

## Review Article

# Primary health care services for obesity and hypertension in sub-urban community: focus on nutrition

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## ABSTRACT

Medical nutrition therapy (MNT) is a major clinical care concept, especially for non-communicable diseases such as obesity and hypertension. Primary healthcare (PHC) centers are the first point of contact with health services and provide a point of entry for the entire health system. Research has revealed that access to primary healthcare services is associated with improved health outcomes, such as an improvement in self-rated health and a decline in all-cause mortality. However, the integration of MNT in hypertension and obesity management at PHC level is unclear. The aim of this study is to establish PHC services for obese and hypertensive individuals with a focus on nutrition, and the need for further research. Awareness of dietary approach to stop hypertension (DASH) among health workers, obese and hypertensive individuals and its utilization in practice was low in PHC centers this is due to lack of registered dietitians' nutritionists who are trained in MNT which is complicated by lack of ministerial funding of PHC facilities.

**Keywords:** Rural community, PHC facility, Medical nutrition, Healthcare service, DASH

## INTRODUCTION

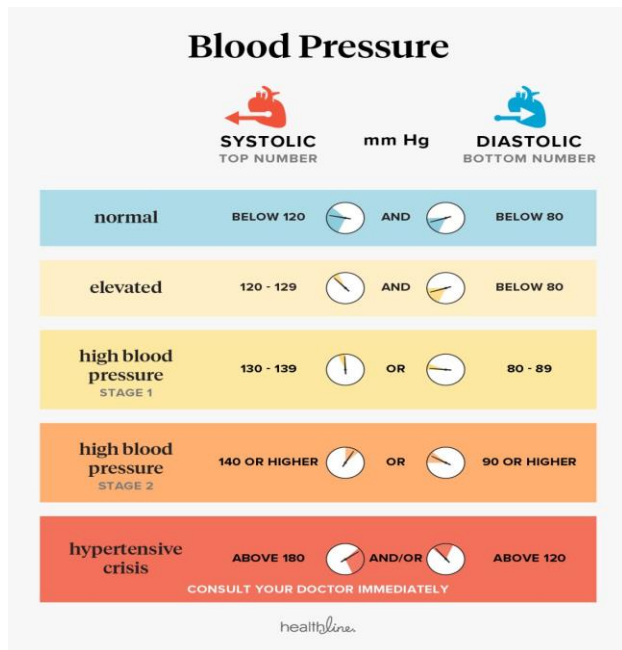
Primary health care (PHC) is essential health care based on practical, scientifically sound and socially acceptable methods and technology, made universally accessible to individuals and families in the community through their full participation and at a cost that the community and the country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination.<sup>1</sup> Primary care is the first point of contact with health services and provides a point of entry for the entire health system. Research has shown that access to primary health services is linked to better health outcomes, including improvements in self-rated health and a reduction in all-cause mortality.<sup>2</sup>

Christian et al, reviewed that globally, dietary factors are responsible for about one in five deaths.<sup>3</sup> In many low- and middle-income countries different forms of malnutrition (including obesity and undernutrition) can co-exist within the same population. Recent research by Raquel et al.<sup>4</sup> revealed that nutritional interventions alone yielded a higher but no significant average reduction on weight when compared with combined components intervention. Interventions delivered through individual or group sessions showed a similar positive effect on weight decrease. The dietary prescription approach yielded a greater effect on weight loss than did the behavioral approaches.<sup>4</sup>

Obesity as a common, serious, costly and chronic medical condition is defined as abnormal or excessive fat

accumulation that may impair health.<sup>5-7</sup> For adults, WHO defines obesity as a body mass index (BMI) of greater than or equal to 30.<sup>7</sup> BMI is a simple index of weight-for-height that is commonly used to classify obesity in adults. It is defined as a person's weight in kilograms divided by the square of his or her height in meters (kg/m<sup>2</sup>). The Centers for Disease Control and Prevention (CDC) likewise define obesity as a BMI of 30 kg/m<sup>2</sup> or higher.<sup>6</sup> The CDC further split obesity into the following classes:<sup>6,8</sup> Class 1: BMI of 30–34, Class 2: BMI 35–39, Class 3: BMI 40 or higher.

