RESEARCH PAPER

Impact of Health Education and Preventive Interventions on Non-Communicable Diseases in Rural Communities: A Community-Based Randomized Controlled Trial

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ABSTRACT

Background: Hypertension, diabetes, and obesity are among the most common non-communicable diseases (NCDs) affecting people today. These conditions require continuous management because they persist for long periods if not properly controlled. The treatment process needs multiple approaches because medication alone fails to provide suitable results. Patients face difficulties in understanding their medical conditions which leads them to skip their prescribed treatments while continuing their unhealthy habits. Factors such as inadequate awareness and poor lifestyle practices make it difficult to achieve optimal disease control. The process of structured health education provides essential support that helps patients learn about their health conditions and improves their treatment compliance which results in better health results. **Methods:** The two groups are compared, common in both groups is standard treatment, in the intervention group both treatment and counseling, in those who are supposed to be sticking to their treatment, how to use drugs cleverly especially when one is taking several drugs, understanding the risks of the disease, taking care of yourself at home, changing lifestyle habits, how to reduce stress, and getting active through exercise. The control group only had standard treatment. They checked all of them at the beginning and then later on, looking at clinical things such as blood pressure or blood sugar. **Results:** The educational program results showed that people who participated in the program achieved better outcomes than those who did not. The study found that blood pressure control for hypertension showed significant improvement according to statistical analysis. Diabetes had better sugar levels too, and for obesity, things like body mass index went down positively. Better medication adherence, increased risk awareness, and making healthier practices all had a part. The control group was not genuinely change much, although they did make a few improvements. **Conclusion:** the conclusion is it appears that implementing these preventive and interventions along with the standard care significantly improves the management among these diseases. The control group not improving much just highlights why this kind of approach is key for taking care towards non-communicable diseases.

KEYWORDS: Hypertension; Type 2 Diabetes Mellitus; Non- communicable diseases; Body mass index.

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INTRODUCTION

Hypertension is a Chronic medical condition that is marked by persistently high arterial blood pressure and is one of the most pivotal adjustable threat factors for cardiovascular conditions, stroke. It's estimated that 1.28 billion grown-ups aged 30- 79 times worldwide are living with hypertension, with nearly two- thirds of them living in low- and middle- income countries [Mills KT, Stefanescu A, He J. 2020]. Hypertension presents a major public health problem in India because it affects approximately 220 million adult citizens of the country. The actual size of the problem becomes apparent through this extremely vast number. The disease management process becomes more difficult because almost 50% of people with high blood pressure either go undiagnosed or liable. In rural areas, where the population was before allowed to be at lower threat, there has been vast expansion in the frequence of hypertension due to life changes, corrective habits, increased sampling input, and dropped physical exertion.

Type 2 Diabetes Mellitus(T2DM) is a habitual metabolic condition that is associated with insulin resistance and

progressive dysfunction of the pancreatic β- cells, leading to hyperglycemia. According to the International Diabetes Federation (IDF), 537 million grown-ups worldwide were living with diabetes in 2021, and this is anticipated to rise [Sun H, et al. 2021] to 783 million by 2045, with over 90 of these cases being T2DM. India has one of the heaviest burdens over this condition, with over 100 million people affected. The rising frequence in rural India is a result of changes in salutary patterns, physical inactivity, and inheritable predilection of South Asians to develop diabetes at lower situations of body mass indicator (BMI) [Anjana RM, et al. 2017] compared to Westerners. T2DM is a major contributor to microvascular complications like retinopathy, nephropathy, and neuropathy, as well as macrovascular complications like coronary roadway complaint and stroke [Diabetes Care 2024;47(Suppl. 1): S1–S4].

Rotundity, which is the abnormal or inordinate accumulation of fat that poses a trouble to health, is one of the major contributing factors for both hypertension and T2DM. The worldwide frequence of rotundity and fat has nearly tripled since 1975[Bluher M. 2019], and it's now also being seen in rural areas due to the transition towards high- calorie diets and reduced physical exertion. In India, the frequence of fat and obesity is leading among both grown-ups and adolescents, leading to the early development of metabolic diseases [Lancet 2020; 396: 1223–49]. Visceral rotundity, or abdominal rotundity, is a major threat factor for insulin resistance, hyperlipidemia, and hypertension, which are the central factors of metabolic pattern [Lancet 2020; 396: 1223–49].

The co-existence of hypertension and diabetes significantly potentiates the threat of cardiovascular morbidity and mortality. Hypertension with diabetes accelerates the process of vascular injury due to endothelial dysfunction, oxidative stress, and habitual inflammation, therefore prepping to myocardial infarction, stroke, and renal failure [Unger T, et al. 2020].

Studies have shown that nearly 40- 60 of cases with T2DM also have hypertension, therefore making their comprehensive operation imperative [Diabetes Care 2024;47(Suppl. 1): S1–S4]. also, the co-existence of hypertension and rotundity further potentiates the cardiovascular load due to sympathetic stimulation, activation of the renin- angiotensin- aldosterone system, and vascular redoing [Williams B, et al. 2018]. When hypertension, diabetes, and rotundity co-occur, the overall cardiometabolic threat significantly escalates, therefore prepping to early complications and poor quality of life.

In pastoral settings, the co-morbidities are affected by low health knowledge, late opinion, artistic food habits, poor preventative webbing, and poor durability of care. Despite the sweats of public programs like the NPCDCS, the perpetration poverties continue in pastoral settings. There's substantiation that systematized health education programs emphasizing diet change, swab restriction, physical exertion, weight control, stress operation, drug compliance, and regular follow- up visits can make a substantial difference in threat factor revision and control of conditions [Eckel RH, et al. 2014, Schulz KF, et al. 2010]. preventative programs in pastoral settings, similar as screening camps, behavioral changes, support groups, and training of community health workers, have proved to be effective in perfecting mindfulness, early discovery, and tone- care practices.

Because of the interlinkages among hypertension, diabetes, and rotundity, comprehensive and culture-specific interventions at the community position are needed. A Community based Randomized Controlled Trial, health education and preventive measures for improvement in the participants [Schulz KF, et al. 2010]. Through the revision of behavioral determinants, early discovery, and bettered tone- operation practices, the interventions have the eventuality to lower the complaint burden and ameliorate quality of life. Substantial evidence was provided by this study demonstrating the effectiveness of the Medication Therapy Management (MTM) interventional strategy at improving clinical outcomes in the patients with hypertension and with type 2 diabetes mellitus (T2DM) [Ugandar, et al.2025].

Therefore, the current study, named " Impact of Health Education and preventative Interventions on Non-Communicable conditions in Rural Communities A Community- Grounded randomized Controlled Trial, " aims to estimate the effectiveness of health education and preventative strategies in the operation of hypertension, diabetes, rotundity, and their co-morbid conditions(hypertension with diabetes, hypertension with rotundity, and hypertension with diabetes and rotundity) in pastoral communities.

METHODS

Study Design: It is a Randomized Control Trial (RCT) (Schulz KF et al. 2010) conducted over a period of 6 months, involving patients diagnosed with Hypertension, Diabetes, Obesity, Hypertension with Diabetes, Hypertension with Obesity and Hypertension with Diabetes with Obesity. Patients were selected from the medical camps of the various places of the General Medicine department at Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India.

Sample Selection: The sample size (Chow S-C, Shao J, Wang H. et al. 2018) was planned for 124 subjects, with 62 in the intervention group and 62 in the control group (Lenth RV 2001). Both groups were again divided into 6 subgroups (Julious SA. 2005) depending on the severity of Hypertension, Diabetes, Obesity, Hypertension with Diabetes, Hypertension with Obesity and Hypertension with Diabetes with Obesity. (Biau DJ, Kernéis S, Porcher R. 2008)

Statistical Methods

Total Sample Size (n): $n = ((Z\alpha/2 + Z_\beta/2)^2 \times 2 \times \sigma^2) / \delta^2$

where:

$Z\alpha/2$ = Z-value for the desired confidence level
$Z_\beta/2$ = Z-value for the desired power
σ^2 = Variance of the outcome measure
δ = Minimum expected effect size
Number of samples in each group = n group = n/2
Total sample of taken sub groups: n total = 124/2 = 62

Ethical approval statement

The study was approved by the institutional ethics committee by the santhiram medical college and general hospital, Nandyal, A.P., India with the certificate of approval reference number IEC/SRMC/SRCP/RESEARCH/158/2025.

