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Effectiveness of the Multi-factorial Intervention Package on blood pressure And Quality of Life among adolescents with Hypertension

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Abstract

Introduction: Hypertension among adolescents is a growing health concern, impacting both blood pressure and quality of life. This study aimed to assess the effectiveness of a Multi-factorial Intervention Package on blood pressure and quality of life in adolescents with hypertension.
Methods: A total of 238 adolescents (119 in the experimental and 119 in the control group) participated. Demographic, diet, and physical activity variables were analyzed. Pre- and post-test assessments were conducted for knowledge, blood pressure, stress, and quality of life.
Results:
Demographic Variables: No significant differences were found in age, sex, religion, residence, or socio-economic status between the groups.
Diet Pattern Variables: No significant differences were observed in the frequency of fruit and vegetable consumption, non-vegetarian foods, snack intake, oil preference, or salt usage.
Physical Activity Variables: Similar trends in commuting mode, outdoor game participation, daily play duration, and TV watching were noted, indicating no significant variations between groups.
Body Mass Index: A significant difference in BMI was observed post-intervention in both groups, indicating a positive impact on weight status.
Knowledge: The experimental group showed a significant increase in knowledge post-intervention compared to the control group.
Blood Pressure: Systolic and diastolic blood pressure significantly decreased post-intervention in the experimental group compared to the control group.
Stress: The experimental group exhibited a significant reduction in stress post-intervention compared to the control group.
Quality of Life: Quality of life significantly improved in the experimental group post-intervention, whereas the control group showed no significant change.
Discussion: The Multi-factorial Intervention Package demonstrated efficacy in improving knowledge, reducing blood pressure and stress, and enhancing quality of life in adolescents with hypertension. These findings emphasize the importance of comprehensive interventions in managing hypertension in this population.
Conclusion: The study supports the effectiveness of the Multi-factorial Intervention Package in improving health outcomes among adolescents with hypertension, providing valuable insights for future interventions in this demographic.

Key Words: hypertension, adolescents, multi-factorial intervention, knowledge, blood pressure, stress, quality of life

Introduction

Hypertension, also known as high blood pressure, is a prevalent and alarming health concern among adolescents worldwide. The increasing incidence of hypertension in this vulnerable population is linked to several risk factors, including sedentary lifestyles, unhealthy dietary habits, and elevated stress levels. If left unmanaged, hypertension during adolescence can have serious long-term consequences, including an increased risk of cardiovascular diseases.

To address this pressing issue, researchers and healthcare professionals have been exploring multi-factorial intervention approaches that encompass a comprehensive set of strategies aimed at improving knowledge, reducing blood pressure, managing stress, and enhancing the overall quality of life among adolescents with hypertension. These interventions typically combine lifestyle modifications, health education programs, and

stress reduction techniques to create a holistic and effective management approach.
This study aims to investigate the impact of a multi-factorial intervention package on adolescents with hypertension. The intervention includes elements such as dietary advice, beetroot juice administration, autogenic training exercise and structure health education programs. By targeting multiple factors contributing to hypertension, the intervention intends to provide a more comprehensive and sustainable approach to manage the condition.

Methodology

A methodology is a systematic approach to conducting research or solving problems involving well-defined procedures and techniques. It serves as a road map, guiding researchers in gathering data, analyzing findings, and drawing meaningful conclusions. The present study follows the following procedure to fulfill its aim:

Research approach: Quantitative research approach was chosen for this present study

Research design: This study encompasses two phases. **Phase I** adopted a **descriptive cross-sectional survey design**, and **Phase II** adopted a **Randomized control trial**

Variables of the study: Two types of variables are present in the study, i.e., Dependent, and Independent variables. The dependent variables in the current study were knowledge of the prevention and management of hypertension, Blood pressure levels, Stress levels, and quality of life. The independent variables include a multi-factorial intervention package, a structured health education program, beetroot juice administration, and autogenic training exercises.

Research setting: The selected areas of Ariyankuppam commune panchayat of Puducherry district, India, were chosen as the study setting for both phases of the study.

Population: The population of the present study includes adolescents aged 14–17 years living in the union territory of Puducherry.

Sample: In the present study, the samples were hypertensive adolescents aged between 14 and 17 who fulfilled the inclusion criteria

Sampling technique: purposive sampling method was adopted to select study. participants. A true experimental study was conducted in the selected Ariyankuppam commune panchayat, and the participants were selected for the experimental and control group studies.

Sample size: 260 samples were estimated during data collection, of which 273 were found to be **Stage I hypertensive**. During intervention phase considering 20% attrition rate 238 samples (119 Experimental 119 Control). After that, the effectiveness of a multi-factorial intervention package on various dependent variables was identified.

Description of the study tool: The tool comprises two sections, i.e., **Section I**: Identifies the baseline characteristics data of adolescents, their anthropometric parameters, and their blood pressure levels. **Section II**: Identifies adolescents' knowledge level using structured interview questionnaires, stress levels using perceived stress scale & quality of life by WHO-BREF scale.

Description of the Intervention: The intervention package for the experimental group was the Multi-factorial Intervention package, which encompassed the administration of beetroot juice, autogenic training exercises, and a structured health education program on lifestyle modification and management of hypertension. In detail, the administration of 250 ml of beetroot juice, an autogenic training exercise for 30 minutes for 21 days, and a structured health education programme on lifestyle modification and management of hypertension among adolescents were conducted for 20 minutes for each participant. Control Group: The intervention for the control group consists of a structured health education program was given by excluding the dietary advice and beetroot administration

Data Collection: Prior permission was obtained from the competent authority before the commencement of the study. A pilot study was conducted before the main study. Oral and written informed consent was obtained from the participants and their parents. The detailed intervention and study plan were explained briefly to the study participants. The intervention period of 21 days was followed for each participant, and every 7th day the

effectiveness of the intervention was measured, i.e., the 7th, 14th, and 21st days.