Blood pressure is the force exerted by circulating blood against the walls of the body's arteries, the major blood vessels in the body. Hypertension is when the blood pressure is too high.<sup>6</sup> Blood pressure is written as two numbers. The first (systolic) number represents the pressure in blood vessels when the heart contracts or beats. The second (diastolic) number represents the pressure in the vessels when the heart rests between beats.<sup>6</sup> Hypertension is diagnosed if, when it is measured on two different days, the systolic blood pressure readings on both days is  $\geq 140$  mmHg and/or the diastolic blood pressure readings on both days is  $\geq 90$  mmHg.<sup>6</sup> When reading a blood pressure measurement, systolic pressure is the first and often larger number followed by the diastolic pressure.<sup>9</sup> For example, a blood pressure reading of 120/80 indicates a systolic pressure of 120 and a diastolic pressure of 80. In a clinical setting hypertension is organized into four levels, normal, elevated, stage 1 and stage 2.<sup>10</sup>



**Figure 1: Understanding your blood pressure readings.<sup>11</sup>**

## METHODS

This was a review study. Journal articles and publications from 2004 to 2022 were reviewed. Search engines included PubMed, Google Scholar, Science Direct and

Cochrane. Search terms included PHC services, obesity, hypertension, and nutrition. A total of 150 papers were retrieved during the search and only 55 were included in the review out of which 39 papers were on nutritional-related issues.

## Stakeholders evaluation (health care professional)

Although nutrition education for the prevention and management of hypertension is the responsibility of registered dietitians and nutritionist, nurses also play this role particularly because there are few registered dietitians.<sup>12</sup> Others include physicians, health care professionals and community health workers. Community health and nutrition programs are often initiated and run by the health sector, but sometimes a separate ministry or service.<sup>13</sup> There is established evidence supporting screening for obesity of in most sick individuals, combined with referral to appropriate intervention services; there is indication that health professionals do not typically adopt this appropriate practice.<sup>14</sup> As well as practical issues such as time and resourcing, implementation is impacted by health professionals' views about the causes of obesity and doubts about the benefits of the health sector intervening once someone is already obese.<sup>14</sup> As well as lacking confidence or knowledge about how to integrate prevention into clinical care, health professional judgments about who might benefit from prevention and negative views about effectiveness of prevention hinder the implementation of practice guidelines. This is compounded by an often prevailing view that preventing obesity is a matter of personal responsibility and choice.<sup>14</sup> Despite scientific evidence to the contrary, the prevailing view in society is that obesity is a choice, which can be reversed by voluntary decisions to eat less and exercise more. These messages are evident in public health policies and campaigns, media portrayal and education.<sup>15</sup> Even though the population health approach is important to address the complexity of obesity, it is important that the remit of health services is extended beyond medical treatment to incorporate obesity prevention through screening and referral. The obesity epidemic has continued to spread worldwide, suggesting that policies and interventions to date have not been fully effective.<sup>16</sup> The characteristics of the obesity epidemic suggest it is a systems problem that could benefit from a systems approach. Systems approaches have transformed many industries and professions and new systems approaches and methods have the potential to similarly transform obesity prevention and control. A systems approach to obesity entails 5 key strategies: a global approach; interdisciplinary collaboration; utilization of new systems methods; modifications of existing methods; and bridging research, education, policy, and action.<sup>17</sup>

Community- and facility-based activities, with enablement from central levels of organization, as well as some centrally run programs are important for protecting and improving health, especially in poor communities.<sup>18</sup> Community-based programs continue to play an essential

role until health care services, education, household income, and communications have improved.<sup>19</sup> Many developing countries are characterized by a state of nutritional transition from prevalent under-nutrition (underweight and deficiencies) to the emergent problem of over-nutrition (overweight, obesity and toxicities), which is associated with increased morbidity and mortality, and whose complications can persist into adulthood with long-term consequences.<sup>19,20</sup>