Inclusion criteria

- Patients who have the selected non-communicable diseases.
- Patients age group of 18-90 years.
- Patients who are willing to join the study & given written informed consent from.

Exclusion criteria

- Patients who have communicable diseases.
- Patients < 18 years of age group.
- Patients who are unwilling to join the study & given written informed consent from.

Randomization procedure

Participants who satisfied the eligibility criteria were randomly allocated to either the intervention group or control group using a computerized randomization technique. A simple randomization method was employed to ensure equal probability of assignment to each study arm. Random numbers were generated using a computer-based random number generator, and participants were assigned in a 1:1 allocation ratio to either the intervention group (n = 62) or the control group (n = 62).

To minimize allocation bias, the randomization sequence was prepared in advance by a researcher who was not directly involved in participant recruitment are outcome assessment. The allocation sequence was concealed using sequentially numbered, opaque, sealed envelopes (SNOSE). After enrolment and basement assessment, each participant was assigned to the respective study are according to the order of the sealed envelopes. Participants in the intervention group received structured health education, life style modification counselling, medication adherence support, and follow up monitoring, whereas the control group receive standard medical care without structured educational intervention. Randomization ensured that baseline demographic and clinical characteristics were distributed evenly between the two groups.

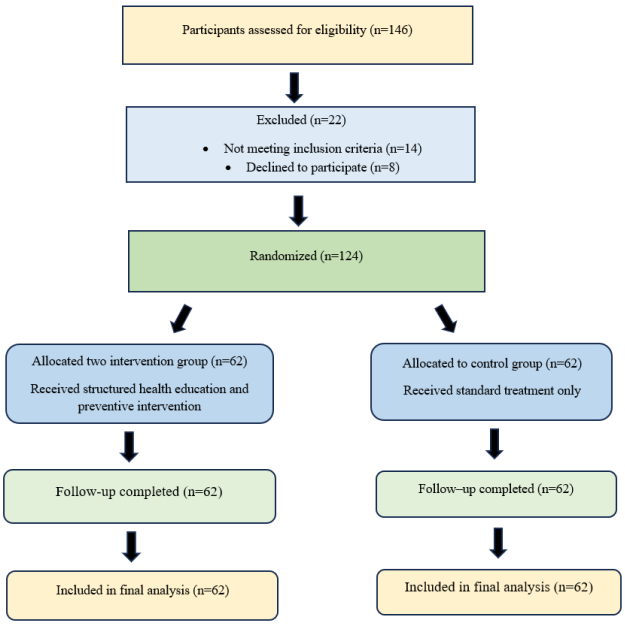
Blinding

Because the intervention involved structured patient education and behavioral counselling, complete blinding of participants and health care providers was not feasible. Therefore, the study followed a single-blind design, in which the investigators responsible for data analysis and outcome evaluation were blinded to the allocation of participants. Outcome measures such as Blood pressure readings, fasting blood glucose levels, HbA1c values, and body mass index (BMI) were obtained from clinical records and laboratory reports using standardized procedures. The data were coded prior to statistical analysis so that the statistician analysing the results was unaware of group allocation. This procedure was implemented to reduce detection bias and analytical bias.

Software used

Data were analysed using IBM SPSS Statistics version 25.0 (IBM corp., Armonk, NY.USA). Continuous variables were expressed as mean ± standard deviation. Differences between baseline and follow-up values were analysed using paired t-tests, while comparisons between intervention and control groups were performed using independent sample t-tests. A p-value of < 0.05 was considered statistically significant.

CONSORT DIAGRAM



The study followed the CONSORT (consolidated standards of reporting trials) guidelines for reporting Randomized control trials the flow of participants through this study stages included screening, enrolment,

randomization, allocation, follow-up, and analysis. A total of 146 individuals initially screened for eligibility during community health screening camps conducted in rural areas associated with Santhiram Medical College and General Hospital. After applying the inclusion and exclusion criteria, 124 eligible participants were enrolled in the study. The enrolled participants were assigned into two groups: Intervention group (n=62); Control group (n=62).

All participants underwent baseline clinical assessment including measurement of blood pressure, fasting blood glucose, HbA1c and BMI. Participants in the intervention group received structured health education, life style counselling, and regular follow-up during the 6 months study period. While the control group continued to receive routine standard care. During the follow-up period all the participants were monitored periodically for clinical outcomes. At the end of the study, the data from all 124 participants were included in the final analysis to evaluate the effectiveness of the intervention in improving the management of Hypertension, Diabetes Mellitus, Obesity and they associated co-morbidities conditions.

Interventional Protocol Design and Details

Participants assigned to the intervention group received a structured health education and preventive intervention program in addition to the standard medical treatment prescribed by physician. The intervention was designed to improve disease awareness, medication adherence, life style modifications, and self-management practices among patients diagnosed with Hypertension, Diabetes Mellitus, Obesity and their associated with co-morbid conditions. The interventional program was implemented over a six-month follow-up period and was coordinated by trained clinical pharmacists and health care professionals.

The structured intervention consists of the following components

1. Health educations and disease awareness

Participants received individualized educational sessions aimed at improving their understanding of non-communicable diseases and their associated complications. Educational discussions focused on: Nature and causes of Hypertension, Diabetes, and Obesity. Risk factors associated with uncontrolled disease. Importance of early detection and routine monitoring. Potential complications such as cardiovascular disease, stroke, nephropathy and neuropathy.

2.Medication Adherence Counselling

Patients were counselled regarding in the appropriate use of prescribed medications. The counselling sessions addressed: correct dosage and timing of medications. Importance of regular medication adherence. Potential adverse drug reactions and management strategies. Risks associated with polypharmacy in patients with multiple co-morbidities. Participants were encouraged to maintain medication schedules and report any adverse events during follow-up visits.

3.Life style modification guidance

Participants were advised regarding life style modifications aimed at improving metabolic health and disease progression. The life style intervention included: Reduction of dietary salt intake for hypertension control, Adoption of balanced and calorie-controlled diet plans, Increased consumption of fruits, vegetables and fiber rich foods, reduction in consumption of processed foods, saturated fats, and refined sugars, participants were also advised to smoking excessive alcohol consumption.

4.Physical Activity Promotion

Participants were encouraged to engage in regular physical activity appropriate to their health status. The recommended physical activity included: Obese patients should walk risk walking for 30 to 45 minutes every day they should practice light aerobic exercise and weight management activities. Patients should start with low-intensity activities and progressively build their physical activity until their body reaches its maximum capacity.

5.Self-Monitoring and Follow-Up

The participants learned self-monitoring methods that help them manage their chronic health conditions. The program included three monitoring activities which required participants to track their blood pressure and blood glucose levels and body weight and body mass index. The medical team conducted follow-up visits at scheduled times to assess patient development while they supported the patient in maintaining their behavioral modifications.

Control Group Protocol

Participants in the control group receive standard medical care according to the routine treatment protocols followed in the hospital. They were managed with prescribed pharmacological therapy but did not receive structured educational counselling or life style intervention sessions during the study period.

Outcome Assessment

Clinical outcomes were evaluated by comparing baseline measurements and follow-up values obtained during the study period. The primary outcomes variables included: Systolic and Diastolic blood pressure, blood glucose levels, Glycated hemoglobin (HbA1c) levels, Body mass index (BMI). These outcomes were measured using standardized clinical procedures and laboratory

investigations to assess the effectiveness of the intervention.

RESULTS

The development of hypertension occurs due to multiple factors which include both lifestyle habits and dietary practices and medication adherence and psychosocial factors. Many clinical settings see patients who need standard treatment but their blood pressure remains uncontrolled because they fail to take their medications properly and they do not make necessary lifestyle changes and they lack knowledge about how to manage their condition. The control group showed no statistically significant improvement which demonstrates that conventional treatment methods fail to work when health professionals do not include behavioral and educational components in their treatment of patients. The existing evidence proves that patients require both pharmacological therapy and lifestyle modifications to achieve optimal blood pressure reduction according to previous clinical studies which show that patients need to engage in their treatment.

