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RESEARCH ARTICLE

THE EFFECT OF CHANGE IN LIFESTYLE MEASURES ON WEIGHT AND BODY MASS INDEX AMONG ADULT HYPERTENSIVE PATIENTS IN A TERTIARY HOSPITAL IN NORTH CENTRAL NIGERIA

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ABSTRACT

Background: The prevalence of obesity has reached epidemic levels over the past few decades, and this is more so among hypertensive adults. Concurrent with this rise are increase in numerous obesity-associated diseases including heart disease, certain types of cancer, and diabetes. The cornerstone of therapeutic interventions to treat or prevent these diseases is weight loss via lifestyle modification. ***Aim***: The study was undertaken to determine the effect of change in lifestyle measures on weight and Body Mass Index (BMI) among adult hypertensive patients. ***Methods***: The study was a randomized controlled study involving hypertensive adults aged 20 years and above presenting in the General Outpatients' Clinic (GOPC) of Jos University Teaching Hospital (JUTH). Participants were consecutively selected and randomized to an intervention group that was offered structured counselling on lifestyle modification and a control group that was offered routine advice only. Participants in both groups were also taking antihypertensive medications. Participants were followed up monthly for twelve weeks and adherence to lifestyle modification measures noted. The proportion of observed changes were analysed using Chi square and Fischer's exact tests. The means at 95% confidence intervals of the weight and BMI values were determined using the independent t-test. Data was analyzed on an intention-to-treat basis. A p-value of <0.05 was considered significant in all analyses. ***Results***: Changes in lifestyle measures were notably more among the intervention group. Twenty four participants lost at least 0.5kg after the study, nine in the control group and 15 in the intervention group. Even though there was a difference in means of 2.47 kg (-11.46, 6.52; 95%CI) between the control and intervention groups at the end of the study, the difference was not statistically significant. Twenty three participants had at least 0.2kg/m^2 decrease in BMI in the study group, nine in the control group and 14 in the intervention group. The difference in means between the two groups was 0.12kg/m^2 (-3.38,3.62; 95%CI) and this was not statistical significant. ***Conclusion***: This study shows that changes in lifestyle measures among hypertensive adults are associated with a decrease in weight and improved BMI. However the effect of lifestyle modification on these clinical indices, during a period of 12 weeks, following structured counselling may not differ from routine verbal advice only.

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INTRODUCTION

The prevalence of obesity has reached epidemic levels over the past few decades, and concurrent with this rise are increases in numerous obesity-associated diseases including heart disease, certain types of cancer, and diabetes (Flegal *et al.,* 2008). The cornerstone of therapeutic interventions to treat or prevent these diseases is weight loss via lifestyle modification, including hypocaloric diet and/or increased physical activity along with behavioral techniques to support these changes (Wadden *et al.,* 2007). Typical weight loss resulting from lifestyle change is between 5–10% of baseline weight, so such approaches rarely bring an obese individual to a normal body weight (Summary, 1995). However, losing even this modest amount of weight brings health benefit (Pi-Sunyer *et al.,* 1996). Multiple non-randomized interventions have demonstrated improvements in biomarkers relating to hypertension, diabetes, cardiovascular disease, and cancer risk (Clinical Guidelines on the Identification, 1998). Smaller-scale randomized studies of lifestyle change to induce weight loss have shown improvements in hypertension and metabolic syndrome (Ebrahim *et al.,* 1998; Phelan *et al.,* 2007). Given the health impacts of the obesity epidemic and the research suggesting that weight loss can ameliorate these problems, there have been numerous calls for optimal obesity treatment strategies. The NIH Obesity Education Initiative Expert Panel suggested a caloric deficit of 500–1000 kcal/day using an individualized dietary strategy, along with 45 minutes of moderate-intensity physical activity 5 days/week (Clinical Guidelines on the Identification, 1998). The Institute of Medicine recommended at least 1 hour/day of moderately-intense physical activity coupled with a caloric deficit while the US Department of Agriculture similarly suggests individuals engage in close to 1 hour of moderate-to-vigorous intensity exercise on most days of the week, without exceeding caloric intake requirements (Agriculture). The US Center for Disease Control instead suggests at least 30 min/d of moderate-intensity exercise most days of the week while maintaining sensible portion sizes (Centers for Disease Control and Prevention, 2009). The recommendations from these agencies are all based on expert opinion supported by the available data. Although numerous studies have examined the effect of lifestyle interventions on body weight, few have focused on hypertensive adults, a group experiencing particularly high rates of overweight and obesity using a tested intervention, a program known to reduce disease risk in other populations, and measured effects over a 12 month period (Witham and Avenell). Hence, questions still remain regarding the best approach for weight loss from lifestyle change for this group in particular, and randomized, controlled studies are the best way to demonstrate effectiveness of interventions that could influence public health recommendations. We conducted a 12 weeks study to examine the effect of lifestyle modification on weight and BMI on hypertensive adults and we hypothesized that the participants randomized to the intervention group would experience greater weight loss and improvements in BMI than those randomized to the control group. Hypertension is defined as systolic blood pressure (SBP) of ≥ 140mmHg or diastolic blood pressure (DBP) of ≥ 90mmHg, based on "two or more properly measured seated blood pressure (BP) readings on each of two or more office visits" (Ezzati *et al.,* 2002). Current recommendations for the prevention and treatment of high BP emphasize non-pharmacological therapy, also termed "lifestyle modification". JNC-7 recommends lifestyle modification for all patients with hypertension and prehypertension (Akinkugbe, 2000; Centers for Disease Control and Prevention, 2008).

