ORIGINAL ARTICLE

Nutritional Evaluation of Therapeutic Diets for Cardiovascular Diseases in Hospitals of General Santos City, Philippines: A Comparative Cross-sectional Study

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ABSTRACT

Objective. This study aimed to evaluate the nutritional adequacy and compliance with cardiovascular disease (CVD) guidelines in therapeutic diets implemented in four hospitals in General Santos City, Philippines.

Methods. The study employed a cross-sectional study and analyzed the one-day therapeutic menus of four hospitals using the Philippine Food Composition Table and the United States Department of Agriculture nutrient database. The nutrient contents calculated in this study were compared among hospitals and benchmarked against the Philippine Dietary Reference Intakes (PDRI) and CVD-specific guidelines, the Dietary Approaches to Stop Hypertension (DASH), and Therapeutic Lifestyle Changes (TLC). The nutrient adequacy ratios (NARs) and the corresponding mean (SD) values were used to interpret the data.

Results. Based on the PDRI, the mean (SD) NARs for proteins, simple sugars, vitamin B6, folate, and vitamin B12 were 116% (11%), 72% (16%), 139% (34%), 115% (7%), and 324% (156%), respectively, which were all interpreted as adequate. However, the mean (SD) NARs for energy, 88% (7%), and dietary fiber, 53% (33%), indicate non-compliance with the requirements for these components. As for the DASH guidelines, the hospitals failed to meet the recommendations for calcium, magnesium, and potassium, with mean (SD) NARs of 45% (14%), 49% (10%), and 51% (7%), respectively. The levels of saturated fatty acids, 195% (53%), and dietary cholesterol, 363% (177%), exceeded the limits set by the guidelines. For the TLC guidelines, the mean (SD) NARs of 70% (24%) and 40% (10%) for monounsaturated fatty acids and polyunsaturated fatty acids, respectively, were interpreted as suboptimal. Conclusive interpretations cannot be drawn for sodium, total carbohydrates, total fats due to large variations in their compositions among the hospitals.

Conclusion. At the menu analysis level, while the therapeutic diets adhered to the recommendations for proteins, simple sugars, and the vitamins, they fell short in their provision for energy, unsaturated fats, dietary fiber, and most minerals. They also exceeded the limits for most dietary lipid parameters set by DASH and TLC. The findings of this study highlight the need for improvements in nutritional adequacy and adherence to CVD guidelines in hospital therapeutic diets. Due to the limited number of observations, future research should aim to confirm and clarify these findings.

Keywords: therapeutic diets, cardiovascular disease, nutrient adequacy, nutrient analysis, PDRI, DASH, TLC

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INTRODUCTION

Cardiovascular diseases (CVDs) comprise a spectrum of disorders that affect the heart and blood vessels. In terms of global health burden, CVDs reign as the leading cause of mortality, responsible for an estimated number of 17.9 million deaths worldwide.[1] In 2021, ischemic heart disease and cerebrovascular disease are the first and second leading causes of mortality, respectively, in the Philippines.[2] Poor diet, often characterized as low intake of plant-based food and high consumption of animal-based food and sodium, is considered as one of the major risk factors of CVDs.[3] A recent multinational prospective cohort study has revealed that most CVD cases globally can be attributed to five (5) modifiable risk factors, including poor diet, along with pre-existing hypertension, hypercholesterolemia, household pollution, and tobacco smoking.[4] Thus, there has been a significant emphasis in the field of public health on the modification of lifestyle factors, particularly diet, as a pivotal approach to mitigate the prevalence of CVDs.[5]