The intervention group experienced a significant blood pressure reduction which resulted in lower systolic and diastolic blood pressure measurements. The study found that systolic blood pressure dropped by 7.55 mmHg while diastolic blood pressure decreased by 6.64 mmHg. The study found that both changes showed statistical significance because their p-values reached 0.033 and 0.021. The intervention group achieved statistically significant results which demonstrate that structured health interventions together with lifestyle counseling and regular medical follow-up enable better blood pressure management for patients who have hypertension. The implementation of behavioral interventions leads to better medication adherence for antihypertensive drugs while dietary changes occur because patients reduce their sodium intake and they increase their physical activity which results in better cardiovascular health outcomes.

Table 1. Hypertension-Control group

HYPERTENSION - CONTROL GROUP							
S.NO	AGE	SAMPLE SIZE		BASE LINE		FOLLOW UP	
		MALE	FEMALE	SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC
1	45	0	1	184	96	188	100
2	50	0	1	148	85	160	90
3	52	0	1	163	110	165	115
4	54	0	1	148	94	156	100
5	55	0	1	174	115	180	120
6	56	1	0	160	91	165	100
7	57	0	1	131	93	140	100
8	60	0	1	210	103	170	90
9	63	1	0	178	104	180	110
10	65	1	0	146	91	155	95
11	65	1	0	124	71	130	80

Table 1. **Hypertension-Intervention group**

HYPERTENSION - INTERVENTION GROUP							
S.NO	**AGE**	**SAMPLE SIZE**		**BASE LINE**		**FOLLOW UP**	
		MALE	**FEMALE**	**SYSTOLIC**	**DIASTOLIC**	**SYSTOLIC**	**DIASTOLIC**
1	**45**	**0**	**1**	**147**	**97**	**135**	**90**
2	**50**	**0**	**1**	**222**	**116**	**195**	**100**
3	**55**	**0**	**1**	**149**	**94**	**136**	**85**
4	**55**	**0**	**1**	**128**	**90**	**120**	**85**
5	**56**	**0**	**1**	**132**	**82**	**128**	**80**
6	**60**	**1**	**0**	**145**	**92**	**160**	**100**
7	**60**	**1**	**0**	**131**	**95**	**126**	**90**
8	**62**	**1**	**0**	**140**	**81**	**138**	**90**
9	**64**	**1**	**0**	**162**	**87**	**150**	**90**
10	**65**	**0**	**1**	**155**	**88**	**145**	**80**
11	**65**	**1**	**0**	**125**	**77**	**120**	**80**

The findings presented in **Table A** provide insight into the changes observed in systolic and diastolic blood pressure among patients diagnosed with hypertension who were assigned either to the control group or to the intervention group. The statistical evaluation indicates that participants who received only routine care in the

control group experienced only minor reductions in blood pressure values. The study found that systolic blood pressure decreased by −2.09 mmHg and diastolic blood pressure decreased by −4.00 mmHg yet these results did not achieve statistical significance because the p-values reached 0.638 and 0.211 for systolic and diastolic blood pressure respectively. The findings show that routine clinical management does not help patients with hypertension achieve short-term blood pressure control improvements.

The results from Table A and the accompanying graphical figures show that structured intervention strategies lead to better hypertension management. The targeted counseling and preventive guidance lead to patient improvements which show that educational and behavioral components must be included in clinical treatment plans. Healthcare professionals can help hypertensive patients achieve better long-term cardiovascular health by increasing their risk factor awareness and promoting healthy lifestyle changes and enforcing their medication schedules.

The research findings demonstrate that patients who receive combined treatment with medication and educational and lifestyle change support achieve better blood pressure results than those who receive only standard medical treatment. The research results demonstrate that structured intervention programs effectively prevent and manage hypertension while showing potential benefits for cardiometabolic disease management programs.

Table A. Statistical Significance for Hypertension Groups (Tables 1-2)

Outcome	Group	Mean Change (mmHg)	p-value	Interpretation
Systolic BP	Hypertension Control	−2.09	0.638	Not significant
Diastolic BP	Hypertension Control	−4.00	0.211	Not significant
Systolic BP	Hypertension Intervention	**7.55 reduction**	**0.033**	Significant
Diastolic BP	Hypertension Intervention	**6.64 reduction**	**0.021**	Significant

The graphical representation shown in Figure 1 further illustrates the difference in mean blood pressure changes between the control and intervention groups. The intervention group bars display greater blood pressure reduction results than the control group. The graph shows that the intervention strategy produced better blood pressure results than other approaches. The graphical presentation demonstrates how the intervention has clinical value because it shows that educational and preventive approaches increase treatment results beyond standard medical treatments.

Figure 1. Mean change in blood pressure in control group patients, Values represent the difference between baseline and follow - up measurements.

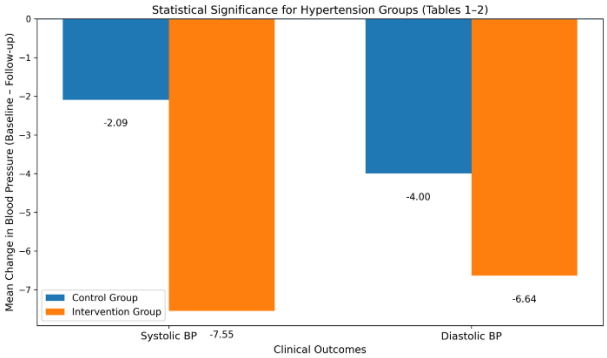
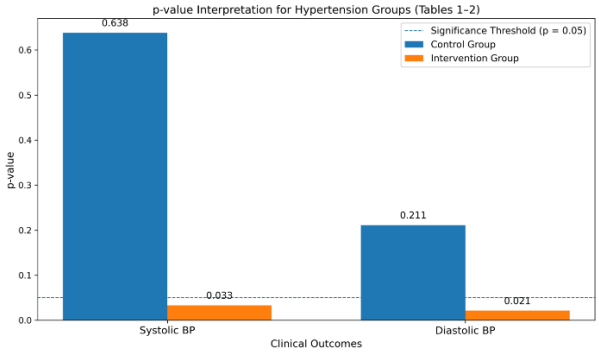


Figure 2 shows p-value comparisons between the two study groups for both systolic and diastolic blood pressure measurements to deliver deeper understanding of the statistical importance of these findings. The graphical depiction includes a reference threshold representing the conventional level of statistical significance (p = 0.05). The p-values corresponding to the intervention group fall below this threshold, confirming that the observed reductions in blood pressure are statistically meaningful. The control group shows p-values that stay above the significance threshold which leads to the conclusion that their observed blood pressure reductions resulted from natural random fluctuations instead of actual treatment effects.

Figure 2. Mean change in blood pressure in intervention group patients, Values represent the difference between baseline and follow -up measurements.



Diabetes management often requires a combination of pharmacological therapy and sustained lifestyle modification. While medications play a central role in regulating blood glucose levels, factors such as dietary

behaviour, physical activity, and patient awareness significantly influence overall glycemic outcomes. In many cases, individuals receiving routine care may continue to exhibit fluctuating glucose levels due to inconsistent adherence to dietary guidelines or limited understanding of the disease process. The lack of statistical significance observed in the control group therefore highlights the challenges associated with achieving effective glycemic regulation without additional supportive interventions.

In contrast, the intervention group demonstrated a substantially greater reduction in blood glucose levels, with a mean decrease of 30.36 mg/dL. The p-value for this change was less than 0.001, indicating a highly significant improvement in glycemic control. This pronounced reduction suggests that the structured intervention implemented during the study played an important role in improving metabolic outcomes among diabetic patients. Interventions that include health education, dietary counseling, and guidance on medication adherence can help patients better understand the importance of consistent disease management. When individuals become more informed about the impact of lifestyle choices on blood glucose levels, they are more likely to adopt behaviors that support effective glycemic regulation.