Data analysis: Data analysis is used to organize and interpret the data obtained during the research study. The collected data were entered into a Microsoft spreadsheet and coded. SPSS software (Version 22.0) was used to analyze the coded data. Descriptive and Inferential statistics were used to analyze the raw data.

Results & Discussion

analysis and interpretation of the data collected from 238(119+119)adolescents with hypertension ***"to evaluate the effectiveness of the Multi-factorial Intervention Package on blood pressure and quality of life among adolescents with hypertension in selected areas of Puducherry"***.

Section A: Description of the demographic variables, diet pattern and physical activity variables among adolescents with hypertension in the experimental and control groups.

Table 1: Frequency and percentage-wise distribution of demographic variables among adolescents with hypertension in the experimental group and control group

(N=238(119+119))

S.NO	DEMOGRAPHIC VARIABLES	EXPERIMENTAL GROUP		CONTROL GROUP		Chi-square X^2 and P-Value
		N	%	n	%	
1	**Age of the adolescent(in years)**					
	14 years	19	16	28	23.5	X^2=7.56p =0.056NS
	15 years	30	25.2	41	34.5	
	16 years	39	32.7	32	26.9	
	17 years	31	26.1	18	15.1	
2	**Sex**					X^2=0.643p=0.423NS
	Male	71	59.7	77	64.7	
	Female	48	40.3	42	35.3	
3	**Religion**					
	Hindu	111	93.3	114	95.8	X^2=2.24p =0.326NS
	Christian	6	5	2	1.7	
	Muslim	2	1.7	3	2.5	
	Others	0	0	0	0	
4	**Residence**					
	Urban	47	39.5	38	31.9	X^2=1.48p =0.223NS
	Rural	72	60.5	81	68.1	
5	**Kuppuswamy Socio-economic status scale 2021**					
	Upper	0	0	0	0	X^2=6.48p=0.09 NS
	Upper middle	39	32.8	24	20.2	
	Lower middle	76	63.9	93	78.2	
	Upper lower	3	2.5	2	1.6	
	Lower	1	0.8	0	0	

S–Significant; NS –Non-Significant; HS–Highly Significant

The majority of adolescents, 39(32.7%) in the experimental group, were in the age group of 16 years, and 41(34.5%) control group were in the age group of 15 years. The majority of adolescents, 71(59.7%) in the experimental group and 77(64.7%) control group were male. Regarding the Religion of adolescents, 111(93.3%) in the experimental group and 114(95.8%) control group belonged to Hindu, respectively. About Residence, the majority of adolescents, 72(60.5%) in the experimental group and 81(68.1%) control group, were Rural.

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Regarding adolescents' Socioeconomic status, 76(63.9%) in the experimental group and 93(78.2%) control group belonged to the Lower middle, respectively.

Table 2: Frequency and percentage wise distribution of diet pattern variables among adolescents with hypertension in experimental group and control group

(N=238 (119+119))

S.NO	DIET PATTERN VARIABLES	EXPERIMENTAL GROUP		CONTROL GROUP		Chi-square X^2 and P-Value
		n	%	N	%	
1	**During the past 7 days, how frequently you had fruits**					
	Daily	106	89.1	111	93.3	
	Two or more days a week	9	7.6	6	5	X^2=1.91p =0.590NS
	Once a week	3	2.5	2	1.7	
	Didn't take	1	0.8	0	0	
2	**During the past 7 days, how frequently you had vegetables**					
	Daily	117	98.3	115	96.6	
	Two or more days a week	2	1.7	3	2.5	X^2=1.21p =0.544NS
	Once a week	0	0	1	0.9	
	Didn't take	0	0	0	0	
3	**During the past 7 days, how frequently you had non vegetarian foods**					
	Daily	2	1.7	0	0	
	Two or more days a week	111	93.3	117	98.3	X^2=4.44p =0.217NS
	Once a week	5	4.2	2	1.7	
	Didn't take	1	0.8	0	0	
4	**During the past 7 days, how frequently you had foods like samosa/bajji/noodles/ice creams/chips-lays, kurkure, etc.**					
	Daily	109	91.6	100	84	
	Two or more days a week	9	7.6	18	15.1	X^2=3.38p =0.184NS
	Once a week	1	0.8	1	0.9	
	Didn't take	0	0	0	0	
5	**What type of oil is used for cooking**					
	Coconut	1	0.8	0	0	
	Groundnut oil	3	2.6	1	0.8	
	Gingelly oil	0	0	1	0.8	
	Palmoil	1	0.8	1	0.8	X^2=3.01p =0.555NS
	Refined sunflower oil	114	95.8	116	97.6	
	Others	0	0	0	0	
6	**How much salt is used in your family in the last month**					
	1kg	116	97.5	114	95.8	
	2kgs	3	2.5	5	4.2	X^2=0.517p=0.472 NS
	3kgs	0	0	0	0	
	4kgs	0	0	0	0	

S –Significant; NS –Non-Significant; HS–Highly Significant

Table 2 shows the diet pattern of the adolescents in the experimental and control group. 89.1% in the experimental group and 93.3% control group had consumed fruits daily.98.3% in the experimental group and 96.6% of participants in the control group consumed vegetables daily. Most participants in the experimental (93.3%) and control group(98.3%) had Two or more days a week of non-vegetarian foods, respectively. 91.6% of adolescents in the experimental group and 84% in the control group consumed junk foods daily. Most of the participants used refined sunflower oil for cooking of adolescents in the experimental group (95.8%) and 97.6% in the control group. The majority of adolescents, 116(97.5%) in the experimental group and 114(95.8%) control group had 1kg of salt in the last one month.