Dietary patterns refer to the combinations and totality of food habitually consumed.[6] Many studies have shown that following certain dietary patterns can improve metabolic and clinical parameters associated with CVDs.[7,8] One of the known dietary patterns related with beneficial cardiovascular outcomes is the Dietary Approaches to Stop Hypertension (DASH). This dietary pattern emphasizes the consumption of fruits, vegetables, whole-grains and other plant-based food, and low-fat dairy products, which are high in dietary fiber and minerals such as potassium, calcium, and magnesium, and limits the intake of red and processed meats, which are high in saturated fats, cholesterol, and sodium, and sweets that are high in simple carbohydrates.[9] This diet approach emerged from research funded by the US National Institutes of Health (NIH) and was specifically designed to address hypertension through non-pharmacological means.[10] An umbrella review of meta-analyses has shown that DASH induced clinically significant reductions in body weight, blood pressure, total cholesterol, LDL-cholesterol, and HbA1c.[11] On the other hand, the Therapeutic Lifestyle Change (TLC) is an approach consisting of promotion of physical activity, weight management, and adherence to a dietary pattern focused in lowering LDL-cholesterol.[12] In 2002, the Third Report of the National Cholesterol Education Program's Adult Treatment Panel (ATP III) released the guidelines for the TLC program, built upon the foundation laid by emerging scientific evidence that showed improvements in lipid profile by following a diet low in cholesterol, saturated fats, trans fats, and high in viscous fiber, plant stanols and sterols, and focus on unsaturated fats as the healthy kind of fats that must be consumed.[13] Other aspect of clinical dietetics that must be addressed in the management of CVDs is the detection and treatment of micronutrient deficiencies, especially the B vitamins.[14]

Clinical dietetics is an integral part of the interdisciplinary medical services offered by hospitals that provide therapeutic diets for certain medical conditions. Adaptations to the recommended Medical Nutrition Therapy (MNT) can lead to an adequate intake of energy and nutrients by hospital patients. This results in an improvement in the nutritional condition of the patient, leading to a decrease in the time and cost of hospital stay.[15] Adherence to the MNT recommendations prescribed by qualified professionals, the registered nutritionist-dietitians, can lead to clinically effective cardiometabolic benefits.[16] The nutritional adequacy and adherence to established guidelines of therapeutic diets implemented in hospital settings require careful evaluation to ensure effective patient care. However, despite the importance of therapeutic diets, there is a paucity of empirical evidence evaluating their nutritional quality and compliance with established guidelines. To date, in the Philippines there was only one study that investigated the nutritional content of regular diets[17], and no other study has been conducted on the evaluation of oral therapeutic diets specifically for cardiovascular diseases.

For these reasons, the study aimed to generate the nutrient composition of therapeutic diets of selected hospitals in General Santos City, Philippines, compare the computed nutritional contents with the Philippine Dietary Reference Intakes (PDRI)[18], DASH[9], and TLC dietary reference standards[12,13], and assess compliance for nutrients relevant to CVDs. This study aims to help the efforts of addressing the leading cause of mortality in the country by covering this research gap in literature.

MATERIALS AND METHODS

Study Design and Setting

The study employed a cross-sectional, descriptive, comparative research design. The study took place during the months of January to May 2021 and invited hospitals located in General Santos City, Philippines to participate. In 2020, General Santos City held the largest number of deaths caused by CVDs in the whole Region XII.[19] It is in this premise that the city was chosen as the study site.

Ethical Considerations

The study underwent an ethical review before the conduct of its methodology. An ethical clearance (No. 0280, s. 2021) was secured from the Institutional Ethics Review Committee (IERC) of Central Mindanao University. Although the protocol of the study did not employ human participants, the methods were reviewed to ensure the anonymity of the hospitals selected and the personnel involved.

Participating Hospitals

Originally, communication letters, together with the research capsule informing them about the purpose and nature of the study, were sent to seven (7) hospitals in

General Santos City to invite them to participate in the study. These hospitals were purposively selected because they are the biggest hospitals in the city in terms of functional capacity. They also happened to be the most accessible to the researchers during the conduct of the study. However, only four (4) hospitals responded to the call. Among the four, three (3) of these hospitals are privately operated and one is government operated. One hospital has level 1 functional capacity whereas the remaining three have level 3 functional capacity.

Data Collection and Measurement

The Nutrition and Dietetics section (NDS) of each of the four hospitals were requested to provide any available one-day therapeutic menu commonly prepared and served to CVD patients for perusal of this research. Computation of nutrients was performed separately for every diet for each hospital. In the calculation of nutrient composition of menus, the portion sizes for each food item were first converted to their equivalent cooked edible portion (EP) weights (g). All mixed dishes were broken down into single ingredients, which was then analyzed individually. A copy of the ingredients for each recipe was also secured from the hospitals. Using the Philippine Food Composition Table (PhilFCT)[20] and the US Department of Agriculture (USDA)[21] National Nutrient Database, both available online, the nutrient contents were then computed using Equation (1):

$$x = \frac{a}{100} \times b \quad \textit{(1)}$$

Where:
x = nutrient or energy content of the item
a = cooked EP weight (g) of the item
b = energy or nutrient content of item in the PhilFCT or USDA database per 100 g