Table 3. Diabetes Mellitus - Control group

DIABETES MELLITUS – CONTROL GROUP					
S.NO	AGE	SAMPLE SIZE		BASELINE	FOLLOW UP
		MALE	FEMALE	VALUE	VALUE
1	46	1	0	210	230
2	49	0	1	320	350
3	50	0	1	349	375
4	52	1	0	186	200
5	55	0	1	200	180
6	58	1	0	192	176
7	58	0	1	151	178
8	60	1	0	167	150
9	60	0	1	242	269
10	64	1	0	280	300
11	72	1	0	147	130

Table 4. Diabetes Mellitus - Intervention group

DIABETES MELLITUS-INTERVENTION GROUP					
S.NO	AGE	SAMPLE SIZE		BASELINE	FOLLOW UP
		MALE	FEMALE	VALUE	VALUE
1	46	1	0	240	195
2	49	0	1	154	126
3	50	0	1	101	90
4	52	1	0	292	255
5	55	1	0	220	190
6	58	0	1	329	298
7	58	0	1	168	130
8	60	1	0	93	95
9	60	0	1	155	127
10	64	1	0	234	200
11	72	1	0	172	118

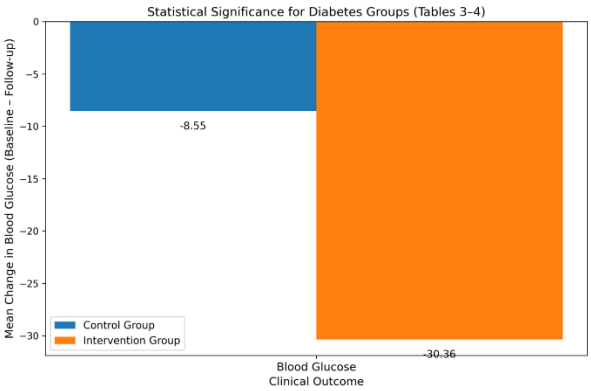
The table B results show how blood glucose levels changed between control and intervention groups tested on diabetes mellitus patients. The control group participants showed only minimal blood glucose decrease throughout the research period. The mean decrease of 8.55 mg/dL shows slight improvement in glycemic status but the p-value of 0.209 shows the change lacks statistical significance. The finding shows that typical treatment methods fail to provide evident glycemic control improvements during short evaluation time frames. The data in Table B and its graphical information shows that structured interventions lead to major improvements in diabetes mellitus treatment results. Educational programs that teach correct dietary habits and blood glucose checking and medication schedule adherence will positively impact metabolic health results. Patients receive knowledge and motivation through these programs which enable them to control their condition better and thus decrease their chances of developing long-term diabetes complications. The research results demonstrate that patient-centered education together with behavioral support must be included in diabetes management programs. The need for pharmacological treatment continues to exist but structured educational and preventive measures should be added because they improve glycemic control and lead to better disease management. The research findings demonstrate how integrated healthcare systems which handle both clinical and behavioral elements of chronic disease management will provide substantial advantages.

Table B. Statistical significance for Diabetes groups (Tables 3-4)

Outcome	Group	Mean Change (mg/dL)	p-value	Interpretation
Blood Glucose	Diabetes Control	−8.55	0.209	Not significant
Blood Glucose	Diabetes Intervention	**30.36 reduction**	**<0.001**	Highly significant

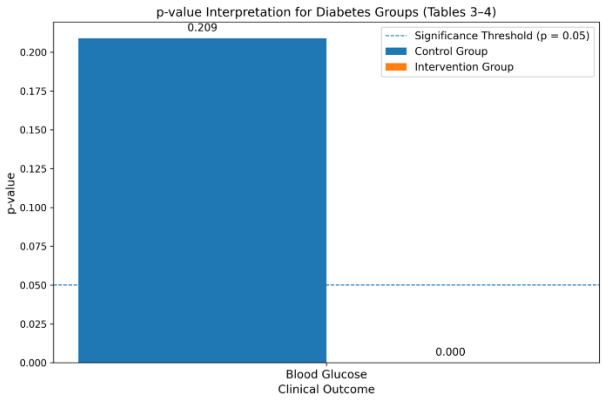
Figure 3 displays a graphical comparison of the average blood glucose level changes which occurred in both study groups. The figure demonstrates that the intervention group experienced a markedly larger decline in glucose levels than the control group. The bars show the extent of improvement which the intervention program helped participants achieve through its work. The visual representation demonstrates the statistical results which show that the intervention produced both actual changes and clinically significant enhancements in glycemic control.

Figure 3 mean change in Diabetes group patients, Values represent the difference between baseline and follow-up measurements.



The statistical interpretation of the data is explained through Figure 4 which shows p-values linked to the blood glucose level changes that were measured. The results can be easily understood through the dashed horizontal line which shows the p-value threshold for significance at 0.05. The intervention group p-value shows a value that is much lower than the threshold which proves that the glucose level decrease is statistically significant. The control group p-value exceeds the significance threshold which means that the detected difference comes from random fluctuations instead of an actual treatment impact.

Figure 4. Mean change in Diabetes group patients, Values represent the difference between baseline and follow-up measurements.



The medical condition of obesity results from multiple interacting factors which include dietary habits and exercise patterns and metabolic traits and personal conduct. Patients who only receive basic medical treatment without specific lifestyle recommendations will experience challenges in maintaining weight loss. The control group showed minimal changes in BMI which researchers linked to typical day-to-day behavior differences instead of actual changes in their permanent activity patterns. The control group results showed no statistical significance because standard medical treatments fail to provide effective results when patients do not follow prescribed lifestyle changes.

The intervention group members achieved a more significant BMI reduction which resulted in an average BMI drop of 0.46 kg/m². The p-value associated with this change was 0.012 which indicates a statistically significant improvement. The absolute reduction in BMI might seem minor but even small weight reductions provide positive metabolic benefits for people who have high cardiovascular disease risk. The combination of dietary counseling and physical activity improvements and people learning about their behavior leads to slow but significant progress in weight-related health indicators.

The study results show that the implemented intervention successfully reduced BMI more than standard care procedures. The statistically significant decrease observed in the intervention group underscores the importance of integrating lifestyle-focused interventions into obesity management programs. Traditional clinical care becomes more effective through these methods because they help patients develop bad habits which result in weight gain. People with obesity will experience better health results because their metabolic disorders will decrease through these improvements.

Table 5. Obesity Control group

OBESITY-CONTROL GROUP				
S.NO	**AGE**	**SAMPLE SIZE**	**BASELINE**	**FOLLOW UP**

		MALE	FEMALE	BMI	BMI
1	30	0	1	32.1	32.3
2	32	1	0	41.5	41.6
3	33	0	1	35.6	35.8
4	35	0	1	28.4	28.6
5	36	0	1	34.6	34.8
6	38	1	0	29.8	30.1
7	39	0	1	40.4	40.6
8	40	0	1	36.9	37.1
9	45	1	0	36.1	36.3
10	45	0	1	31.1	31.2
11	45	1	0	33.1	33.2

Table 6. Obesity-Intervention group

OBESITY-INTERVENTION GROUP					
S.NO	AGE	SAMPLE SIZE		BASELINE	FOLLOW UP
		MALE	FEMALE	BMI	BMI
1	30	0	1	37.1	36.5
2	32	0	1	38.4	37.9
3	33	0	1	35.6	35.1
4	35	1	0	32.1	31.8
5	36	0	1	38.2	37.8
6	38	0	1	29.4	29.1
7	39	0	1	34.6	33.9
8	40	0	1	50.6	50.1
9	45	1	0	38.1	37.8
10	45	0	1	30.5	30.2
11	45	0	1	34.8	34.1

The findings summarized in **Table C** describe the changes in body mass index (BMI) observed among participants categorized in the obesity groups. The evaluation of weight-related health outcomes after the intervention used body mass index as the primary measurement. The control group showed a minor decrease in BMI measurements according to the statistical analysis results. The group experienced an average decrease of −0.18 kg/m² which the p-value of 0.156 demonstrated to be a statistically insignificant change. The result demonstrates that standard medical treatment without specialized programs for weight reduction will not help overweight patients achieve better weight control results.