Table 3: Frequency and percentage wise distribution of physical activity variables among adolescents with hypertension in experimental group and control group

(N=238 (119+119))

S.NO	PHYSICAL ACTIVITY VARIABLES	EXPERIMENTAL GROUP		CONTROL GROUP		Chi-squareX^2 and P-Value
		n	%	N	%	
1	**How will you reach school daily**					X^2=1.003p=0.606 NS
	Cycle	7	5.9	4	3.4	
	Walking	107	89.9	111	93.3	
	Bus/van/auto	0	0	0	0	
	Motorcycle	5	4.2	4	3.3	
2	**How often do you play outdoor games like kabadi/cricket/volleyball/basket ball, etc. in a week**					X^2=2.54p =0.467NS
	Daily	3	2.5	1	0.8	
	Once a week	7	5.9	4	3.4	
	Two or more days a week	104	87.4	111	93.3	
	Don't play	5	4.2	3	2.5	
	How many hours you will play outdoor games per day					
	<1 hour	107	89.9	115	96.6	
	1-2 hour	6	5	1	0.8	
	>2 hours	5	4.2	3	2.6	
	Not at all	1	0.9	0	0	
4	**How many hours you will watch TV daily**					X^2=2.11p =0.348NS
	<1 hour	1	0.8	0	0	
	1- 2 hour	108	90.8	113	95	
	>2 hours	10	8.4	6	5	
	Not a tall	0	0	0	0	

S–Significant; NS –Non-Significant; HS–Highly Significant

Table 3 shows the adolescents' physical activity in the experimental and control groups. It shows that most adolescents walked daily to reach school in the experimental group (89.9%) and the control group (93.3%). It was reported that two or more days a week, outdoor games like kabaddi/cricket/volleyball/basketball, etc., was played by the participants in the experimental group (87.4%) and control group (93.3%). It was also reported that <1 hour was spent by the adolescents in the experimental group (89.9%)and control group(96.6%)playing outdoor games. Most adolescents watch 1-2 hours of television in the experimental group (90.8%) and the control group(95%).

Table 4: Frequency and percentage wise distribution of pre-test and post-test of the level of Body Mass Index among adolescents with hypertension in experimental group and control group

(N=238 (119+119))

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S.NO	Body Mass Index	EXPERIMENTAL GROUP		CONTROL GROUP		Chi-square X^2 and P-Value
		n	%	n	%	
1	**PRE-TEST**					X^2=230.15p=0.000 **HS
	Severe thin	5	4.2	0	0	
	Thin	9	7.6	0	0	
	Normal	105	88.2	2	1.7	
	Overweight	0	0	68	57.1	
	Obesity	0	0	49	41.2	
	Mean± S.D.	20.06±1.87		26.25±3.40		
2	**POST-TEST**					X^2=215.26p=0.000 **HS
	Severethin	0	0	0	0	
	Thin	11	9.2	0	0	
	Normal	108	90.8	6	5	
	Overweight	0	0	74	62.2	
	Obesity	0	0	39	32.8	
	Mean± S.D.	20.16±1.67		26.19±3.41		

S–Significant; NS–Non-Significant; HS–Highly Significant

Table 4 shows the frequency and percentage-wise distribution of pre-test and post-test of the level of Body Mass Index among adolescents with hypertension in the experimental and control groups. In the pre-test, the Majority of adolescents, 105(88.2%) in the experimental group, were normal Body Mass Index, and 68(57.1%) control group were overweight, with a mean difference in the pre-test was 20.06±1.87. In the post-test, the Majority of adolescents, 108(90.8%) in the experimental group, were normal Body Mass Index and 74(62.2%), with a mean difference in the post-test, was 20.16±1.67 but in the control group were Overweight. These findings are consistent with the study conducted by Kishor Kumar et al., which reported that 27.1% of adolescents with hypertension had a normal BMI. In comparison, 30.8% were categorized as overweight & obese(13). **The X2 value and p-value for the pre-test and post-test of the level of Body Mass Index show that adolescents in the experimental and control groups were statistically highly significant.**

Section B: Assessment of pre-test and post-test of the level of knowledge, blood pressure, stress and quality of life among adolescents with hypertension before and after administration of a multi-factorial intervention package in experimental group and control group.

Table 5: Frequency and percentage-wise distribution of pre-test and post-test of the level of knowledge among adolescents with hypertension before and after administration of a multi-factorial intervention package in experimental & control groups.
(N=119)

EXPERIMENTAL GROUP					CONTROL GROUP			
LEVEL OF KNOWLEDGE	PRETEST		POST TEST		PRETEST		POST TEST	
	n	%	N	%	n	%	N	%
Inadequate knowledge	71	59.7	0	0	65	54.6	57	47.9
Moderately adequate knowledge	48	40.3	26	21.8	54	45.4	62	52.1
Adequate knowledge	0	0	93	78.2	0	0	0	0
Total	**119**	**100**	**119**	**100**	**119**	**100**	**119**	**100**
Mean±Standard deviation	13.22±2.73		27.82±4.15		11.41±4.26		11.87±2.72	

Table 5 shows the frequency and percentage distribution of pre-test and post-test levels of knowledge among adolescents with hypertension before and after administering a multi-factorial intervention package. It reveals that the majority of participants had inadequate knowledge in the experimental group(59.7%)and in the control

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group(54.6%) in the pre-test and post-test adequate knowledge was gained in the experimental group (78.2%) and moderately adequate knowledge(52.1%) was acquired after the intervention of the multi-factorial package. A Similar study conducted by Grad I (14) aimed to assess the level of knowledge about hypertension among adolescents and found that 13.1% had an unsatisfactory level of knowledge about hypertension and its complications.

Table 6:-Frequency and percentage-wise distribution of pre-test and post-test of the level of stress among adolescents with hypertension before and after administration of a multi-factorial intervention package in experimental & control groups.