The dietary components that were analyzed using the PhilFCT were the following: energy (kcal), total carbohydrates (g), dietary fiber (g), simple sugars (g), proteins (g), total fats (g), saturated fatty acids (SFA) (g), monounsaturated fatty acids (MUFA) (g), polyunsaturated fatty acids (PUFA) (g), sodium (mg), calcium (mg), and cholesterol (mg). On the other hand, the USDA database was used to analyze the following nutrients: potassium (mg), magnesium (mg), vitamin B6 (mg), folate (mcg), and vitamin B12 (mcg). Furthermore, the USDA database was used as an alternate reference for any food not available in the PhilFCT. To minimize any potential error that may come from using food composition databases, accurate use of portion sizes is of paramount importance. This was ensured by checking the portion sizes written on the menus through an interview with the registered nutritionist-dietitian (RND) in charge. The units of these portion sizes were also ensured to be consistent with their corresponding references used in the databases. For each dietary component, contents of all food items belonging to the same menu were then added up and considered as the possible total energy content (TEC) or total nutrient content (TNC) that the CVD patients can consume in a day for each hospital. It is important to note that the nutrient contents generated may only represent the nutritional profile of the menus and may not reflect the actual intake of CVD patients.

Data Analysis

To assess the adequacy of TNCs or TECs derived from each hospital or determine whether they exceed the limits established by the dietary reference standards, the nutrient adequacy ratio (NAR) for each dietary component was calculated using Equation (2):

$$\text{NAR} = \frac{\text{TEC or TNC}}{\text{reference standard}} \times 100 \quad \textit{(2)}$$

Using the PDRI[18] as the reference standard, the NARs were calculated for all dietary components except SFA, MUFA, PUFA, and cholesterol. Also, using DASH[9], the NARs were computed except for energy, simple sugars, proteins, MUFA, PUFA, and the B vitamins. Using TLC,[12,13] the NARs were not calculated for energy, simple sugars, proteins, minerals, and the B vitamins. To meet the acceptable energy or nutrient adequacy, the NARs for energy, dietary fiber, proteins, MUFA, PUFA, calcium, potassium, magnesium, and the B vitamins must be at least 100%. To assess other dietary components deemed unhealthy when excessive, the NARs for total carbohydrates, simple sugars, total fats, SFA, sodium, and cholesterol must be below 100%. For each dietary component, the TECs and TNCs were averaged across the hospitals to get the mean energy content or mean nutrient content and the corresponding standard deviations (SD). The mean (SD) values for NARs were also calculated. This is to summarize the energy and nutrient contents across all hospitals and generally evaluate their adequacy.

RESULTS

The results of the nutritional content analysis of one-day menu therapeutic diets of the four hospitals and the mean (SD) values for each dietary component are presented in Table 1. The mean energy (SD) composition of the therapeutic diets was 1785 (143.27) kcal, with Hospital D and A garnering the highest (1930 kcal) and lowest (1550 kcal) one-day total energy content (TEC), respectively. On the other hand, the total nutrient content (TNC) values for the macronutrients across the hospitals were generally within 5-20 g from the mean composition values. The highest one-day TNCs for total carbohydrates (240 g) and SFA (30 g) were registered by Hospital C. Hospital D got the highest for total fats (83 g) and MUFA (36 g), was tied with Hospital B for the highest for proteins (85 g) and PUFA (10 g), and with Hospital A for dietary fiber (13 g). While Hospital A got the highest TNC

Table 1. The Total Energy Contents (TECs) and Total Nutrient Contents (TNCs) of Therapeutic Diets for each Dietary Component and their Corresponding Mean (SD) Values by Hospital

Energy/Nutrient	Hospital A	Hospital B	Hospital C	Hospital D	Mean	SD
Energy (kcal) [a]	1550	1800	1860	1930	1790	140
Macronutrients [b]						
Total Carbs (g)	232	190	240	206	217	20
Simple sugars (g)	61	15	38	29	36	17
Fiber (g)	13	5	11	13	11	3
Proteins (g)	74	85	68	85	78	7
Total Fats (g)	37	74	71	83	66	17
SFA (g)	11	26	30	29	24	8
MUFA (g)	10	31	26	36	26	10
PUFA (g)	4	10	8	10	8	2
Minerals [b]						
Sodium (mg)	3014	1235	2214	1077	1885	784
Calcium (mg)	541	327	807	565	560	170
Magnesium (mg)	229	173	301	286	247	51
Potassium (mg)	2537	1831	2542	2681	2396	332
Vitamins						
Vitamin B6 (mg) [c]	2.91	1.51	2.01	1.95	2.10	0.51
Folate (mcg) [b]	418	455	487	482	460.50	27.39
Vitamin B12 (mcg) [c]	3.65	7.37	6.27	13.80	7.77	3.73
Miscellaneous						
Cholesterol (mg) [b]	98	633	646	799	544	266