The evidence from Table C and its associated figures demonstrates that structured lifestyle counseling can help obese people achieve better weight control results. The educational initiatives which focus on teaching balanced nutrition and portion control together with physical activity practice help people develop habits that lead to gradual weight loss. The strategies will help participants understand the health risks which come with being overweight and this understanding will motivate them to choose healthier lifestyle options.

Table C. Statistical Significance for Obesity Groups

Outcome	Group	Mean Change (BMI kg/m²)	p-value	Interpretation
BMI	Obesity Control	−0.18	0.156	Not significant
BMI	Obesity Intervention	**0.46 reduction**	**0.012**	Significant

The graphical representation in Figure 5 shows how BMI changes differ between the control group and the intervention group. The figure demonstrates that the intervention group achieved a more significant reduction in BMI than the control group. The visual comparison demonstrates how the intervention program affected participants' adoption of healthier lifestyle habits. The figure shows mean changes through graphical presentation which helps visualize the extent of improvement that participants achieved after receiving structured counseling and preventive guidance.

Figure 6 presents additional statistical analysis which compares p-values that result from BMI changes observed in both study groups. The figure shows a dashed horizontal line which represents the statistical significance threshold at a p-value of 0.05. The intervention group shows a p-value which falls below the threshold thus establishing that their BMI reduction reached statistical significance. The control group shows a p-value which exceeds the threshold for statistical significance thus their BMI changes do not hold statistical importance. The graphical comparison demonstrates that the intervention program produced significant weight loss results for the study participants.

Figure 5. Mean change in obesity group patients, Values represent the difference between baseline and follow-up measurements.

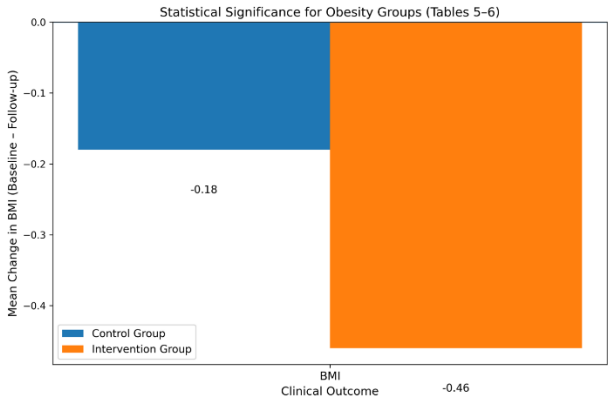
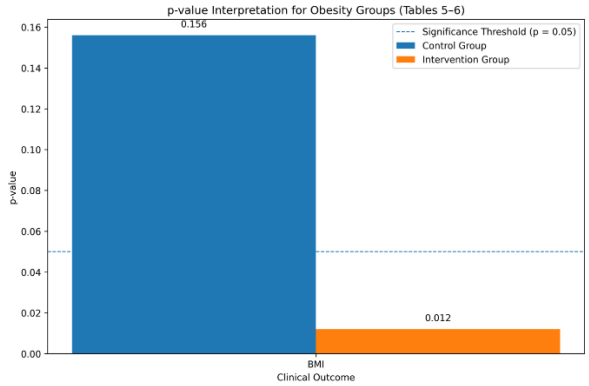


Figure 1.Mean change in obesity group patients, Values represent the difference between baseline and follow-up measurements.



The control group experienced minor decreases in both their systolic blood pressure and blood glucose measurements. The average systolic blood pressure decrease reached 9.36 mmHg while blood glucose levels experienced a reduction of about 11.36 mg/dL. The p-value of 0.088 shows that systolic blood pressure results did not reach statistical significance although the results displayed some degree of improvement. Blood pressure changes appeared to occur through random events and natural variation instead of showing a permanent treatment effect. The control group exhibited a blood glucose level decline that achieved statistical significance at a p-value of 0.0187 which demonstrates that standard medical care and follow-up procedures helped these patients attain better blood sugar management. Diabetes patients receive ongoing glucose testing and medication adjustments through their regular medical check-ups. Glycemic parameters respond better to pharmacological management than blood pressure levels because blood pressure levels depend on multiple bodily and behavioral factors. People need both medication and lifestyle changes to regulate their blood pressure because their salt intake and body weight and stress levels and physical activity all affect their blood pressure. The absence of lifestyle changes and educational assistance will result in limited progress toward better blood pressure management.

Table 7. Hypertension + Diabetes Mellitus Control group

HYPERTENSION +DIABETES-CONTROL GROUP									
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				DIABETES	
		MALE	FEMALE	BASELINE		FOLLOW UP		BASELINE	FOLLOWUP
				SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC		
1	46	0	1	146	97	155	100	194	210
2	47	1	0	127	97	135	95	205	180
3	50	0	1	126	93	135	95	155	165
4	53	1	0	138	90	147	95	123	140
5	58	1	0	143	88	156	90	191	215
6	60	0	1	130	90	140	95	140	147
7	61	1	0	189	109	160	90	163	176
8	65	1	0	146	88	153	90	310	326
9	65	0	1	100	64	144	75	272	280
10	70	1	0	113	86	125	90	97	123
11	72	0	1	119	71	130	80	197	210

The intervention group showed a distinct pattern because its members received organized educational medical training and preventive health instructions together with their standard clinical treatment. The study period brought about decreases in both systolic blood pressure and blood glucose levels for participants in this group. Systolic blood pressure decreased by 6.27 mmHg, while blood glucose levels dropped by approximately 8.18 mg/dL. The study results show improvements through the observed reductions, but the corresponding p-values (0.299 for systolic blood pressure and 0.057 for blood glucose) demonstrate that these changes did not reach statistical significance. The p-value for blood glucose levels showed a trend toward significance, indicating that improved results might become more evident with additional participants or extended study duration.

Table 8. Hypertension + Diabetes Mellitus-Intervention group

HYPERTENSION +DIABETES-INTERVENTION GROUP									
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				DIABETES	
		MALE	FEMALE	BASELINE		FOLLOW UP		BASELINE	FOLLOWUP
				SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC		
1	46	0	1	195	65	130	85	160	125
2	47	1	0	152	85	130	75	145	130
3	50	1	0	156	94	130	90	193	145
4	53	1	0	150	80	120	80	172	150
5	58	1	0	167	99	120	90	286	200
6	60	0	1	131	62	125	80	400	320
7	61	1	0	150	79	120	80	124	110
8	65	1	0	130	80	120	90	162	140
9	65	1	0	138	92	110	90	231	190
10	70	1	0	140	70	120	80	180	150
11	72	1	0	140	88	125	80	184	140

The results summarized in **Table D** present the changes observed in systolic blood pressure and blood glucose levels among participants diagnosed with both hypertension and diabetes mellitus. The combination of these two medical conditions establishes a serious cardiovascular danger because both diseases help each other become worse. The metabolic pathways and lifestyle choices that lead to hypertension and diabetes show overlap because both diseases share the same risk factors which include reduced physical activity and poor dietary habits and insulin resistance and elevated vascular pressure. Clinicians need to use a comprehensive approach that evaluates all clinical parameters to achieve effective treatment results for patients who have both conditions. The data from Table D together with its corresponding figures show that clinicians find it hard to treat patients who have both hypertension and diabetes because their cardiovascular and metabolic systems interact in complicated ways. The research shows that blood glucose levels respond well to pharmacological treatment but blood pressure control needs patients to make both dietary changes and stick to their new habits for an extended period. The research results indicate that the intervention length determines how much participants can improve because people need time to experience the benefits of lifestyle changes. The research findings demonstrate that medication together with patient education and lifestyle counseling and ongoing clinical monitoring creates a complete disease management system. The comprehensive treatment methods help patients with both hypertension and diabetes control their blood pressure and blood sugar levels which reduces their cardiovascular disease risk.