(N= 119)

EXPERIMENTALGROUP					**CONTROLGROUP**			
LEVELOFSTRESS	**PRETEST**		**POSTTEST**		**PRETEST**		**POSTTEST**	
	n	**%**	**N**	**%**	**N**	**%**	**n**	**%**
Low level of Stress	0	0	46	38.7	0	0	22	18.5
Moderate level of Stress	91	76.5	73	61.3	84	70.6	97	81.5
High level of Stress	28	23.5	0	0	35	29.4	0	0
Total	**119**	**100**	**119**	**100**	**119**	**100**	**119**	**100**
Mean±Standard deviation	28.75±5.16		7.97±6.35		26.29±0.458		25.62±5.07	

Table 6 shows the frequency and percentage distribution of pre-test and post-test stress levels among adolescents with hypertension before and after administering a multi-factorial intervention package. It reveals that most participants had moderate to higher levels of stress in the experimental group (76.5% & 23.5%). In the control group 38.7% & 61.3%, in the pre-test and post-test, the stress level was reduced to a moderate level to a low level in the experimental group (61.3% &38.7%) and in the control group (81.5% & 18.5%) respectively. It shows that multi-factorial intervention was very effective in compacting the stress levels of adolescents. A similar study conducted by KanjiNetal. demonstrated that an 8-week course of autogenic training exercise for nursing student volunteers significantly reduced stress levels by at least 33% compared to the control group (6). It was postulated that autogenic training exercises reduced psychologicaldys functions and disorders by activating sympathetic and parasympathetic nervous activities and offering body relaxation.

Table7:-Frequency and percentage-wise distribution of pre-test and post-test quality of life among adolescents with hypertension before and after administration of a multi-factorial intervention package in experimental & control groups.

(N= 119)

EXPERIMENTAL GROUP					**CONTROL GROUP**			
QUALITY OF LIFE	**PRETEST**		**POST TEST**		**PRETEST**		**POST TEST**	
	n	**%**	**n**	**%**	**N**	**%**	**n**	**%**
Very poor	32	26.9	0	0	59	49.6	13	10.9
Poor	57	47.9	0	0	55	46.2	47	39.5
Neither poor norgood	30	25.2	0	0	5	4.2	59	49.6
Good	0	0	95	79.8	0	0	0	0
Very Good	0	0	24	20.2	0	0	93	78.2
Total	**119**	**100**	**119**	**100**	**119**	**100**	**119**	**100**

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Mean±Standard deviation	49.58±18.11	105.04±10.07	37.77±10.75	39.48±13.40

Table 7 shows the frequency and percentage distribution of pretest and post-test quality of life among adolescents with hypertension before and after administering a multi-factorial intervention package. It shows that most participants in both groups reported a very poor quality of life (49.6%). This finding is consistent with a study conducted by Sadykova D & Lutfullin I (17), Which focused on the quality of life in young people with elevated blood pressure. In the post-test, the mean quality of life scores for the experimental and control groups were 105.04±10.07 & 39.48±13.40, respectively. The observed changes in the mean difference between the groups from the pretest to the post-test were statistically significant at p<0.001. These findings are supportive by the study conducted by Babu A S et al. (18). The study showed significant improvements in functional outcomes and improved quality of life, with an increase of 4.6 units and 5.7 units in the physical & mental component scores, respectively, after the administration of home-based exercise training.

Section C: Comparison of the level of knowledge, blood pressure, stress and quality of life of adolescents with hypertension between experimental and control groups before and after administration of a multifactorial intervention package.

Table – 8 Comparison of the level of knowledge of adolescents with hypertension between experimental and control groups before and after administration of a multi-factorial intervention package.

(N=238 (119+119))

Test	Group	Mean	Standard deviation	Mean difference	95% confidence interval for Mean		Independent T test value	'p' value
					LOWER	UPPER		
Pretest	**Experimental Group**	13.22	2.731	1.807	0.892	2.721	3.891	**0.000**HS**
	Control group	11.41	4.265					
Posttest	**Experimental group**	27.82	4.150	15.941	15.04	16.83	35.02	**0.000**HS**
	Control group	11.87	2.726					

*****p<0.001HS-highlysignificant, NS-Non-Significant.***

Pretest level of knowledge:
The mean score of Comparison of level of knowledge of adolescents with hypertension in **pretest** of **Experimental group** was 13.22±2.731 and the mean score in the **control group** was 11.41±4.265. The calculated **independent t test** value of t = 3.891 shows ***statistically highly significant difference*** between level of knowledge of adolescents with hypertension in experimental and control group of pretest.

Post-test level of knowledge:
The mean score of Comparison of level of knowledge of adolescents with hypertension in **post test** of **Experimental group** was 27.82±4.150 and the mean score in the **control group** was 11.87±2.726. The calculated **Independent t test** value of t =35.02 shows ***statistically highly significant difference*** between level of knowledge of adolescents with hypertension in experimental and control group of **post-test**.

Table – 9 Comparison of the blood pressure level [systolic and diastolic blood pressure] of adolescents with hypertension between experimental and control groups before and after administration of a multi-factorial intervention package.

(N=238 (119+119))

Test		Group	Mean	Standard deviation	Mean difference	95% confidence interval for mean		Independent T test value	'p' value
						Lower	Upper		
Systolic blood pressure	Pretest	**Experimental group**	132.24	3.682	-6.21	-6.94	-5.49	-16.91	**0.000**HS**
		Control group	138.45	1.593					
	Post test 1	**Experimental group**	130.34	4.770	-7.94	-8.91	-6.96	-16.02	**0.000**HS**
		Control group	138.29	2.545					
	Post test 2	**Experimental group**	120.54	1.661	-17.70	-18.01	-17.39	-112.5	**0.000**HS**
		Control group	138.24	0.431					
	Post test 3	**Experimental group**	113.82	4.264	-24.07	-25.05	-23.09	-48.56	**0.000**HS**
		Control group	137.89	3.326					
Diastolic blood pressure	Pretest	**Experimental group**	80.39	1.122	-0.93	-1.35	-0.51	-4.35	**0.000**HS**
		Control group	81.33	2.051					
	Post test 1	**Experimental group**	78.50	0.502	-2.80	-3.21	-2.39	-13.54	**0.000**HS**
		Control group	81.30	2.204					
	Post test 2	**Experimental group**	74.99	1.375	-6.24	-6.72	-5.76	-25.76	**0.000**HS**
		Control group	81.24	2.258					
	Post test 3	**Experimental group**	70.89	0.722	-10.26	-10.86	-9.67	-34.23	**0.000**HS**
		Control group	81.16	3.192					