[a] *The TECs and their mean (SD) values are declared in the nearest tens.*
[b] *The TNCs and their mean (SD) values are declared in the nearest whole numbers.*
[c] *The TNCs and their mean (SD) values are declared in the nearest hundredths.*

for simple sugars (61 g), it also had the lowest for total fats (37 g) and SFA (11 g). The lowest TNCs for total carbohydrates (190 g), simple sugars (15 g), and fiber (5 g) were also provided by Hospital B. The TNC values for the minerals were much scattered from the mean composition values, ranging from 50-800 mg. The mean one-day sodium (SD) composition was 1885 (783.94) mg, with Hospital A and D giving the highest (3014 mg) and lowest (1077 mg) TNCs for sodium, respectively. Hospital C got the highest for calcium (807 mg) and magnesium (301 mg). Additionally, Hospital D registered the highest for potassium (2681 mg), while the lowest for calcium (327 mg), magnesium (173 mg), and potassium (1831 mg) were observed in Hospital B. For the vitamins, Hospital A garnered the highest TNC for vitamin B6 (2.91 mg) and lowest for folate (418 mg) and vitamin B12 (3.65 mcg). The lowest for vitamin B6 (1.51 mg) was observed in Hospital B, while the highest for folate (487 mg) and vitamin B12 (13.80 mcg) were provided by Hospital C and D, respectively. For cholesterol, Hospital A and D had the lowest (98 mg) and highest (799 mg) TNCs, respectively.

To assess the compliance of each hospital's therapeutic diet to standard references relevant to CVD management in terms of nutritional composition, the nutritional adequacy ratios (NARs) were calculated. Table 2 shows the generated NARs against the PDRI values with mean (SD) NAR values for each nutrient. All hospitals had NARs of at least 100% for proteins and the B vitamins, which were the only nutrients consistently met by all hospitals. The mean (SD) NAR values for proteins, vitamin B6, folate, and vitamin B12 were 116% (11%), 139% (34%), 115% (7%), and 324% (156%), respectively. Also, they all had NARs of <100% for total carbohydrates (TC), with the mean (SD) values of 57% (5%).

A similar pattern was also noted for simple sugars, with mean (SD) values of 72% (26%), however, there was one hospital (A) that exceeded the recommended limit. On the other hand, no hospital met the recommended energy intake (REI) and the recommended nutrient intakes (RNIs) for dietary fiber (DF) and potassium (K). The mean (SD) NAR values for energy, DF, and K were 88% (7%), 53% (33%), and 68% (9%), respectively. For calcium (Ca), the mean (SD) NAR values of 72% (22%) also did not meet the acceptable threshold, however, one hospital (B) did meet it. Other findings were so inconsistent that large deviations from the means cannot conclusively determine whether they complied the acceptable recommendations or not. For example, the sodium (Na) in Hospital B (62%) and Hospital D (54%) were well below the limit of 100%, giving a mean NAR of 94%, but the SD value (39%) signifies that the NARs of other hospitals were so high and distant from the mean. A similar pattern was also noted for total fats (TF) and magnesium (Mg).

Table 3 shows the generated NARs against the DASH recommendations with mean (SD) NAR values for each dietary component. All hospitals had consistently higher saturated fatty acids (SFA) than the recommended limit,

Table 2. The NARs (%) of Therapeutic Diets against the Philippine Dietary Reference Intake (PDRI) for each Dietary Component and their Corresponding Mean (SD) Values by Hospital