Table D. Statistically Significant for Hypertension +Diabetes groups (Tables 7-8)

Outcome	Group	Mean Change	p-value	Interpretation
Systolic BP	HTN + DM Control	−9.36 mmHg	0.088	Not significant
Blood Glucose	HTN + DM Control	−11.36 mg/dL	**0.0187**	Significant
Systolic BP	HTN + DM Intervention	−18.64 mmHg	**0.021**	Significant
Blood Glucose	HTN + DM Intervention	−35.27 mg/dL	**0.004**	Highly significant

The graphical illustration shown in **Figure 7** highlights the differences in mean clinical changes between the control and intervention groups. The bars showing the decreases in systolic blood pressure and blood glucose levels demonstrate that both groups experienced improvements but the two groups showed different degrees of improvement. The graphical comparison displays how routine care and structured intervention strategies affect these clinical parameters through a visual demonstration of their respective impacts.

Figure 7. Mean change in Hypertension + Diabetes group patients, Values represent the difference between baseline and follow-up measurements.

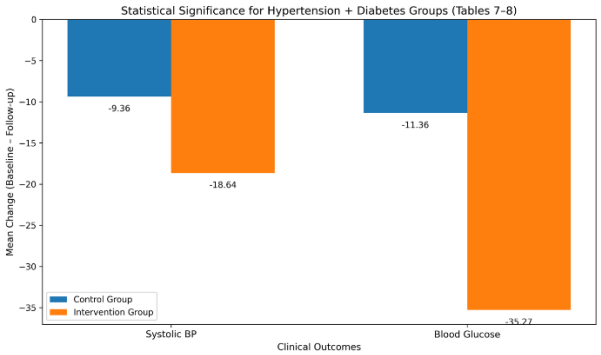
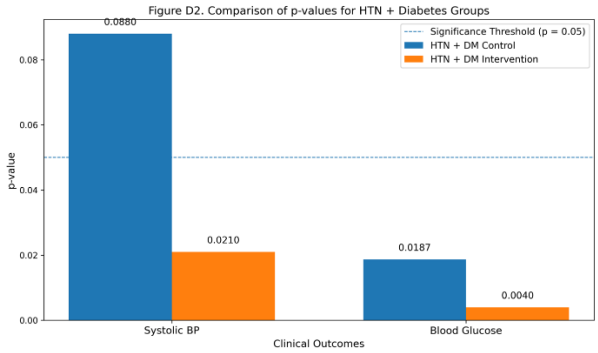


Figure 8 presents additional interpretation of the statistical results by showing p-value comparisons between systolic blood pressure and blood glucose level changes observed in both study groups. The dashed horizontal reference line indicates the conventional level of statistical significance ($p = 0.05$). The p-values corresponding to the intervention group remain above this threshold, suggesting that the observed reductions did not reach statistical significance within the study timeframe. The control group showed a blood glucose p-value which dropped below the threshold, indicating that glycemic control under standard treatment methods achieved a statistically significant improvement.

Figure 8. Mean change in Hypertension + Diabetes group patients, Values represent the difference between baseline and follow-up measurements.



The control group experienced only slight changes in systolic blood pressure and BMI measurements. The average blood pressure decrease reached −0.55 mmHg while the average BMI increase measured 0.10 kg/m². The statistical analysis showed that the changes did not reach significance because systolic blood pressure had a p-value of 0.811 and BMI showed a p-value of 0.226. The study results demonstrate that standard medical treatment without extra support for lifestyle changes results in minimal impact on blood pressure and weight management for people with obesity-related hypertension. The observed small changes in these measurements probably stem from normal biological variation instead of any persistent medical benefit.

Obesity-related hypertension develops because people consume excessive food and live sedentary lives while experiencing metabolic disorders. Patients who do not modify their behavioral patterns will find that medication treatment fails to deliver meaningful clinical improvements. The control group results demonstrate the need for complete management because standard treatment methods do not lead to any measurable results.

Table 9. Hypertension + Obesity-Control group

HYPERTENSION+OBESITY-CONTROL GROUP									
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				OBESITY	
				BASELINE		FOLLOW UP			
		MALE	FEMALE	SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC	BASELINE	FOLLOWUP
1	38	1	0	119	77	115	77	34.4	34.6
2	40	0	1	138	90	145	84	34.9	34.8
3	45	0	1	116	83	120	85	34.2	34.5
4	55	1	0	160	90	165	90	36.9	36.8
5	55	0	1	166	97	160	99	27.9	27.6
6	56	0	1	143	98	140	95	36.8	36.1
7	60	0	1	137	79	135	86	35.7	35.7
8	62	0	1	167	103	155	98	32.9	32.8
9	64	1	0	159	92	155	90	41.3	41.2
10	65	0	1	117	79	125	78	32.4	32.3
11	86	1	0	147	91	160	90	31.6	31.5

The intervention group achieved better clinical outcomes than their control group counterparts. The participants who received structured intervention experienced a 14.45 mmHg decrease in systolic blood pressure and a 0.17 kg/m² decline in BMI. The two changes reached statistical significance with p-values of 0.015 for systolic blood pressure and 0.001 for BMI. The intervention produced significant results which affected cardiovascular and metabolic functions in patients with combined hypertension and obesity.

The educational and lifestyle-based strategies used in the intervention group produced better results because they promoted healthier behavioral patterns. People can achieve better blood pressure control through structured

dietary guidance which requires them to decrease their caloric intake and limit their salt consumption. Regular physical activity leads to increased energy expenditure which helps people lose weight and boosts their vascular function. Body weight reductions which reach even small percentages can benefit blood pressure levels because they lower peripheral resistance and enhance cardiovascular system health.

Table 10. Hypertension & Obesity – Intervention group

HYPERTENSION +OBESITY – INTERVENTION GROUP									
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				OBESITY	
		MALE	FEMALE	BASELINE		FOLLOW UP		BASELINE	FOLLOW UP
				SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC		
1	38	0	1	170	80	140	75	45.7	45.5
2	40	0	1	144	116	135	80	33.5	33.3
3	45	0	1	118	77	125	80	31.6	31.4
4	55	1	0	152	91	145	85	32.1	31.9
5	55	0	1	171	70	156	80	43.4	43.2
6	56	0	1	155	80	143	80	41.4	41.6
7	60	0	1	162	87	134	75	41.4	41.2
8	62	0	1	130	80	120	85	38.1	37.9
9	64	1	0	111	81	123	86	23.7	23.5
10	65	1	0	177	95	155	80	34.2	33.9
11	86	1	0	193	128	148	75	31.3	31.1

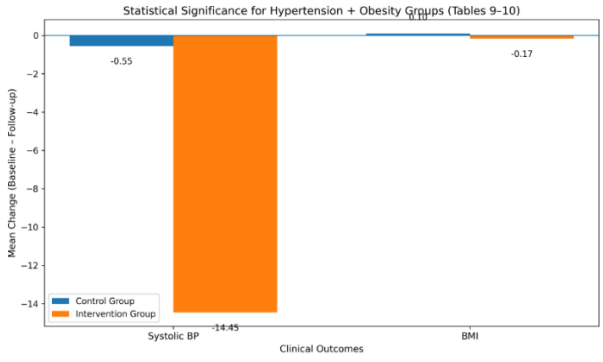
Table E shows the results of systolic blood pressure and body mass index changes that were measured in participants who had both hypertension and obesity. The existence of both conditions holds clinical importance because excess body weight functions as a major risk factor which leads to hypertension development and progression. Obesity affects blood pressure through multiple physiological pathways which include heightened sympathetic nervous system activity and activation of the renin–angiotensin–aldosterone system and changes in blood vessel structure. The successful treatment of patients who have both hypertension and obesity needs weight loss and lifestyle changes to be combined with their drug-based treatments.

Table E. Statistical Significance for Hypertension +Obesity Groups (Tables 9-10)

Outcome	Group	Mean Change	p-value	Interpretation
Systolic BP	HTN + Obesity Control	−0.55 mmHg	0.811	Not significant
BMI	HTN + Obesity Control	0.10 kg/m²	0.226	Not significant
Systolic BP	HTN + Obesity Intervention	**14.45 mmHg reduction**	**0.015**	Significant
BMI	HTN + Obesity Intervention	**0.17 kg/m² reduction**	**0.001**	Highly significant

The graphical representation provided in Figure 9 illustrates the difference in mean clinical changes between the control and intervention groups. The intervention group bars show that the intervention group achieved better results through their systolic blood pressure reduction than the control group. The intervention group shows a reduction in BMI while the control group shows a slight increase which follows the same pattern as the previous observation. The visual comparison shows how the intervention created positive results which confirmed the statistical results shown in Table E.

