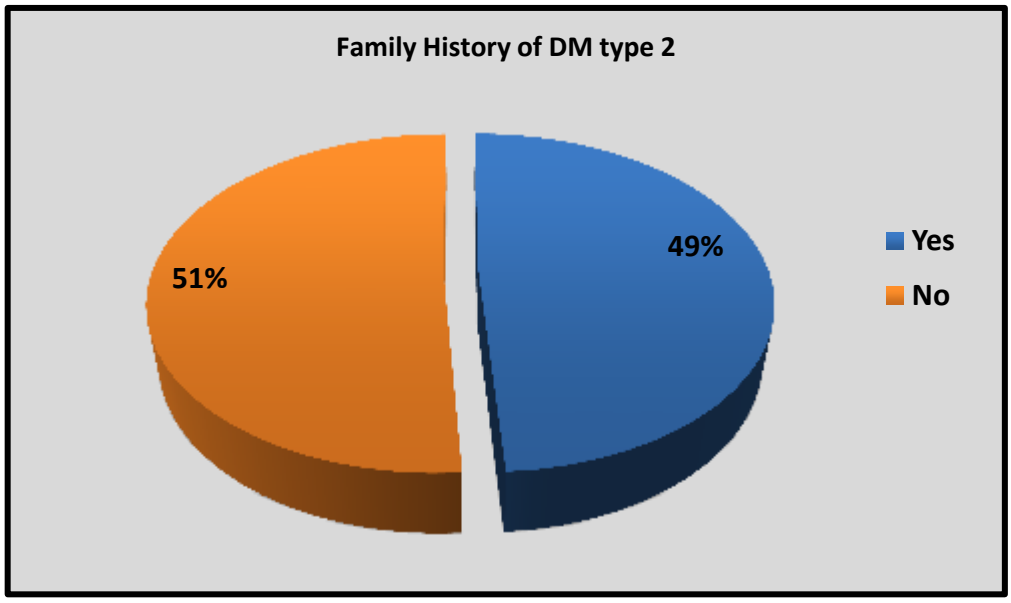

Fig 1:-Percentage distribution of elderly with DM type 2 as per the Family History of Diabetes

Table III:-Mean distribution of Baseline Clinical profile of elderly population with DM type 2 elderly residing in rural area **N=243**

Clinical Parameters	**Mean ± SD**
Anthropometric measurements	
Height (cm)	163.25± 8.56
Weight (Kg)	74.87±16.03
BMI (Kg /m^2)	27.95±5.49
Waist Circumference (cm)	1.05±13.34
Waist /Hip ratio	0.95±0.06
Blood glucose levels	
FBS	156.01±33.70
RBS	243.77±63.73
Hb1ac	7.74± 0.53
Blood Pressure measurements	
Systolic BP	138.93±13.58
Diastolic BP	83.14±8.06

Table IV:-Baseline Lifestyle modification of elderly subjects with DM type 2 residing in rural area.

N=243

Lifestyle pattern	**Scores**	**Frequency**	**Freq. %**	**Mean ±SD**	**Mean %**
Good	>30	7	2.9	**20.16 ± 4.34**	**50.4%**
Average	20-30	108	44.4		
Below average	14-20	100	41.2		
Poor	<14	28	11.5		

Min score= 00 Max score= 40

Table V:-Mean distribution of Lifestyle Modification of elderly population with DM Type 2 as per each component

N=243

Lifestyle Modification	**Max. Score**	**Mean ± SD**	**Mean %**	**Rank**
Physical activity	4	1.16±1.13	29	8
Diet	11	4.58±2.12	41.6	6

No smoking	1	1.00±0.00	100	1
Non Alcoholics	1	0.94±0.23	94	2
Personal care	9	5.16±1.78	57.33	5
Stress management	5	1.62±0.86	32.4	7
Treatment	8	5.13±1.32	64.1	3
Health learning	1	0.59±0.49	59	4