Nutrient/Energy	PDRI [a]	Hospital A		Hospital B		Hospital C		Hospital D		Mean NAR	SD
		TEC/TNC	NAR	TEC/TNC	NAR	TEC/TNC	NAR	TEC/TNC	NAR		
Energy (kcal)	2030	1550	76	1800	89	1860	92	1930	95	88	7
Macronutrients											
Total Carbs (g)	380	232	61	190	50	240	63	206	54	57	5
S. Sugars (g)	50	61	122	15	30	38	76	29	58	72	16
Fiber (g)	20	13	65	5	25	11	55	13	65	53	33
Proteins (g)	67	74	110	85	127	68	101	85	127	116	11
Total Fats (g)	68	37	54	74	109	71	104	83	122	97	26
Minerals											
Na (mg)	2000	3014	151	1235	62	2214	111	1077	54	94	39
Ca (mg)	775	541	70	327	42	807	104	565	73	72	22
Mg (mg)	225	229	102	173	77	301	134	286	127	110	22
K (mg)	3510	2537	72	1831	52	2542	72	2681	76	68	9
Vitamins											
Vit B6 (mg)	1.51	2.91	193	1.51	100	2.01	133	1.95	129	139	34
Folate (mcg)	400	418	105	455	114	487	122	482	121	115	7
Vit B12 (mcg)	2.4	3.65	152	7.37	307	6.27	261	13.8	575	324	156

[a] *The PDRI values were derived from the recommended energy intakes (REI) & recommended nutrient intakes (RNIs) by averaging those values across age groups (≥19 years) for most nutrients. For total carbs & fats, the upper & lower limits of the Acceptable Macronutrient Distribution Ranges (AMDRs) were averaged before translating into intakes by g. For simple sugars, <10% of the mean REI was used. For Na, 2 g was used. For K, 3510 mg was used.*

Table 3. The NARs (%) of Therapeutic Diets against the Dietary Approach to Stop Hypertension (DASH) for each Dietary Component and their Corresponding Mean (SD) Values by Hospital

	Energy (kcal)	Macronutrients				Minerals				Cholesterol (mg)
		Total Fats	SFA	Total Carbs	Dietary Fiber	Na	Ca	Mg	K	
Hospital A [a]	1550	37	11	232	13	3014	541	229	2537	98
DASH [b]		47	10	213	30	1500	1250	500	4700	150
NAR (%)		80	106	109	43	201	43	46	54	65
Hospital B [a]	1800	74	26	190	5	1235	327	173	1831	633
DASH [b]		54	12	248	30	1500	1250	500	4700	150
NAR (%)		137	217	77	17	82	26	35	39	422
Hospital C [a]	1860	71	30	240	11	2214	807	301	2542	646
DASH [b]		56	12	256	30	1500	1250	500	4700	150
NAR (%)		127	242	94	37	148	65	60	54	431
Hospital D [a]	1930	83	29	206	13	1077	565	286	2681	799
DASH [b]		58	13	265	30	1500	1250	500	4700	150
NAR (%)		143	225	78	43	72	45	57	57	533
Mean NAR (%)		122	198	89	35	126	45	49	51	363
SD		25	53	13	11	52	14	10	7	177

[a] *The TECs for energy and TNCs for the nutrients. The macronutrients are declared in g while the minerals in mg.*
[b] *All these nutrient recommendations were based on the nutrition composition of the DASH dietary pattern. For total fats, 27% of the hospitals' TECs was used as the limit. 6% and 55% of the hospitals' TECs were used as the limits for SFA & total carbs, respectively.*

with mean (SD) NAR values of 198% (53%). A similar pattern was observed for cholesterol with mean (SD) values of 363% (177%), but there was one hospital (A) that did not exceed the limit. Additionally, all hospitals did not consistently comply with the DASH recommendations for DF and minerals except sodium. The mean (SD) NARs for DF, Ca, Mg, and K were 35% (11%), 45% (14%), 49% (10), and 51% (7%), which were all way below the 100% minimum requirement. The recommendations for TF, TC, and Na were inconsistently met. The deviations from their means were high enough that conclusive decision cannot be made whether they complied with the requirements. For instance, the mean (SD) NAR for TF was 122% but the deviation of 25% waslarge enough that it cannot be confidently said that

Table 4. The NARs (%) of Therapeutic Diets against the Therapeutic Lifestyle Change (TLC) for each Dietary Component and their Corresponding Mean (SD) Values by Hospital