Nutrition and lifestyle modifications are important components of primary healthcare services for obesity and hypertension in communities. In January, 2015, the Endocrine Society released new guidelines on the treatment of obesity to include the following: Diet, exercise, and behavioral modification should be included in all obesity management approaches for body mass index (BMI) of 25 kg/m<sup>2</sup> or higher.<sup>21</sup> Other tools, such as pharmacotherapy for BMI of 27 kg/m<sup>2</sup> or higher with comorbidity or BMI over 30 kg/m<sup>2</sup> and bariatric surgery for BMI of 35 kg/m<sup>2</sup> with comorbidity or BMI over 40 kg/m<sup>2</sup>, should be used as adjuncts to behavioral modification to reduce food intake and increase physical activity when this is possible.<sup>21</sup>

According to Ken controlling the disease through dieting particularly dietary approach to stop hypertension (DASH) is considered a major advancement in the field of clinical Nutrition.<sup>22,23</sup> DASH involves the development of a moderate carbohydrate eating plan combined with the recommended intake of vegetables and fruits to supply relevant macro and micro nutrients necessary to alleviate hypertension. Although, currently being used in Nigeria by dietitians and clinical nutritionists, several public health challenges have continuously hindered the country from reaping the full benefits of the DASH plan.<sup>23</sup>

DASH Eating Plan	
The Benefits: Lowers blood pressure & LDL "bad" cholesterol.	
Eat This	Limit This
Vegetables	Fatty meats
Fruits	Full-fat dairy
Whole grains	Sugar sweetened beverages
Fat-free or low-fat dairy	Sweets
Fish	Sodium intake
Poultry	
Beans	
Nuts & seeds	
Vegetable oils	

www.nhlbi.nih.gov/DASH

**Table 2: Description of the DASH eating plan.<sup>24</sup>**

Dietary Approach to Stop Hypertension was the most effective intervention in lowering blood pressure for adults with pre-hypertension to established hypertension. Low-sodium and high-potassium salt, comprehensive lifestyle modification, breathing control and low-calorie diet also have obvious effects in lowering BP. Moreover, our findings suggest that salt restriction be used for lowering BP, especially in patients with hypertension.<sup>25</sup>

Individual nutrition education is more effective than group education in terms of improving anthropometric and biochemical indices in overweight-obese hypertensive adults.<sup>26</sup> Guidelines underline that weight loss in obesity should be emphasized.<sup>27</sup> According to a study by Danuta et al., dietary counseling provided by dietitians/nutritionists can significantly improve the management of patients suffering from hypertension and obesity.<sup>26</sup> Between individual and group nutrition education, the former-tailored to a patient's need-has much greater potential for improving anthropometric and biochemical indices in overweight-obese hypertensive adults.<sup>26</sup>

**Stakeholders evaluation (community)**

Advocacy is important in allowing social voice, facilitating prioritization, and bringing different forces/actors together.<sup>28,29</sup> Key advocacy organizations and individuals including health professional groups, the media, civil society organizations, powerful individuals, and policymakers were involved in advocacy activities. The nature of their engagement included organizing workshops, symposiums, town hall meetings, individual meetings, press conferences, demonstrations, and engagements with media. All these enhanced the entrenchment of primary health care services on the political and financial agenda at the State and Federal levels.<sup>29</sup> In the context of poor health outcomes, interest from policymakers and politicians in health care services, combined with advocacy from key policy actors armed with evidence, can improve prioritization and sustained implementation of health care services.<sup>29</sup>

To prevent obesity and high blood pressure in the community, everyone should be encouraged to make lifestyle modifications, such as eating a healthier diet, quitting smoking, and getting more exercise.<sup>30</sup> According to a research conducted by Chukwu et al. frequent dietary salt intake, insufficient consumption of fruits and vegetables, hypercholesterolemia, being obese and a current smoker, and having a family history of hypertension were identified as significant risk factors for hypertension in the study population. There is strong and consistent evidence that reducing sodium intake reduces blood pressure.<sup>30</sup> Adults who would benefit from lowering blood pressure should be advised to limit their sodium intake to no more than 2,400 mg per day (about 1 teaspoon of table salt).<sup>31</sup> Further reduction of sodium intake to 1,500 mg per day is desirable because it is associated with an even greater reduction in blood pressure. The average

blood pressure reduction in patients consuming a sodium-restricted diet of 2,400 mg per day is 2/1 mm Hg, or 7/3 mm Hg for those restricting sodium to 1,500 mg per day.<sup>32</sup>