These modifications include:

1. Reducing dietary sodium to less than 2.4g per day
2. Increasing exercise to at least 30 minutes per day, four days per week
3. Limiting alcohol consumption to two drinks or less per day for men and one drink or less per day for women. One standard drink contains 10g of alcohol e.g one bottle of beer = 2.6 standard drinks
4. Following the dietary approaches to stop hypertension (DASH) eating plan (high in fruits, vegetables, potassium, calcium and magnesium, low fat and salt)
5. Achieving a weight loss goal of 4.5kg or more
6. Cessation of smoking (not recommended in JNC 7).

The aim of this study, was to determine the effect of change in lifestyle measures on blood pressure control among hypertensive adults.

MATERIALS AND METHODS

The study was conducted between February to May 2012 among hypertensive individuals aged 20 years and above presenting in the General Outpatients Clinic (GOPC) of Jos University Teaching Hospital (JUTH). The study was a randomized, comprising an intervention group that received structured counseling on lifestyle modification and a control group that was only advised on lifestyle modification. Using the Power of 80% and a 95% confidence level, the sample size for means was used for the study and 60 participants were recruited, with thirty in each group. Patients with a systolic blood pressure of ≥140 mmHg and/or diastolic blood pressure of ≥ 90 mmHg were included. Information collected included the participants' socio-demographic data, weight, BMI, alcohol intake and smoking, current exercise activity and a 24-hour dietary recall. Each Subject had a focused physical examination. The physical examination included the height, weight and body mass index (BMI). Height was measured in centimetres (cm) using a wall-mounted stadiometer. The subjects were without shoes and head gears while they stood erect with their hands at their sides. Their heads, buttocks and feet touched a vertical wall with the head level in the horizontal plane. Weight was measured in kilograms (kg) to the nearest 100g without shoes and with minimal clothing using a digital bathroom scale that was regularly calibrated with a known weight. Body mass index (BMI) was calculated as weight (in kg) divided by height (in metres) squared (kg/m2). All patients in the intervention group were counseled and advised concerning diet and exercise using a structured format. They were given written dietary and exercise instructions in either English or Hausa and asked to keep an exercise diary. They were asked to return for follow up at four, eight and twelve weeks. At each follow up visit, the instructions were reviewed and repeated according to the structured format to reinforce them. The blood pressure was recorded at each follow up visit as described above. The duration of exercise each day was also recorded. The control group were only given general advice on exercise and a healthy diet. Data was analysed using Epi Info version 3.5.3 (Centres for Disease Control and Prevention, Atlanta, Georgia, USA).[15] Background descriptive analysis was done to compare both groups. The primary outcome variable of interest was blood pressure. The proportions of categorical variables were compared using the χ^2 test and the Fisher's exact test. A p value of 0.05 was considered significant in all analyses. Analyses were carried out on an intention to treat basis.