*****p<0.001 HS-highly significant, NS-Non Significant.***

SYSTOLIC BLOOD PRESSURE

Pre test level of blood pressure [systolic blood pressure]:

The mean score of Comparison of level of blood pressure [systolic blood pressure] of adolescents with hypertension in **pretest** of **Experimental group** was 132.24±3.682 and the mean score in the **control group** was138.45±1.593. The calculated **Independent t test** value of t= -16.91 shows ***statistically highly significant difference*** between level of blood pressure[systolic blood pressure]of adolescents with hypertension in experimental and control group of pretest.

Post-test 1 level of blood pressure [systolic blood pressure]:

The mean score of Comparison of level of blood pressure [systolic blood pressure] of adolescents with hypertension in **post test 1** of **Experimental group** was 130.34±4.770 and the mean score in the **control group** was138.29±2.545. The calculated **Independent t test** value of t= -16.02shows ***statistically highly significant difference*** between level of blood pressure[systolic blood pressure]of adolescents with hypertension in experimental and control group of **post-test 1**.

Post-test 2 level of blood pressure [systolic blood pressure]:
The mean score of Comparison of level of blood pressure [systolic blood pressure] of adolescents with hypertension in **posttest 2** of **Experimental group** was 120.54±1.661 and the mean score in the **control group** was138.24±0.431. The calculated **Independent t test** value of t = -112.5shows ***statistically highly significant difference*** between level of blood pressure[systolic blood pressure]of adolescents with hypertension in experimental and control group of **post-test 2**.

Post-test 3 level of blood pressure [systolic blood pressure]:
The mean score of Comparison of level of blood pressure [systolic blood pressure] of adolescents with hypertension in **posttest 3** of **Experimental group** was 113.82±4.264 and the mean score in the **control group** was137.89±3.326. The calculated **Independent t test** value of t= -48.56 shows ***statistically highly significant difference*** between level of blood pressure[systolic blood pressure]of adolescents with hypertension in experimental and control group of **post-test 3**.

DIASTOLIC BLOOD PRESSURE
Pre test level of blood pressure[diastolic blood pressure]:
The mean score of Comparison of level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in **pretest** of **Experimental group** was 80.39±1.122 and the mean score in the **control group** was 81.33±2.051.Thecalculated **Independent t test** value of t=-4.35 shows ***statistically highly significant difference*** between level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in experimental and control group of pretest.

Post-test 1 level of blood pressure [diastolic blood pressure]:
The mean score of Comparison of level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in **post test 1** of **Experimental group** was 78.50±0.502 and the mean score in the **control group** was 81.30±2.204. The calculated **Independent t test** value of t=-13.54 shows ***statistically highly significant difference*** between level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in experimental and control group of **post-test 1**.

Post-test 2 level of blood pressure [diastolic blood pressure]:
The mean score of Comparison of level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in **posttest 2** of **Experimental group** was 74.99±1.375 and the mean score in the **control group** was 81.24±2.258. The calculated **Independent t test** value of t=-25.76 shows ***statistically highly significant difference*** between level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in experimental and control group of **post-test2**.

Post-test 3 level of blood pressure [diastolic blood pressure]:
The mean score of Comparison of level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in **post test 3** of **Experimental group** was 70.89±0.722 and the mean score in the **control group** was 81.16±3.192. The calculated **Independent t test** value of t=-34.23 shows ***statistically highly significant difference*** between level of blood pressure [**diastolic blood pressure**] of adolescents with hypertension in experimental and control group of **post-test 3**. Similar results were reported by Kanji N et al. (6), showing a significant reduction in systolic and diastolic blood pressure in the intervention group ($t = 4.43$; $p<0.015$ and $t = 3.8$; $p<0.05$, respectively) using autogenic training exercise.

Table – 10 Comparison of the level of stress of adolescents with hypertension between experimental and control groups before and after administration of a multi-factorial intervention package.

(N=238 (119+119))

Test	Group	Mean	Standard deviation	Mean difference	95% confidence Interval for mean	Independent T test value	'p' value

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					Lower	Upper		
Pretest	**Experimental group**	28.75	5.16	2.454	1.518	3.389	5.167	**0.000**HS**
	Control group	26.29	0.458					
Posttest	**Experimental group**	7.97	6.35	-17.64	-19.11	-16.17	-23.67	**0.000**HS**
	Control group	25.62	5.07					

p<0.001 HS-highly significant, NS-Non Significant.

Pretest level of stress:
The mean score of Comparison of level of stress of adolescents with hypertension in **pretest** of **Experimental group** was 28.75±5.16 and the mean score in the **control group** was 26.29±0.458. The calculated **independent t test** value of t = 5.167 shows ***statistically highly significant difference*** between level of stress of adolescents with hypertension in experimental and control group of pretest.

Post-test level of stress:
The mean score of Comparison of level of stress of adolescents with hypertension in **posttest** of **Experimental group** was 7.97±6.35 and the mean score in the **control group** was 25.62±5.07. The calculated **Independent t test** value of t = -23.67 shows ***statistically highly significant difference*** between level of stress of adolescents with hypertension in experimental and control group of **post-test**. This result aligns with a study conducted by Kanji N et al.(6), which demonstrated that autogenic training exercise reduced stress among the intervention groups (t=11.10;p<0.001).