Non-pharmacologic interventions that modify lifestyle can lower blood pressure (BP) and have been assessed in numerous randomized controlled trials and pair wise meta-analyses. It is still unclear which intervention would be most efficacious.<sup>26</sup> Appropriate physical activities can take any form that increases heart rate and energy expenditure. Walking is the most commonly prescribed and likely to be the most successful because of its safety and accessibility.<sup>33</sup> A pedometer can be used to provide feedback concerning the number of steps or miles walked. Patients should start by walking for 10 minutes on 3 days per week and then increase the duration, frequency, and intensity of walking to the target level. Guidelines underline that weight loss in obesity should be emphasized.<sup>21</sup> The National Weight Control Registry recommends walking 4000 steps per day initially and increasing to 12,000 steps over 6 months.<sup>33</sup> Regular physical activity should also be encouraged during long-term maintenance, because it is one of the most consistent traits of patients who keep their weight off.<sup>33</sup> Besides its beneficial physiological effects, an aerobic exercise program combined with dietotherapy improves pro-atherogenic, pro-inflammatory and metabolic factors in obese patients with controlled hypertension.<sup>34</sup>

The prevalence of non-communicable diseases including hypertension and obesity is rising and alcohol consumption is predisposing factor.<sup>35</sup> High alcohol consumption was associated with higher risks of obesity, hypertension, and dyslipidemia in Korean men. In particular, binge drinkers were associated with higher risks of obesity, hypertension, diabetes, and dyslipidemia compared to non-binge drinkers.<sup>36</sup> Given the social significance of alcohol worldwide it is not surprising that there is continuing strong interest in the relationship between alcohol and hypertension. These issues all need to be considered in the context of social aspects of drinking and effects on morbidity and mortality.<sup>37</sup> Alcohol consumption pattern partly modifies the age-hypertension relationship.<sup>35</sup> Prevalence ratios are higher with higher age groups among moderate drinkers and abstainers while they stagnate among the frequent drinkers.<sup>35</sup> The differences in hypertension level by age group were most evident among the moderate drinkers and the abstainers while there was minimal change across the age groups among the frequent drinkers.<sup>29</sup>

Hypertension, the leading risk factor for cardiovascular disease, originates from combined genetic, environmental, and social determinants. Environmental factors include obesity, unhealthy diet, excessive dietary sodium, inadequate dietary potassium, insufficient physical activity, and excessive consumption of alcohol.<sup>38</sup> Hypertension is a major modifiable risk factor for cardiovascular diseases and all-cause death globally and in Africa.<sup>30</sup>

## RESULTS

The result from this review revealed that health workers (including registered dietitians and nutritionists) perceived rural life as difficult and lack the desire to work in PHC centers located in rural communities with general shortage of manpower. Poor PHC funding was another issue. Due to shortage of registered dieticians and nutritionist, nurses also carry out nutritional intervention. DASH (Dietary Approach to Stop Hypertension) diet and other nutritional interventions were not fully utilized for the prevention and management of obese and hypertensive individuals in most of the PHC due to the absence of certified and licensed MNT providers (registered dietitians and nutritionists). Therefore, most services at the PHC facilities are limited to health fairs. There are still concerns about inadequate consumption of fruits and vegetables concomitantly with relatively high intake of fatty/oily and calorie dense foods as well as sedentary lifestyle which were common among the obese and hypertensive individuals.

The study found that frequent dietary salt intake, insufficient consumption of fruits and vegetables coupled with hypercholesterolemia, being obese, a current smoker and having a family history of hypertension were significant risk factors for hypertension and its complications. Appropriate physical activity as adjunct to nutrition intervention increases heart rate and energy expenditure which reduced the risk of complications associated with obesity and hypertension.