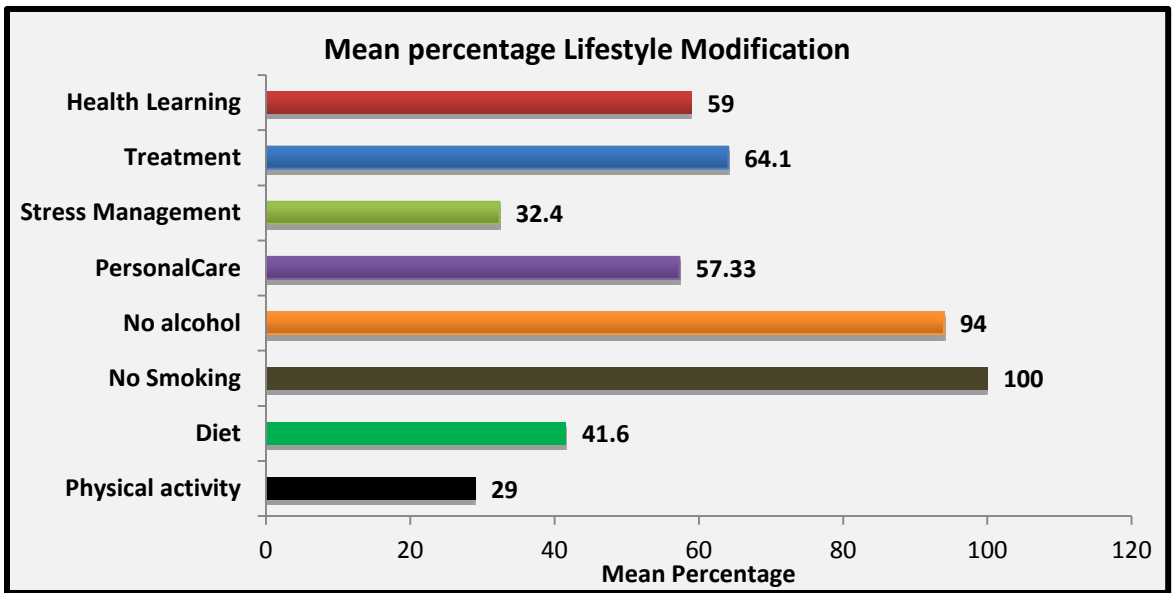

Fig 2:-Mean Percentage distribution of various components of Lifestyle modifications

Table VI:-Mean distribution of Lifestyle Modification Of DM Type 2 Patients as per physical activity performed per week (Walk in km per day, days per week, and minutes of walk per day) N=243

Physical activity	**Mean±SD**
Walk (km/day)	**0.63±0.84**
Days/wk	**2.25±1.5**
Minutes/ day	**12.32±14.65**

Table VII:-Association of lifestyle modifications with socio demographic variables.

Sample characteristics	**N**	**Mean ± S.D**	**F/t**	**p value**
Age (years) [1]			4.26	0.01*
60-70	162	20.51± 4.41		
70-80	061	20.11± 4.38		
>80	020	17.55± 2.45		
Gender				
Male	107	20.22± 4.86	0.031	0.86^{NS}
Female	136	20.12± 3.89		
Marital status			0.05	0.82^{NS}
Married	209	20.14± 4.46		
Widow/Widower	034	20.32± 4.52		

Education Status			5.69	0.000*
Illiterate	47	19.63± 4.31		
Primary	75	19.06± 3.60		
Matric	82	20.53± 4.26		
Secondary	10	22.50± 4.24		
Graduation & above	28	23.66± 5.59		
Religion			3.11	
Sikh	229	20.24± 4.36		
Hindu	14	18.15± 2.88		0.046*
Type of Family			5.26	
Nuclear	63	21.6 ±6.67		0.006*
Joint	174	19.6±3.22		
Extended	06	20.0 ±0.00		
Lifestyle Pattern			16.65	
Sedentary	167	19.42±3.87		0.000*
Moderate	76	21.80± 4.85		
Heavy worker	0	-		
Dietary pattern				
Vegetarian	161	19.75± 4.08	2.16	0.09^{NS}
Non-vegetarian	76	21.15± 4.85		
Eggetarian	06	18.00± 0.56		

NS- Not significant at p>0.05 *Min LM Score 00*
**Significant at p<0.05* *Max LMScore 40*

Table VII:-Association of Lifestyle modifications with clinical profile

Sample characteristics	N	Mean ± S.D	F/t	p value
Age of onset(in yrs)				
30-45	63	20.63±3.89	1.21	0.298^{NS}
45-60	107	20.32±5.00		
>60	73	19.53±3.57		
Duration of illness (in yrs)				
1-5	27	21.29±5.04	1.49	0.21^{NS}
5-10	77	19.71±4.59		
>10	138	20.15±4.01		
Duration of Treatment(in yrs)				
No treatment	06	18.00±3.09		
<5	24	22.29±5.09	3.98	0.008*
5-10	82	19.24±4.27		
>10	131	20.45±4.13		
History of present illness				
Yes	183	19.59 ± 3.97	13.58	0.000*
No	60	21.91 ±4.94		
DM Complication				
Yes	228	19.75± 3.89	37.95	0.000*
No	15	26.40± 5.97		
BMI				
Normal range	99	20.23±5.04	8.78	0.000*
Overweight	81	21.41±3.53		
Obese	63	18.46±3.50		