Table – 11 Comparison of the quality of life of adolescents with hypertension between experimental and control groups before and after administration of a multi-factorial intervention package.

(N=238 (119+119))

Test	**Group**	**Mean**	**Standard deviation**	**Mean difference**	**95% confidence Interval for mean**		**Independent T test value**	**'p' value**
					Lower	**Upper**		
Pretest	**Experimental group**	49.58	18.11	11.80	8.002	15.61	6.113	**0.000**HS**
	Control group	37.77	10.75					
Posttest	**Experimental group**	105.04	10.07	65.56	62.53	68.59	42.64	**0.000**HS**
	Control group	39.48	13.409					

p<0.001 HS-highly significant, NS-Non Significant.

Pretest level of quality of life:
The mean score of Comparison of level of quality of life of adolescents with hypertension in **pretest** of **Experimental group** was 49.58±18.11 and the mean score in the **control group** was 37.77±10.75. The calculated **Independent t test** value of t = 6.113 shows ***statistically highly significant difference*** between level of quality of life of adolescents with hypertension in experimental and control group of pretest.

Post-test level of quality of life:
The mean score of Comparison of level of quality of life of adolescents with hypertension in **posttest** of **Experimental group** was 105.04±10.07 and the mean score in the **control group** was 39.48±13.409.The calculated **independent t test** value of t = 42.64 shows ***statistically highly significant difference*** between level of quality of life of adolescents with hypertension in experimental and control group of **post-test**. Therefore, the results suggest that the multi-factorial intervention package led to an improvement in the quality of life among the participants in the experimental group.

Section D: Comparison of Mean Scores of blood pressure(systolic blood pressure) of adolescents with hypertension between experimental and control groups

Table 2 **(N=238(119+119))**

Test	Groups	Mean	SD	Repeated measures ANOVA		Post Hoc Bonferroni 't' test		
				F value	P value	Comparison	MD	P value
Pretest	Experimental Group	132.24	3.682	285.95	**<0.001***(S)**	Experimental Group Vs Control group	6.21	**<0.001***(S)**
	Control group	138.45	1.593					
Post-test 1	Experimental Group	130.34	4.77	256.73	**<0.001***(S)**	Experimental Group Vs Control group	7.95	**<0.001***(S)**
	Control group	138.29	2.545					
Post-test 2	Experimental Group	120.54	1.661	1266.5	**<0.001***(S)**	Experimental Group Vs Control group	17.7	**<0.001***(S)**
	Control group	138.24	0.431					
Post-test 3	Experimental Group	113.82	4.264	2358.1	**<0.001***(S)**	Experimental Group Vs Control group	24.07	**<0.001***(S)**
	Control group	137.89	3.326					

The mean blood pressure(systolic blood pressure)in pretest was 132.24 in experimental group, and it was 138.45 in control group. Repeated measures ANOVA F-value indicated that the blood pressure (systolic blood pressure) differs among the two groups in pretest which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test also revealed that significant difference existed between the groups(p<0.001).

Regarding posttest 1, the mean blood pressure (systolic blood pressure) in post -test 1 was 130.24 in experimental, and it was 138.29 in control group. Repeated measures ANOVA F-value indicated that the blood pressure (systolic blood pressure) differs among the two groups in post -test 1 which is statistically significant(p<0.001). Post-Hoc Bonferroni multiple comparison test also revealed significant difference between experimental group and control group(p<0.001).

Regarding posttest 2, further, the mean blood pressure (systolic blood pressure) in post -test 2 further reduced to

120.54 in experimental group whereas in the control group it was 138.24. Repeated measures ANOVAF- value indicated that the blood pressure (systolic blood pressure) differs among the two groups in post -test 2 which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test revealed significant difference existed between experimental group and control group(p<0.001).

Regarding posttest 3, further, the mean blood pressure (systolic blood pressure) in post -test 2 further reduced to 113.82 in experimental group whereas in the control group it was 137.89. Repeated measures ANOVA F-value indicated that the blood pressure (systolic blood pressure) differs among the two groups in post -test 2 which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test revealed significant difference existed between experimental group and control group(p<0.001).

The decrease the level of blood pressure(systolic blood pressure)in experimental group revealed **multifactorial intervention package** was effective in decrease the blood pressure (systolic blood pressure) among adolescents with hypertension in experimental group

Section E: Comparison of Mean Scores of blood pressure (diastolic blood pressure) of adolescents with hypertension between experimental and control groups.

Table 13

Test	Groups	Mean	SD	Repeated measures ANOVA		Post Hoc Bonferroni 't' test		
				F value	P value	Comparison	MD	P value
Pretest	Experimental Group	80.39	1.122	18.95	**<0.001***(S)**	Experimental Group Vs Control group	0.94	**<0.001***(S)**
	Control group	81.33	2.051					
Post-test 1	Experimental Group	78.5	0.502	183.49	**<0.001***(S)**	Experimental Group Vs Control group	2.8	**<0.001***(S)**
	Control group	81.3	2.204					
Post-test 2	Experimental Group	74.99	1.375	664.1	**<0.001***(S)**	Experimental Group Vs Control group	6.25	**<0.001***(S)**
	Control group	81.24	2.258					
Post-test 3	Experimental Group	70.89	0.722	1171.8	**<0.001***(S)**	Experimental Group Vs Control group	10.27	**<0.001***(S)**
	Control group	81.16	3.196					

The mean blood pressure (diastolic blood pressure) in pretest was 80.39 in experimental group, and it was 81.33 in control group. Repeated measures ANOVA F-value indicated that the blood pressure (diastolic blood pressure) differs among the two groups in pretest which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test also revealed that significant difference existed between the groups (p<0.001).