	Energy	Macronutrients						Cholesterol (mg)
		Total Fats	SFA	MUFA	PUFA	Total Carbs	Dietary Fiber	
Hospital A [a]	1550	37	11	10	4	232	13	98
TLC [b]		60	12	31	17	194	20	199
NAR (%)		61	91	32	23	120	65	49
Hospital B [a]	1800	74	26	31	10	190	5	633
TLC [b]		70	14	36	20	225	20	199
NAR (%)		106	186	86	50	84	25	318
Hospital C [a]	1860	71	30	26	8	240	11	646
TLC [b]		72	14	37	21	233	20	199
NAR (%)		98	208	70	39	103	55	325
Hospital D [a]	1930	83	29	36	10	206	13	799
TLC [b]		75	15	39	21	241	20	199
NAR (%)		111	193	93	47	85	65	402
Mean NAR (%)		94	170	70	40	98	53	273
SD		19	46	24	10	15	16	133

[a] *The TECs for energy and TNCs for the nutrients, which are declared in g.*

[b] *All these nutrient recommendations were based on the nutrition composition of the TLC dietary pattern. For total fats, 35% of the hospitals' TECs was used as the limit. 6.9%, 18%, 10%, and 50% of the hospitals' TECs were used as the limits for SFA, MUFA, PUFA, & total carbs, respectively.*

generally hospitals had higher TF than the recommendation. This was similarly noted on Na and TC values.

The generated NARs against the TLC recommendations with mean (SD) NAR values for each dietary component are presented in Table 4. Again, DF was not consistently met by all hospitals, with mean (SD) NAR of 53% (16%). No hospital also reached the 100% threshold for MUFA and PUFA, with mean (SD) NARs of 70% (24%) and 40% (10%), respectively. The SFA was also significantly higher than the recommended limit at 170% (46%) mean (SD) NAR, but there was one hospital (A) that had TNC with a gram lower than the limit. This was similarly noted on cholesterol values. Furthermore, just like the observation using the DASH, the mean (SD) NAR values for TF and TC also had considerable variations among the hospitals. Taking the TC values as an example with mean (SD) NAR values of 98% (15%), which indicates that while the mean NAR was below the limit, the SD signifies that some hospitals have NARs that deviated significantly from the average. This makes sense because half of the hospitals also had NARs higher than the recommendation for both TF and TC.

DISCUSSION

Based on the results presented, the hospitals did not generally meet the recommendations of dietary standards, especially the nutrient compositions of DASH and TLC, which are guidelines specifically designed to manage CVDs. The mean NARs and their comparisons with all three standards used in the study are summarized in Figure 1. The Philippine Dietary Reference Intakes (PDRI) are a set of nutrient standards recommended to meet the requirements of healthy Filipino individuals.[18] In this study, the PDRI was utilized primarily to assess the adequacy of hospital diets in terms of B vitamins. The current recommendation for B vitamins is implied based on meeting the baseline dietary reference intakes (DRIs) through diet rather than relying on supplements.[22,23] Furthermore, the calculated average recommended energy intake (REI) from the PDRI (2030 kcal/day) was used as a reference point as it aligns closely with the recommended energy value of 2000 kcal/day for hospital standard diets outside of the individualized approach.[24] All hospitals in this study did not meet the 100% threshold adequacy for energy. Among the macronutrients, only the protein recommendation was met. This is similar to the findings of a study conducted in a hospital in New York where the regular diets fell short of the recommended composition for energy (1887 vs 2200 kcal).[25] The computed mean energy content of 1790 kcal in this study closely approximates with the averaged energy value (1600 kcal) derived from regular diets across nineteen (19) public hospitals with level 2-3 functional capacity in the Philippines.[17] In that study, only 35% of the hospitals met the recommendation of 1800 kcal/day. Another study in an Australian hospital revealed that therapeutic diets were found to have lower amounts of both energy and proteins compared to patients' requirements.[26] On the contrary, several authors showed that composition of hospital standard diets satisfied the energy and protein requirements of patients,[27-29] including the diets catered to patients admitted in the cardiology depatment.[30] Meeting the energy and protein requirements is of paramount importance in clinical dietetics. Hospital malnutrition, often caused