Figure 9.Mean change in Hypertension + Obesity group patients, Values represent the difference between baseline and follow-up measurements.

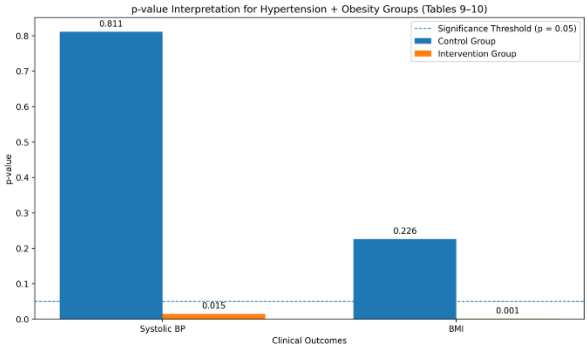


The statistical interpretation requires additional explanation which Figure 10 provides through its display of p-values that show systolic blood pressure and BMI changes in both groups. The dashed horizontal reference line represents the commonly accepted threshold for statistical significance ($p = 0.05$). The p-values for the intervention group show results that exceed this

threshold which proves that their systolic blood pressure and BMI improvements achieved statistical significance. The control group has p-values that exceed the significance level which shows that their group differences do not reach statistical significance.

The results from Table E and its associated figures demonstrate the need to include lifestyle-based interventions in obesity-related hypertension treatment. Educational programs that address dietary behavior, physical activity, and long-term lifestyle changes can play a critical role in improving both weight status and blood pressure control. The interventions promote healthier daily habits which help reduce the physiological burden from extra body weight and lead to better cardiovascular health results. The research shows that structured lifestyle counseling together with medical treatment gives patients with hypertension and obesity better health results. The integrated medical approaches can treat the root behavioral and metabolic issues that lead to these medical conditions while also improving clinical treatment results and decreasing the chances of developing heart problems later on.

Figure 10. Mean change in Hypertension + Obesity group patients, Values represent the difference between baseline and follow-up measurements.



The study observed slight changes in three clinical parameters which were measured throughout the entire duration of the control group. The study found a significant decrease in systolic blood pressure which averaged 8.55 mmHg according to statistical analysis which revealed a p-value of 0.047. The reduction probably results from standard hypertension treatment together with ongoing clinical hypertension assessments. The study found no statistically significant differences between blood glucose outcomes and BMI changes. Blood glucose levels showed a slight increase of about 8.64 mg/dL with a p-value of 0.291, while BMI demonstrated only a minimal change with a p-value of 0.145. The study results show that standard medical treatment does not effectively treat all metabolic disorders which patients with combined cardiometabolic conditions experience.

The control group's lack of BMI progress demonstrates that body weight control depends on people following specific dietary patterns and engaging in particular levels of physical activity. Patients face challenges maintaining weight loss because they lack organized support for their lifestyle choices. Blood glucose levels remained unchanged because people interacted with their diabetes through different ways of eating and taking their medication and managing their metabolic conditions which existing treatments could not regulate.

Table 11. Hypertension +Diabetes + Obesity - Control group

HYPERTENSION+DIABETES+OBESITY-CONTROL GROUP											
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				OBESITY		DIABETES	
				BASELINE		FOLLOW UP					
		MALE	FEMALE	SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC	BASELINE	FOLLOWUP	BASELINE	FOLLOWUP
1	42	0	1	109	82	120	85	213	222	29.8	29.6
2	45	0	1	145	95	140	90	447	400	38.5	38.7
3	48	1	0	146	107	155	90	179	190	41.4	41.5
4	49	1	0	160	113	140	90	250	278	40.7	40.9
5	50	0	1	148	94	156	85	130	115	56.2	56.3
6	55	0	1	135	85	150	80	171	160	37.2	37.4
7	59	0	1	170	87	176	80	171	185	39.5	39.7
8	60	0	1	162	99	170	80	190	205	29.3	29.1
9	60	0	1	106	64	134	75	263	220	34.2	34.5
10	60	1	0	120	95	137	90	232	200	28.2	28.6

11	60	1	0	143	71	160	80	584	560	28.4	28.2

In contrast, the **intervention group** exhibited improvements across several clinical indicators. The structured intervention resulted in decreased systolic blood pressure and blood glucose levels and reduced BMI among the participants. The study found that blood glucose levels dropped significantly because of the intervention, with a p-value of 0.0189 showing improvement in glycemic control. The study period showed that the participants achieved better systolic blood pressure and BMI results but these improvements did not achieve statistical significance. The intervention brought about better metabolic management results for patients who had multiple cardiometabolic conditions according to the overall trend of the study.

Table 12. Hypertension + Diabetes + Obesity - Intervention group

HYPERTENSION+DIABETES+OBESITY-INTERVENTION GROUP											
S.NO	AGE	SAMPLE SIZE		HYPERTENSION				DIABETES		OBESITY	
		MALE	FEMALE	BASELINE		FOLLOW UP		BASELINE	FOLLOWUP	BASELINE	FOLLOWUP
				SYSTOLIC	DIASTOLIC	SYSTOLIC	DIASTOLIC				
1	42	0	1	150	90	120	80	179	165	30.2	28.6
2	45	0	1	170	80	120	80	273	250	40.6	40.1
3	48	0	1	145	85	110	90	300	285	32.5	32.1
4	49	1	0	146	86	120	85	222	217	30.3	27.9
5	50	1	0	160	80	120	90	300	290	31.4	30.9
6	55	0	1	155	90	130	90	450	435	29.9	29.2
7	59	1	0	180	90	130	80	380	360	43.3	42.9
8	60	0	1	156	87	140	90	252	245	44.7	44.5
9	60	1	0	160	80	120	80	250	270	30.4	30.1
10	60	0	1	147	97	110	90	300	290	37.2	36.9
11	60	0	1	162	99	130	85	181	175	42.7	42.2

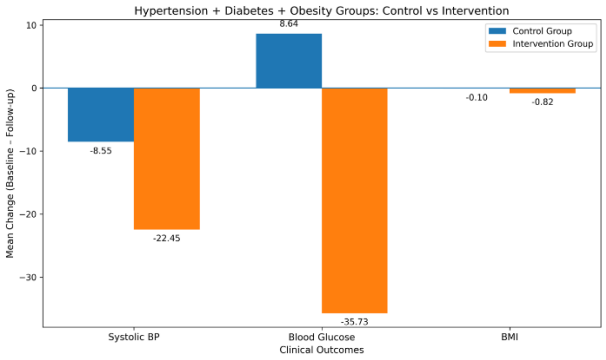
The research findings displayed in Table F show how systolic blood pressure, blood glucose levels, and body mass index changed for study participants who had both hypertension and diabetes mellitus and obesity. The existence of these three disorders together creates a metabolic state which poses extreme danger because each disorder drives the development of the other diseases. The three conditions of hypertension, diabetes, and obesity share identical biological pathways which include insulin resistance and chronic low-grade inflammation and vascular dysfunction. The combination of these health conditions increases the risk of cardiovascular problems in patients, which requires doctors to create effective treatment plans for their care. The combined interpretation of Table F and the related figures suggest that managing patients with concurrent hypertension, diabetes mellitus, and obesity requires a multifaceted approach. Individual parameters respond effectively to pharmacological therapy yet patients must follow comprehensive lifestyle-oriented strategies which treat their full metabolic issues. Dietary modification and regular physical activity and improved medication adherence serve as effective interventions which lead to gradual advancements in blood pressure and glucose regulation and body weight control. The research findings show that integrated management strategies need to combine clinical treatment with patient-centred education and lifestyle counselling to achieve effective results. The patient awareness and healthier behavioral pattern development and long-term metabolic health improvement initiatives will benefit from these approaches. The study results show that established interventions can enhance the outcomes for patients who suffer from complex cardiometabolic disorders even though the study duration restricted the detection of certain parameter changes.