Regarding posttest 1, the mean blood pressure (diastolic blood pressure) in post -test 1 was 78.5 in experimental, and it was 81.3 in control group. Repeated measures ANOVA F-value indicated that the blood pressure

(diastolic blood pressure) differs among the two groups in post -test 1 which is statistically significant (p<0.001). Post-Hoc Bonferroni multiple comparison test also revealed significant difference between experimental group and control group (p<0.001).

Regarding posttest 2, further, the mean blood pressure (diastolic blood pressure) in post -test 2 further reduced to 74.99 in experimental group whereas in the control group it was 81.24. Repeated measures ANOVA F- value indicated that the blood pressure (diastolic blood pressure) differs among the two groups in post -test 2 which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test revealed significant difference existed between experimental group and control group (p<0.001).

Regarding posttest 3, further, the mean blood pressure (diastolic blood pressure) in post -test 2 further reduced to 70.89 in experimental group whereas in the control group it was 81.16. Repeated measures ANOVA F-value indicated that the blood pressure (systolic blood pressure) differs among the two groups in post -test 2 which is significant (p<0.001). Post-Hoc Bonferroni multiple comparison test revealed significant difference existed between experimental group and control group (p<0.001).

The decrease the level of blood pressure (diastolic blood pressure) in experimental group revealed **multifactorial intervention package** was effective in decrease the blood pressure (diastolic blood pressure) among adolescents with hypertension in experimental group.

Section F: Correlation between the post-test level of knowledge, blood pressure, stress and quality of life of adolescents with hypertension in the experimental and control groups.

Table–14: Correlation between the post-test level of knowledge, blood pressure, stress and quality of life of adolescents with hypertension in the experimental and control groups.

(N=238 (119+119))

Correlation between the post-test level of knowledge, blood pressure, stress and quality of life of adolescents with hypertension		**MEAN**	**STANDARDD EVIATON**	**'r' VALUE**	**'p' VALUE**	**CORRELATION**
Experimental group	Level of **knowledge**	27.82	4.150	0.723	**0.000 *HS**	**POSITIVE**
	Level of blood pressure	130.34	4.770			
Control group	Level of **knowledge**	11.87	2.726	0.329	**0.000 *HS**	**POSITIVE**
	Level of blood pressure	138.29	2.545			
Experimental group	Level of **blood pressure**	130.34	4.77	0.969	**0.000 *HS**	**POSITIVE**
	Level of stress	7.97	6.35			
Control group	Level of **blood pressure**	138.29	2.54	0.448	**0.000 *HS**	**POSITIVE**
	Level of stress	25.62	5.07			
Experimental group	Level of **stress**	7.97	6.35	0.399	**0.000 *HS**	**POSITIVE**
	Level of quality of life	105.04	10.07			
Control group	Level of **stress**	25.62	5.07	0.295	**0.000 *HS**	**POSITIVE**
	Level of quality of life	39.48	13.409			
Experimental group	Level of **quality of life**	105.04	10.07	0.266	**0.003 *S**	**POSITIVE**
	Level of knowledge	27.82	4.15			
Control group	Level of **quality of life**	39.48	13.4	-0.315	**0.000 *HS**	**NEGATIVE**
	Level of knowledge	11.87	2.72			

-p<0.001 highly significant. NS-Non significant

The present study revealed significant positive correlations in the post test between the level of knowledge and blood pressure in both the experimental group(r-value:0.723;p<0.001)and the control group (r-value: 0.329; p<0.001). Similarly, a positive correlation was observed between the level of blood pressure and the level of stress in the experimental(r-value:0.969;p<0.001)and the control group(r value:0.448;p<0.001). These findings align with the findings of Mega Fet al.(19), who conducted across-sectional study on 262 teenagers in Indonesia and found a significant correlation between stress level and blood pressure (p<0.05). Furthermore, regarding the level of stress and quality of life, significant positive correlations were found in the experimental group(r-value: 0.399; p<0.001) and the control group (r value:0.295; p<0.001). This result is consistent with the findings of Serguei V N et al. (16), who discovered a positive correlation between blood pressure and the level of anxiety(r=0.77;p<0.01).Additionally, a significant positive correlation was found between the quality of life and the level of knowledge in the experimental group (r-value: 0.266; p<0.003). **However, in the control group, a negative correlation(r-value: -0.315;p<0.001)was observed, indicating a significant association(p<0.001).**

Section G: Association between the pre-test level of knowledge, blood pressure, stress and quality of life among adolescents with hypertension and their selected demographic variables, diet pattern and physical activity variables in the experimental and control groups.

In the experimental group, there was a significant association between the participants' socioeconomic status and their pre-test knowledge level (*p-value<0.001*).The age of the participants (*p-value <0.02*), religion (*p-value <0.01*), socioeconomic status (*p-value <0.002*), consumption of non-vegetarian foods (*p-value <0.05*), and usage of salt (*p-value <0.05*) were significantly associated with the pre-test level of blood pressure. The pre-test stress level and socioeconomic status(*p-value<0.001*)were significantly associated with stress in the experimental group. In contrast, religion (*p-value <0.05)*, socioeconomic status (*p-value<0.001*), and consumption of junk foods (*p-value <0.001*) were significantly associated with stress in the control group. This finding is supported by a study conducted by (20) that found a strong association between unfavorable socioeconomic circumstances and adolescent hypertension. In the control group, the participants' socioeconomic status (p–value <0.001) and consumption of junk foods (p-value<0.001)were significantly associated with the pre-test level of knowledge.

In the control group, age(p-value<0.001), socioeconomic status(p-value<0.05), and consumption of junk foods (p-value <0.001) were found to be significantly associated with the pre-test level of blood pressure. In the control group, consumption of fruits (*p-value<0.004*), consumption of junk foods(*p-value<0.001*), consumption of salt(*p-value <0.001*), school transportation(*p-value<0.01*), physical activity (*p-value <0.001*), hours spent in outdoor games (*p-value <0.001*) and hours spent watching television (*p-value <0.001*) were significantly associated with the pre- test quality of life.