RESULTS

Sixty subjects fulfilled the inclusion criteria and participated in the study – 30 each in the control and intervention groups. Fifty three completed follow-up (88.33%) while seven (11.67%) did not complete the study, comprising three in the control group and four in the intervention group.

Socio-demographic characteristics of study participants: The mean ages of the participants in the control and intervention groups were 48.64±9.78 years and 48.22±10.46 years (p=0.87). The age range was 27 to 68 years. Seventeen (28.3%) of the participants were males and 43 (71.7%) were females. Ninety percent of them were married. Details are shown in Table 1.

Lifestyle Habits

Alcohol consumption: At baseline, sixteen (26.67%) participants in the control group and 19 (31.67%) in the intervention group had a current history of alcohol consumption in the form of beer, wine, whisky and local brew, of more than two standard drinks per day and a duration of at least one year. One "standard" drink contains roughly 14 grams of pure alcohol, which is found in: 12 ounces of regular beer, which is usually about 5% alcohol, 5 ounces of wine, which is typically about 12% alcohol, 1.5 ounces of distilled spirits (gin/whisky), which is about 40% alcohol.

Table 1: Sociodemographic characteristics of the study participants

	Control group N=30	Intervention group N=30	p value
Mean Age (years)	48.64±9.78	48.22±10.46	0.87
Age category(years)			
20-29	2	1	
30-39	3	4	
40-49	10	9	
50-59	10	12	
60-69	5	4	
Gender:			0.77
Male	8	9	
Female	22	21	
Educational Level:			**0.92**
None	12	12	
Primary	4	5	
Secondary	6	7	
Tertiary	8	6	
Marital Status:			0.38
Married	26	28	
Single	4	2	
Religion:			0.60
Christian	19	17	
Muslim	11	13	
Ethnicity			0.39
Plateau People	20	23	
Non- Plateau People	10	7	

Post intervention, nine (15%) participants in the control group and 12 (20%) in the intervention group had reduced alcohol consumption (p=0.04).

Cigarette smoking: No participant in either the control group or the intervention group had a current history of cigarette smoking, and none had resumed or started smoking during the study.

Exercise: At enrollment, nine participants (15%) from the control group and ten (16%) from the intervention group were involved in some form of regular aerobic exercise. The control group exercised for an average of two days per week for an average of 34.5 minutes per day while the intervention group also exercised for an average of two days per week but for an average of 37 minutes per day. Among those that exercised, the most common exercise undertaken was brisk walking in both groups, comprising seven (77.7%) participants in the control group and five (50%) in the intervention group. At the end of the study, 25 (54.3%) participants from the control group and 22 (47.8%) from the intervention group were involved in some form of regular aerobic exercise (p=0.18). The control group exercised for an average of three days per week for an average of 32 minutes per day while the intervention group exercised for an average of four days per week for an average of 35 minutes per day. The most common exercise undertaken was brisk walking in both groups, with 13 (43.3%) participants in the control group and 15 (50%) in the intervention group (p=0.68). Jogging, skipping, climbing staircases, cycling, tennis, football and other forms of aerobic exercises made up the remaining.