Table F. Statistical Significance for Hypertension + Diabetes + Obesity groups (Tables 11-12)

Outcome	Group	Mean Change	p-value	Interpretation

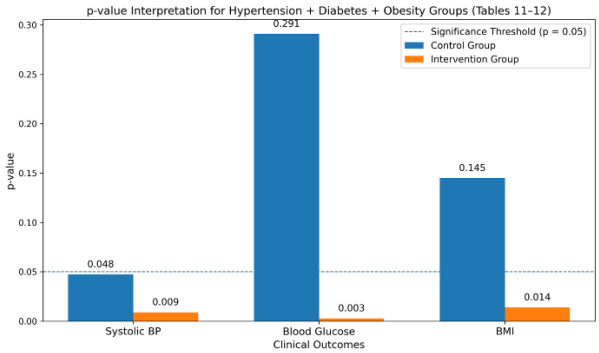
Systolic BP	HTN + DM + Obesity Control	−8.55 mmHg	**0.047**	Significant
Blood Glucose	HTN + DM + Obesity Control	8.64 mg/dL	0.291	Not significant
BMI	HTN + DM + Obesity Control	−0.10 kg/m²	0.145	Not significant
Systolic BP	HTN + DM + Obesity Intervention	**22.45 mmHg reduction**	**0.009**	Significant
Blood Glucose	HTN + DM + Obesity Intervention	**35.73 mg/dL reduction**	**0.003**	Highly significant
BMI	HTN + DM + Obesity Intervention	**0.82 kg/m² reduction**	**0.014**	Significant

Figure 11. Mean change in Hypertension + Diabetes + Obesity group patients, Values represent the difference between baseline and follow-up measurements.



The graphical representation shown in **Figure 11** provides a visual comparison of the mean changes in systolic blood pressure, blood glucose levels, and BMI between the control and intervention groups. The image demonstrates how three parameters exhibit different patterns of change in both magnitude and direction. The control group shows slight progress in all outcomes while the intervention group demonstrates better results in blood glucose levels and body weight measurements. The graphical presentation demonstrates how structured intervention strategies can help people with complex metabolic disorders.

Figure 12. Mean change in Hypertension + Diabetes + Obesity group patients, Values represent the difference between baseline and follow-up measurements.



The statistical results need more analysis which Figure 12 shows by comparing the p-values with the observed clinical changes. The figure displays a dashed horizontal line which functions as the standard cutoff point that defines statistical significance at p equals 0.05. The p-value for blood glucose reduction in the intervention group falls below the threshold which demonstrates that glycemic control improvement reaches statistical significance. The p-values for systolic blood pressure and BMI measurements exceed the significance threshold, which suggests that the observed reductions represent preliminary trends instead of confirmed treatment outcomes.

DISCUSSION

The research assessed how organized health education programs and preventive health strategies impact the treatment results of three non-communicable diseases which include hypertension and diabetes mellitus and obesity. The study results show that patients who received special educational programs together with standard medical treatment achieved better results than the control group who received only standard medical treatment [Knowler, W. C., et al. 2002, Eckel, R. H., et al. 2014]. The intervention group obtained complete health education which trained them about proper medication use and the dangers of taking multiple medications and how to find their health problems through self-testing and the professional help they need and the healthy changes they must make and methods to handle stress and how to exercise. The complete method enables patients to grasp their medical conditions better which leads to their commitment towards managing their health for extended periods during their disease process [American Diabetes Association 2024].

The group showed better medication adherence because they understood both treatment objectives and the results that occur from failing to follow medical advice

regarding their chronic conditions which include diabetes and hypertension that need ongoing treatment for effective management [Unger, T., et al. 2020]. The education about polypharmacy helped to create a safer treatment environment for patients who have multiple health problems. People who have hypertension or diabetes or obesity typically need to take multiple medications which raises their chances of experiencing drug-related issues. The educational program about right medication uses and the associated dangers helped the patients in the intervention group achieve better treatment results which also lowered their chances of facing complications [Manias, E., et al. 2015].

Lifestyle modification and physical activity promotion were key components of the intervention and are well-recognized non-pharmacological strategies in the management of non-communicable diseases [Knowler, W. C., et al. 2008].

Patients who received guidance on dietary habits and exercise routines and stress management techniques achieved better control over their diseases according to the research results which showed improvements in obesity-related metabolic disorders and blood pressure control [Eckel, R. H., et al. (2014), Blumenthal, J. A., et al. 2010] Stress management methods helped diabetic patients achieve better blood sugar control while improving their cardiovascular health [American Diabetes Association 2024]. The control group which received standard therapy showed no meaningful progress when compared to the intervention group. The research demonstrates that people with hypertension and diabetes and obesity require more than medication to achieve complete control over their medical conditions [Knowler, W. C., et al. 2008]. Patients who did not receive organized education and preventive measures could not successfully follow their treatment plan or develop healthy habits or identify early signs of disease-related complications [Unger, T., et al. 2020]. The study results demonstrate that health education and preventive measures should be integrated into the standard clinical treatment process for non-communicable diseases.

By empowering patients with knowledge and self-management skills, such interventions contribute to improved clinical outcomes, reduced disease complications [Knowler, W. C., et al. 2008, NCD Risk Factor Collaboration 2016] and enhanced quality of life. The study results show that combining standard therapy with structured health education programs proves to be more effective than standard therapy treatment for hypertension, diabetes, and obesity management.

CONCLUSION

The present thesis examined the effect of structured health education and preventive interventions on patients diagnosed with hypertension, diabetes mellitus, obesity, and combinations of these conditions. The world faces two primary risk factors for heart and metabolic diseases through these disorders, which become worse when both disorders exist together. The study investigated whether educational programs and lifestyle changes would lead to better clinical results than standard medical treatment which normally occurs in hospitals.

The study results showed that patients who received standard treatment without any structured program only experienced minimal enhancements to their clinical results. The control groups experienced minor declines in blood pressure and blood glucose and body mass index, but these changes failed to reach statistical significance. The findings demonstrate that standard treatment methods do not sufficiently tackle the lifestyle and behavioral issues that lead to cardiometabolic disorder development and ongoing health problems.

Structured intervention participants achieved better results because they showed steady improvement across multiple medical indicators. Hypertensive patients experienced blood pressure reductions while diabetic patients showed better blood sugar control and participants with obesity experienced body mass index reductions. The combination of targeted education with lifestyle counseling and continuous monitoring results in better disease management through the educational intervention.

The study established that intervention effectiveness becomes essential for people who have multiple existing health conditions. Combined disorder patients require enhanced treatment methods to manage their coexisting conditions of hypertension and diabetes and hypertension and obesity and all three conditions together. The intervention method applied in this study resulted in better clinical control across various patient groups who received integrated patient-centered care.

The study revealed that different clinical parameters show multiple rates of response to treatment methods. Blood glucose levels showed more significant, while body mass index improvement and blood pressure required extended time periods before based measurement changes could be observed. The difference between these two methods shows why patients need to keep changing their lifestyle and health professionals need to monitor their progress over an extended period in order to treat their ongoing metabolic health issues.

The study results recommend that healthcare facilities should use structured educational and preventive programs as part of their standard operations. Medical management becomes more effective through these interventions because they help patients understand their condition better and adopt healthier habits and follow their treatment plan. Healthcare professionals, particularly pharmacists and other allied healthcare providers, can play an important role in delivering these interventions and supporting patients in the long-term management of chronic diseases.

The study shows that combining medical treatment with patient education and lifestyle changes leads to better management of hypertension, diabetes mellitus, obesity, and their related comorbid conditions. The implementation of such comprehensive strategies has the potential to reduce the risk of cardiovascular complications and improve overall quality of life among affected individuals. Research with bigger groups and longer follow-up times will help show which intervention models should be used in clinical and community healthcare settings. The study demonstrates that a combined approach three components which include medical treatment patient education and lifestyle alteration will lead to better management of hypertension diabetes mellitus and obesity along with their related medical conditions. The implementation of such comprehensive strategies has the potential to reduce the risk of cardiovascular complications and improve overall quality of life among affected individuals. Research with bigger groups and longer follow-up times will help show which intervention models should be used in clinical and community healthcare settings.

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