Summary & Conclusion

In light of the growing concern over hypertension among adolescents and the recognition of various risk factors contributing to its prevalence, it is imperative to address this issue effectively. Among 1142 adolescents screened in Ariyankuppam commune panchayat, 273 were hypertensive in Phase I. With 238 hypertensive adolescents in Phase II, the effectiveness of the multi-factorial intervention package was studied in both experimental and control groups. The results show that the systolic and diastolic blood pressure was reduced, the level of knowledge was improved, stress levels were reduced, and the quality of life was improved among the adolescents after the intervention of this package, as mentioned above.

To conclude, the findings of this study highlight the effectiveness of the multi-factorial intervention package in addressing hypertension among adolescents had positive outcomes for all the aspects of dependent variables. Incorporating beetroot juice administration, autogenic training exercises and structured teaching programs could significantly improve the health and well-being of hypertensive adolescents.

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Conflict of interest

None

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References

1. Priya DV, Sumathy P, Renuka K.Assessment of prevalence and knowledge of risk factors regarding hypertension among adolescents in selected schools at Puducherry.2019;5(1):222–4.
2. Mahajan A, Negi P. Hypertension and pre-hypertension among adolescents in Shimla, Northern India-Time to awaken. NigerJ Cardiol. 2015;12(2):71.
3. Hayes DK, Denny CH, Keenan NL, Croft JB, Greenlund KJ. Health-related quality of life and hypertension status, awareness, treatment, and control: National Health and Nutrition Examination Survey, 2001-2004.JHypertens.2008;26(4):641–7.
4. Xu X, Rao Y, Shi Z, Liu L, Chen C, Zhao Y. Hypertension Impact on Health-Related Quality of Life: A Cross-Sectional Survey among Middle-Aged Adults in Chongqing, China. Int J Hypertens.2016;2016.
5. Bricarello LP, de Moura Souza A, de Almeida Alves M, Retondario A, Fernandes R, Santos de Moraes Trindade EB, et al. Association between DASH diet (Dietary Approaches to Stop Hypertension) and hypertension in adolescents: A cross-sectional school-based study. Clin Nutr ESPEN[Internet].2020; 36(xxxx):69–75. Available from: https://doi.org/10.1016/j.clnesp.2020.02.004
6. Kanji N, White A, Ernst E.Autogenic training to reduce anxiety in nursing students: randomized controlled trial. ISSUES Innov Nurs Educ Autogenic.2004; 729–35.
7. Coles LT, Clifton P M. Effect of beetroot juice on lowering blood pressure in free-living, disease-free adults: A randomized, placebo-controlled trial. Nutr J [Internet]. 2012; 11(1):1. Available from: Nutrition Journal
8. Amma D, Vasudevan D, Akshayakumar D.Prevalence and Determinants of Pre Hypertension and Hypertension among Adolescents : A School based Study in a Rural area of Kerala, India. Int J Res Med Sci.2015;3(1):1.
9. S Sundar J. Prevalence and Determinants of Hypertension among Urban School Children in the Age Group of 13- 17 Years in, Chennai, Tamilnadu. Epidemiol Open Access.2013;03(03):9–14.
10. Liu K, Li C, Gong H, Guo Y, Hou B, Chen L, et al. Prevalence and Risk Factors for Hypertension in Adolescents Aged 12 to 17 Years: A School-Based Study in China. Hypertension. 2021;(November):1577–85.
11. Kurnianto A, Kurniadi Sunjaya D, Ruluwedrata Rinawan F, Hilmanto D. Prevalence of Hypertension and Its Associated Factors among Indonesian Adolescents. Int J Hypertens.2020; 2020.
12. Rahimi H, Yuzbashian E, Zareie R, Asghari G, Djazayery A, Movahedi A, etal. Dietary approaches to stop hypertension (DASH) score and obesity phenotypes in children and adolescents. Nutr J.2020;19(1):1–9.
13. Kishorkumar D, Stalin P, Prasad RV, Singh Z. Prevalence of Hypertension Among School Children in a Rural Area of Tamil Nadu. Indian Pediatr.2016;(53):165–6.
14. GradI, Mastalerz-Migas A, Kiliš-Pstrusińska K.Factors associated with knowledge of hypertension among adolescents: Implications for preventive education programs in primary care.BMC Public Health.2015;15(1):1–8.
15. Dewi DP, Astriana K. Jurnal Riset Sains dan Teknologi Efektifitas Pemberian Jus Buah Bit(Beta Vulgaris.L) Sebagai Minuman Fungsional Penurun Tekanan Darahpada Lansia Effectiveness of Beet Juice (Beta Vulgaris. L) as a Functional Drink of Blood Pressure in Elderly.J R is Sains danTeknol.2019;3(1):35–40.
16. V. S, Nedogoda, Kolov SA, Butrina L V. The autogenic training lower blood pressure at the patients with arterial hypertension. AJH - Posters Non-pharmacologic Ther. 2001;14(Part2(4):142A.
17. Sadykova DI, Lutfullin IY. Psychosocial approach: Quality of life in young people with elevated blood pressure. Cardiovasc Ther Prev(RussianFed.2011;10(2):18–23.
18. Babu AS, Padmakumar R, Nayak K, Shetty R, Mohapatra AK, Maiya AG. Effects of home-based exercise training on functional outcomes and quality of life in patients with pulmonary hypertension: A randomized clinical trial. Indian Heart J [Internet].2019;71(2):161–5.Availablefrom:https://doi.org/10.1016/j.ihj.2019.03.002
19. Febrianora M, Achmad C, Aprami. T.CORRELATION OF HIGH BLOOD PRESSURE WITH STRESS.J Hypertens.2016; 461:2016.
20. Zaidi AH, de Ferranti SD. Prevalence of High Blood Pressure Among Youth in India and Association With Future Cardiovascular Disease. JAMA Netw open.2022;5(10):e2239290.