## DISCUSSION

For control of hypertension, the targeted strategy involves interventions to increase awareness, treatment, and control in individuals. Having a usual source of care, optimizing adherence, and minimizing therapeutic inertia are associated with higher rates of blood pressure (BP) control.<sup>38</sup> Yvette and Gregory revealed that maintaining a moderate weight or losing weight through diet and exercise can help prevent or reduce obesity. In some cases, however, a person may need surgery.<sup>39</sup> Drinking fewer calorific sweet drinks is the best way to curb excessive weight and prevent chronic diseases such as obesity and diabetes, although fat and salt in processed foods are also at fault.<sup>40</sup> In addition to the importance of accuracy in measurement of BP, team-based care with shared decision-making, maximizing adherence by use of once-daily medications and combination pills when feasible, promotion of lifestyle strategies proven to be effective in lowering blood pressure.<sup>38</sup>

Salt intake was positively associated with systolic blood pressure (SBP) in men but not in women. Alcohol intake was positively associated with SBP in both sexes; physical activity was not.<sup>41</sup> Individual nutrition education is more effective than group education in terms of improving anthropometric and biochemical indices in overweight-obese hypertensive adults.<sup>20</sup> Dietary counseling provided



by dietitians can significantly improve the management of patients suffering from hypertension. Between individual and group nutrition education, the former-tailored to a patient's need-has much greater potential for improving anthropometric and biochemical indices in overweight-obese hypertensive adults.<sup>26</sup> A recent study carried out by Osama et al. to evaluate the impact of obesity and its related complications on the course of COVID-19 in Egyptian patients revealed that obesity and its related complications increase the risk of presenting a more severe form of COVID-19 in Egyptian patients.<sup>43</sup>

Further research is needed to study the effectiveness of various approaches to nutrition counseling, one of the key aspects being and the role of dietitians and their skills in multidisciplinary health care teams.<sup>26</sup> The continuing discovery of mechanisms regulating appetite and metabolism is likely to lead to new therapies for obesity-induced hypertension.<sup>44</sup> Weight loss occurs when energy expenditure exceeds energy intake. An energy deficit of 500–1,000 kcal/day will result in a loss of ~1–2 pounds/week and an average total weight loss of about 8% after 6 months.<sup>44</sup> Weight loss of 5–10 kg in women with obesity substantially lowers the risk of developing hypertension by up to 25%.<sup>45</sup>

Severe calorie restriction that involves the use of a very-low-calorie diet (<800 kcal/day) causes rapid weight loss of about 15–20% within 4 months. However, very-low-calorie diets are not recommended for most patients, because they do not result in greater long-term weight loss and have a higher risk of developing medical complications, such as gallstones, than low-calorie diets.<sup>46,47</sup> However, adipocytes also possess potent endocrine functions, secreting a myriad of cytokines and adipokines that contribute to insulin resistance.<sup>48</sup> Dietary pattern should be adapted to appropriate calorie requirements, personal and cultural food preferences, and nutritional therapy for other medical conditions. One way to achieve this is by following plans such as the Dietary Approaches to Stop Hypertension (DASH) diet.<sup>49</sup>

Although some significant issues regarding assessment/management of obesity remain to be addressed and the underlying mechanisms governing these disparate effects of obesity on cardiovascular disease are complex and not completely understood, a variety of factors could have a critical role.<sup>50</sup>

## CONCLUSION

Dietary and other lifestyle modifications including regular exercise are still important and safe first-line measures for the management of obesity and hypertension. Interventions that address diet, physical activity and weight have been found to be very beneficial in reducing systolic and diastolic blood pressures by 12.5 mmHg and 7.9 mmHg, respectively.

Control of both obesity and hypertension in the population at risk is the overriding current public health challenge while primary and even primordial prevention is the long-term goal for reducing the prevalence of obesity. Obesity related hypertension is multifactorial in nature and its prevention and management requires multiple and parallel efforts with the involvement of government, industry, health professionals, and individual self-care.