NS- Not significant at p>0.05 *Min LM Score 00*
**Significant at p<0.05* *Max LMScore 40*

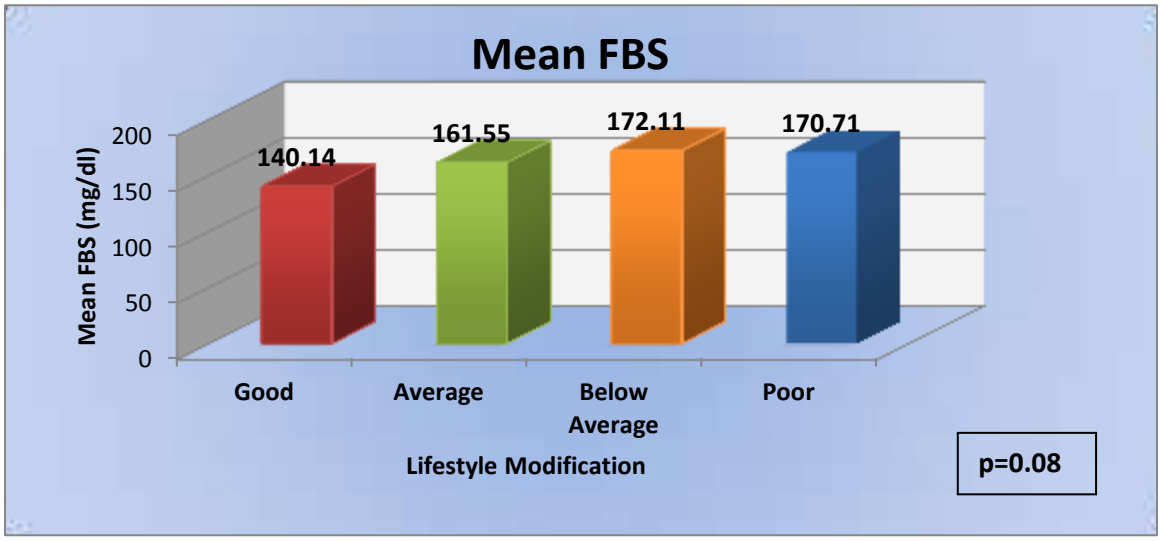

Figure 3:- Association of levels of lifestyle modifications with Mean Fasting Blood Glucose (mg/dl)

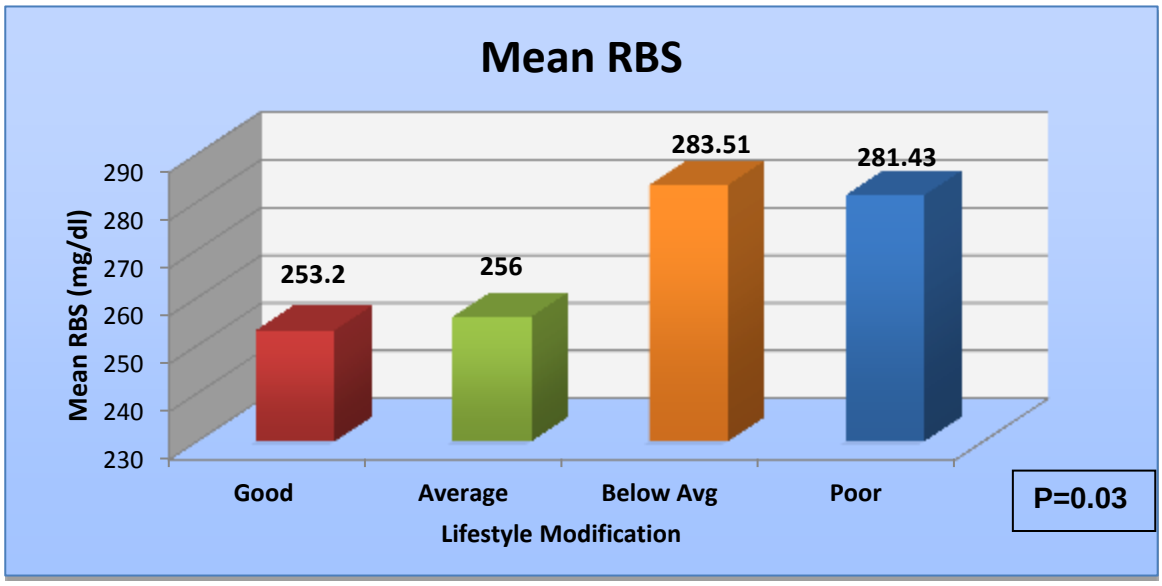

Figure 4:- Association of levels of lifestyle modifications with Mean Random blood sugar (mg/dl)

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