Dietary pattern: Based on a 24-hour dietary recall and estimated from the average equivalent of the DASH diet, the dietary pattern of participants in the study groups were compared. All patients in both groups had less than the expected daily servings of fruits with 63.3% and 70% of participants having less than the expected daily servings of fruits and vegetables in the control and intervention groups respectively. Of the total study participants, 93.3% of the participants in the control group had more than the expected daily servings of fats and oils versus 96.7% in the intervention group while 70% of the control group had more than the expected daily servings of grain and grain cereals versus 76.7% in the intervention group. Only 13.3% of the control population had the expected value for lean meat, poultry or fish against 10% of the intervention population. Only 10% of the control population had some form of nuts, seeds or legumes and in required daily amounts at enrollment versus 6% in the intervention group. All participants in the study group were taking more than the expected daily servings of more than one teaspoon full of salt either in prepared meals or on the table or both. On completing the study, 47.2% of the control group had the expected daily servings of fruits against 67.8% of the intervention group (p=0.03). The control and intervention groups comprised 47.7% and 56.3% of participants who had the expected daily servings of vegetables respectively (p=0.035). In the control group, 11.4% had the expected daily servings of fats and oils versus 18.3% in the intervention group (p=0.58). The control group was made up of 27.8% who had the expected daily servings of grain and grain cereals which was comparable with 34.9% in the intervention group (p=0.41). Only 41.1% of the control group had the expected servings for lean meat, poultry or fish against 38.9% of the intervention group (p=0.63). On completion of the study, 9.3% of the control group had some form of nuts, seeds or legumes versus 11.4% of the intervention group (p=0.29). All participants in both study arms had reduced their salt intake at the end of the study. Based on a 24 hour dietary recall and estimated from the average equivalent of the DASH diet, the dietary pattern of participants in the study groups were compared at baseline and on completing the study (Figures 1 and 2).

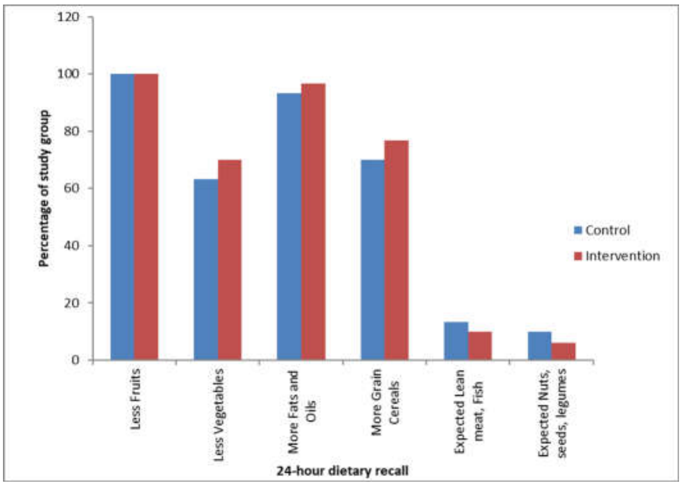

Fig 1. Baseline dietary pattern of the control and intervention groups based on a 24-hour dietary recall

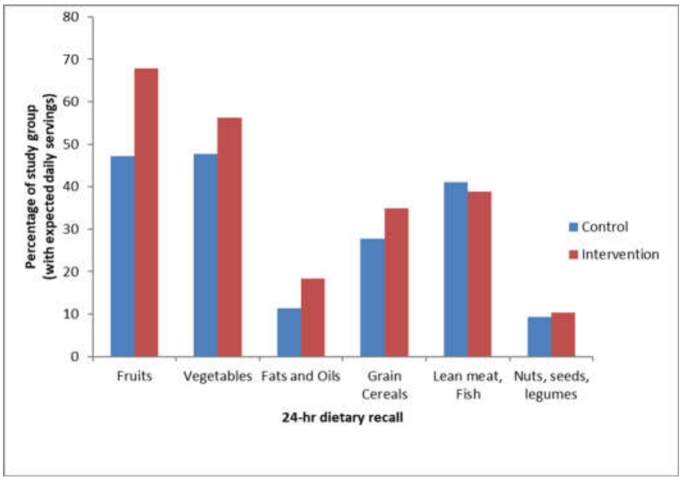

Fig 2. Post-intervention dietary pattern of the control and intervention groups based on a 24-hour dietary recall

Weight: The mean weights of the control and intervention groups were 78.54±16.75 kg and 76.91±19.03kg (p=0.73) respectively. In the control group, the least weight was 51kg and the maximum was 111kg while in the intervention group, the least weight was 53kg and the maximum, 119kg. Post intervention, the mean weights of the control and intervention groups were 77.27±16.40 kg and 74.8±18.34kg respectively (p=0.59). In the control group, the least weight remained 51kg and the maximum weight was 109kg while in the intervention group, the least weight was at 52kg and the maximum weight reduced to115kg. Twenty four participants lost at least 0.5kg after the study, nine in the control group and 15 in the intervention group. Even though there was a difference in means of 2.47 kg (-11.46, 6.52; 95%CI) between the control and intervention groups at the end of the study, the difference was not statistically significant.