The total food rations of rural dwellers consisted of larger amounts of fat/oil and vitamin A compared to those of city dwellers. Lifestyle interventions are useful for all obese hypertensive individuals in most of whom a modest weight loss is sufficient enough to normalize the blood pressure levels and avoiding the aggressive use of multiple antihypertensive medications.

## Recommendation

According to NICE guidelines, in the first instance, when a patient is either hypertensive or pre-hypertensive, diet modifications and improved physical activity are recommended; this should include high intake of vegetables, fruits, and whole grains, less processed, salty and fatty foods.

Behavioral modification is very essential and highly recommended for the prevention and control of obesity and hypertension.

Other recommendations include consuming low-fat dairy products, poultry, fish, legumes, moderate intake of non-tropical vegetable oils, and nuts; and limiting intake of sweets, sugar-sweetened beverages, and red meat.

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## REFERENCES

1. Alma Ata Declaration on Primary Health Care, WHO-UNICEF, 1978; <https://www.who.int/teams/social-determinants-of-health/declaration-of-alma-ata>. Accessed on 17 May 2021.
2. Stefan D, Zhou B, Carrillo-Larco RM, Danaei G, Riley LM, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants, *Lancet*. 2021;398:957-80.
3. Kraef C, Wood B, von Philipsborn P, Singh S, Petersone SS, Kallestrup P. Primary health care, nutrition and Universal Health Coverage, *World Health Organization; Policy*. 2020;16:1.
4. Canuto R, Garcez A, de Souza RV, Kac G, Olinto MTA. Nutritional intervention strategies for the management of overweight and obesity in primary health care: A systematic review with meta-analysis, *Review Obes Rev*. 2020;22(3):e13143.