Body mass index: The mean BMI of the control group at the start of the study was 29.69± 6.28kg/m^2 while that of the intervention group was 30.15±7.4 kg/m^2 (p=0.80). At the end of the study, the mean BMI of the control group was 29.48±6.37 kg/m^2 while that of the intervention group was 29.36±7.16kg/m^2 (p=0.95). Twenty three participants had at least 0.2kg/m^2 decrease in BMI in the study group, nine in the control group and 14 in the intervention group. The difference in means between the two groups was 0.12kg/m^2 (-3.38,3.62; 95%CI) and this was not statistical significant.

DISCUSSION

This study evaluated the cumulative benefit of multiple lifestyle interventions and the benefit that can be expected from structured therapeutic lifestyle changes. Several similar studies investigating the effect of lifestyle interventions on hypertension have been done elsewhere (Steptoe *et al.,* 2002; Wister *et al.,* 2007; Appel *et al.,* 2003). Although the average weight loss in the control group was not statistically significant when compared to the intervention group, the average reduction in weight from baseline to the end of the study was higher in the intervention group, with 30% and 50% loosing at least 0.5kg in the control and intervention groups respectively at the end of the study. This may have been possible with the exercise and dietary pattern observed among participants in the study. The Trials of Hypertension Prevention (TOHP), a multicentre study done in USA, also demonstrated a similar but larger effect (Stevens *et al.,* 2002). In that trial, a behavioral weight loss intervention in adults with hypertension led to an average reduction in body weight of 2 kg at six months. The evidence of an effect of weight loss on reduction in BP is strong and consistent as was seen in other studies (Lawoyin *et al.,* 2002; Staessen *et al.,* 2003; Cutler, 2001; Hill and Wyatt, 2002; Puepet *et al.,* 2002). It may be argued that the modest average reduction in weight loss among study participants at the end of the study may have resulted from a sizeable number of individual weights being maintained rather than reduced, due to effected lifestyle changes during the period of the study. These modest reductions should be viewed in the context of public health goals that emphasize prevention of additional weight gain, rather than weight loss, because of the well-documented difficulties of sustaining weight loss (Lawoyin *et al.,* 2002; Cutler, 2001). Although the difference in the mean BMI between the control and intervention groups was not statistically significant at the end of the study, the mean BMI was slightly higher in the intervention group than in the control group. However, only 30% of the control group had at least a reduction of 0.2kg/m^2 versus 46.67% in the intervention group at the end of the study. This study was unlike other studies which showed a significant decrease in BMI following the period of intervention (Writing Group of the PREMIER Collaborative Research Group, 2003; Steptoe *et al.,* 2002; Wister *et al.,* 2007). The inability to detect this difference may be because, the relatively short twelve-week duration of the study was inadequate to demonstrate a difference compared to at least one year in these other studies. Since the weekly target weight loss in the intervention group was 0.5 kg, it was expected that each subject in the intervention group lose 6 kg over the twelve-week period of the study.

Conclusion

This study shows that changes in lifestyle measures are associated with a decrease in weight and improved BMI. Individuals with hypertension can make and sustain, during a period of 12 weeks, multiple lifestyle modifications which can help to reduce weight or improve BMI and reduce the risk for cardiovascular diseases. However, administration of structured counselling of lifestyle changes may not differ from routine verbal advice in terms of improvement of these clinical indices.

Implication for clinical practice: This study demonstrates the utility of effecting lifestyle changes in reducing weight and BMI and consequently reducing co-morbidities that may be associated with elevated blood pressure. Clinicians should therefore be aware of the presence of risk factors associated with increased blood pressure and the screening and risk categorization of patients should be a routine aspect of patient care.

Implication for policy makers: Public policy to support and encourage lifestyle changes can be implemented at all levels of government. The provision of sports grounds, smoke-free public spaces and 'green' spaces in communities, and legislation on the sale and consumption of alcohol, among other measures will create a supportive environment in which healthier lifestyle choices are easier to make.

Consent: Written informed consent was obtained from participants.

Conflict of Interest: There is no conflict of interest to declare

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