5. Nnate DA, Eleazu CO, Abaraogu UO. Ischemic Heart Disease in Nigeria: Exploring the Challenges, Current Status, and Impact of Lifestyle Interventions on Its Primary Healthcare System. *Int J Environ Res Public Health.* 2022;19:211.
6. Centers for Disease Control and Prevention, 2021. Adult Overweight & Obesity, <https://www.cdc.gov/obesity/adult/index.html>, Accessed on the 17 May 2021.
7. World Health Organization, 2021. Obesity and overweight, <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Accessed on the 17 May 2021.
8. Daniel SJ. Education and the COVID-19 pandemic. *Prospects (Paris).* 2020;49(1-2):91-6.
9. American Heart Association, 2020. Understanding Blood Pressure Readings. <https://www.heart.org/en/health-topics/high-bloodpressure/understanding-blood-pressure-readings>. Accessed 15 November 2022.
10. Jeffrey S. New ACC/AHA hypertension guidelines make 130 the new 140. *Medscape Medical News.* Available at <https://www.medscape.com/viewarticle/888560>. Accessed 18 November 2017.
11. Madell R, Hersh E. Blood Pressure Readings Explained. <https://www.healthline.com/health/high-blood-pressure-hypertension/blood-pressure-reading-explained#stage-2>. Retrieved on the 19 March 2023.
12. Nsiah AS, Setorglo J, Mie JB. "Nutritional Counseling for Hypertensive Patients: Have Final-Year Nursing Students Learnt Enough to Be Able to Offer Advice to Such Patients?", *Journal of Biomedical Education.* 2017.
13. Elijah AA, Adesoye AK, Chinwendu OS, Ifeoma OA, Ewah-Odiase RO, Ukhueigbe OI, Obozokhale AG. Socio-demographic factors associated with overweight and obesity among primary school children in semi-urban areas of mid-western Nigeria, *PAMJ.* 2019;20(103):5619.
14. Pearce C, Rychetnik L, Wutzke S, Wilson A. Obesity prevention and the role of hospital and community-based health services: a scoping review. *BMC Health Serv Res.* 2019;19:453.
15. Brown A, Flint SW, Batterham RL. Pervasiveness, impact and implications of weight stigma, *e Clinical Medicine.* 2022;47:101408.
16. WHO. WHO European Regional Obesity Report 2022. <https://apps.who.int/iris/bitstream/handle/10665/353747/9789289057738-eng.pdf>. Accessed 15 April 2023.
17. Lee BY, Bartsch SM, Mui Y, Haidari LA, Spiker ML, Gittelsohn J. A systems approach to obesity. *Nutr Rev.* 2017;75(suppl 1):94-106.
18. Wilson MG, Lavis JN, Guta A. Community-based organizations in the health sector: A scoping review. *Health Res Policy Sys.* 2012;10:36.
19. Pingali P, Aiyar A, Abraham M, Rahman A. The Nutrition Transformation: From Undernutrition to Obesity Transforming Food Systems for a Rising India. 2019;978-3-030-14408-1.
20. Abrahams Z, Mchiza Z, Steyn NP. Diet and mortality rates in Sub-Saharan Africa: Stages in the nutrition transition. *BMC Public Health* 2016;11:801.
21. Jakubowski E, Kluge H, Rechel B. Organization of public health services. In: Rechel B, Jakubowski E, McKee M, et al., editors. *Organization and financing of public health services in Europe* [Internet]. Copenhagen (Denmark): European Observatory on Health Systems and Policies; 2018. (Health Policy Series, No. 50.) 3. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK535720/>.
22. Apovian CM, Aronne LJ, Bessesen DH, Mc Donnell ME, Murad MH, Pagotto U et al. Pharmacological management of obesity: an endocrine Society clinical practice guideline. *Journal of Clinical Endocrinology and Metabolism.* 2016;100(2):342-62.
23. Sikaris KA. The Clinical Biochemistry of Obesity, *Clinical Biochemist Review.* 2004;25(3):165-81.
24. Ogunkoya OE, Besidonne CE. A review of the DASH plan in Nigeria, *Journal of Public Health and Nutrition.* 2019;2(2):156-60.
25. National Heart, Lung and Blood Institutes. DASH Eating Plan. Last updated December 29, 2021 <https://www.nhlbi.nih.gov/education/dash-eating-plan>. retrieved on the 19th March 2023.
26. Fu J, Liu Y, Zhang L, Zhou L, Li D, Quan et al. Nonpharmacologic Interventions for Reducing Blood Pressure in Adults With Prehypertension to Established Hypertension, *Journal of the American Heart Association.* 2020;9(19):e016804.
27. Gajewska D, Kucharska A, Kozak M, Niegowska SWJ. Effectiveness of Individual Nutrition Education Compared to Group Education, in Improving Anthropometric and Biochemical Indices among Hypertensive Adults with Excessive Body Weight: A Randomized Controlled Trial, *Nutrients.* 2019;11(12):2921.
28. Pasquali R, Casanueva F, Haluzik M, van Hulsteijn L, Ledoux S, Monteiro MP, et al. European Society of Endocrinology Clinical Practice Guideline: Endocrine work-up in obesity, *European Journal of Endocrinology.* 2020;182(1):1-32.
29. Uzochukwu B, Onyedinma C, Okeke C, Onwujekwe O, Manzano A, Ebenso B, et al. What makes advocacy work? Stakeholders' voices and insights from prioritisation of maternal and child health programme in Nigeria. *BMC Health Serv Res.* 2020;20:884.
30. Beckerman J, 2019. An Overview of High Blood Pressure Treatment. <https://www.webmd.com/hypertension-high-blood-pressure/guide/hypertension-treatment-overview#1-2>. Accessed 15 April 2023.
31. Chukwu Charity E, Ebuehi Osaretin AT, Ajuluchukwu Janet NA, Adedeji HS. Anthropometric, socio-demographic and biochemical risk factors of hypertension in Lagos,

- Nigeria, Alexandria Journal of Medicine. 2021;57(1):44–51.
32. Eckel RH, Jakicic JM, Ard JD, de Jesus JM, Miller NH, Hubbard VS, et al. AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2021. <http://circ.ahajournals.org/content/early/2013/11/11/01.cir.0000437740.48606.d1.full.pdf+html>. Accessed 6 July 2021.
  33. Bray GA, Vollmer WM, Sacks FM, Obarzanek E, Svetkey LP, Appel LJ. DASH Collaborative Research Group. A further subgroup analysis of the effects of the DASH diet and three dietary sodium levels on blood pressure: results of the DASH-Sodium Trial, *Am J Cardiol.* 2004;105 (4):579.
  34. Fujioka K. Management of Obesity as a Chronic Disease: Nonpharmacologic, Pharmacologic, and Surgical Options, *Obesity Research*; 2012;10(2):116-21.
  35. Zoltán J, Ágnes H, Adél N, Ildiko S, György P, Péter F. Alterations in Anthropometric, Physiological and Biochemical Parameters During a Complex Exercise and Dietary Treatment Program for Obese Patients with Controlled Hypertension, *Journal of Hypertension.* 2021;39:333-4.
  36. Tumwesigye NM, Mutungi G, Bahendeka S, Wesonga R, Katureebe A, Biribawa C, et al. Alcohol consumption, hypertension and obesity: Relationship patterns along different age groups in Uganda, *Preventive Medicine Reports.* 2020;19:101141.
  37. Kim BY, Nam H, Yoo JJ, Cho YY, Choi DH, Jung CH, et al. Association between alcohol consumption status and obesity-related comorbidities in men: data from the 2016 Korean community health survey, *BMC Public Health.* 2021;21:733.
  38. Beilin LJ, Puddey IB. Alcohol and Hypertension, *Hypertension.* 2006;47:1035–8.
  39. Carey RM, Muntner P, Bosworth HB, Whelton PK. Prevention and Control of Hypertension: JACC Health Promotion Series. *J Am Coll Cardiol;* 2018;72(11):1278–93.
  40. Yvette and Gregory. What is obesity, and what causes it? Medically reviewed by Gregory Minnis, DPT, Written by Yvette Brazier, 2021. Updated on 18 April 2021.
  41. Nebehay S. Tax sugary drinks to fight obesity, WHO urges governments. GENEVA (Reuters) – Health News. <https://www.reuters.com/article/us-health-sugar-idUKKCN12B0ZB>, 2016. Sourced on the 14 April 2023.
  42. Lelong H, Galan P, Kesse-Guyot E, Fezeu L, Hercberg S, Blacher J. Relationship Between Nutrition and Blood Pressure: A Cross-Sectional Analysis from the NutriNet-Santé Study, a French Web-based Cohort Study, *American Journal of Hypertension.* 2019;28(3):362–71.
  43. Mehanna O, El Askary A, Ali E, Esawy BEI, Alla TF, Gharib AF. Impact of Obesity and Its Associated Comorbid Conditions on COVID-19 Presentation, *Dovepress.* 2021;14:409-5.
  44. Rahmouni K, Correia MLG, Haynes WG, Mark AL. Obesity-Associated Hypertension, *Hypertension.* 2005;45:9–14.
  45. Bacon SL, Sherwood A, Hinderliter A, Blumenthal JA. Effects of exercise, diet and weight loss on high blood pressure, *Sports Med.* 2004;34:307-16.
  46. Engeli S, Böhnke J, Gorzelniak K, Janke J, Schling P, Bader M, et al. Weight loss and the renin-angiotensin-aldosterone system, *Hypertension;* 2005;45:356–62.
  47. Kim JY. Optimal Diet Strategies for Weight Loss and Weight Loss Maintenance. *J Obes Metab Syndr.* 2021;30(1):20-31.
  48. Arabi T, Shafqat A, Sabbah BN, Fawzy NA, Shah H, Abdulkader H, et al. Obesity-related kidney disease: Beyond hypertension and insulin-resistance. *Front Endocrinol (Lausanne).* 2023;13:1095211.
  49. Suri S, Kumar V, Kumar S, Goyal A, Tanwar B, Kaur J, et al. DASH Dietary Pattern: A Treatment for Non-communicable Diseases. *Curr Hypertens Rev.* 2020;16(2):108-14.
  50. Leggio M, Lombardi M, Caldarone E. The relationship between obesity and hypertension: an updated comprehensive overview on vicious twins. *Hypertens Res.* 2017;40:947–63.

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