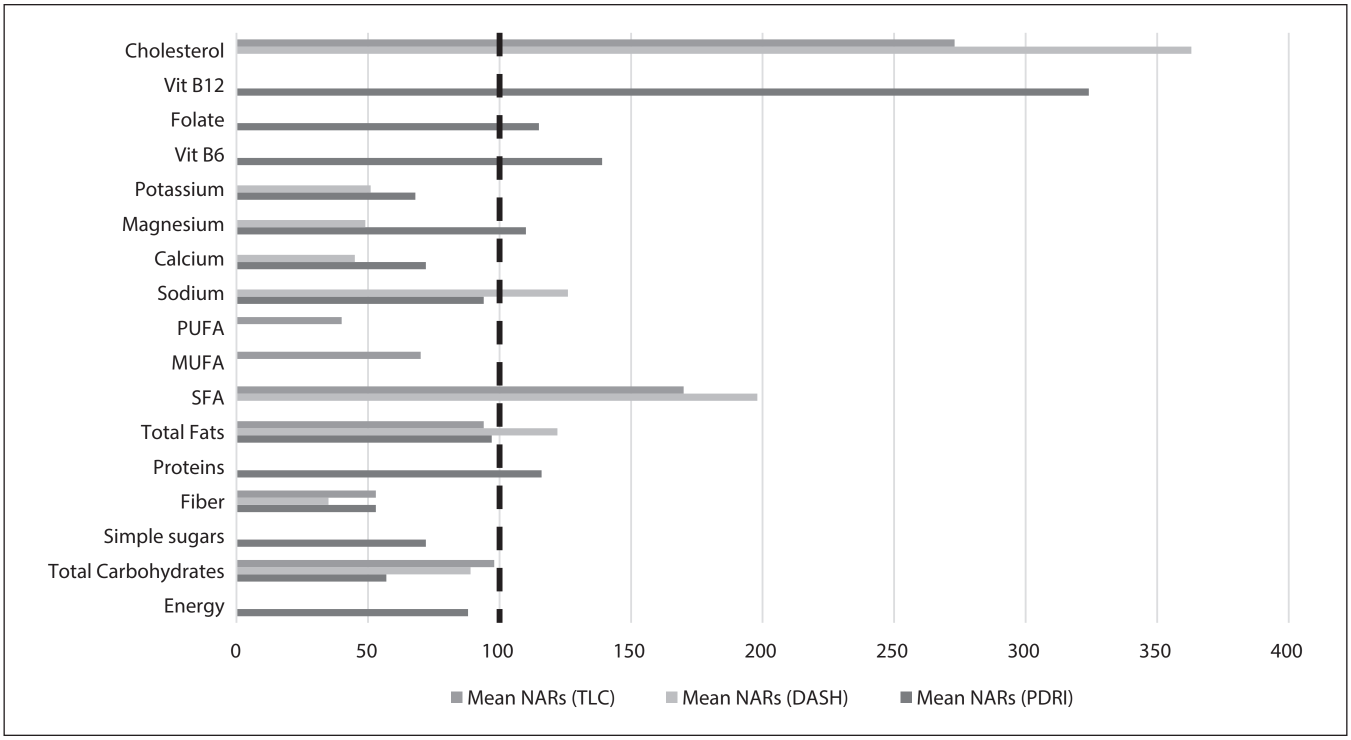

Figure 1. The mean NARs (%) of therapeutic diets against the different dietary reference standards. The dotted line signifies the 100% threshold set to determine whether the mean NARs met the adequate levels or exceeded the recommended levels.

by inadequate protein and energy intake, is significantly linked with frequent hospital readmissions[31], poor clinical outcomes[32], and risk of early death in patients[33], including those with cardiac disease.[34] A retrospective cohort study has revealed that malnutrition among patients with ischemic heart disease is significantly associated with longer hospital stay and transfer to ICU.[35] On the other hand, the therapeutic diets in this study met the PDRI requirements for the B vitamins. As shown in Figure 1, the levels were above the minimum 100% adequacy level, and they remained below the tolerable upper limit intake. These findings align with a study conducted in a Greek hospital that was converted into a COVID-19 facility, showing that the levels of vitamin B6 and vitamin B12 in their standard menu exceeded the dietary reference intakes (DRIs), except for folate levels that remained below the recommended threshold pre- and post-COVID-19.[36] The clinical importance of these B vitamins is their association with hyperhomocysteinemia, a recognized risk factor for cardiovascular disease (CVD).[37] Deficiencies in these vitamins can lead to this condition. However, research has shown limited evidence of long-term benefits in using B vitamin supplements for the prevention and treatment of CVD.[14,23] Therefore, the primary recommendation remains the regular consumption of food rich in these vitamins, such as whole grains, green leafy vegetables, legumes, fish, and low-fat dairy products.

In terms of the recommendations of the DASH dietary pattern, the therapeutic diets did not meet the minimum recommended nutrient levels for calcium (Ca), magnesium (Mg), potassium (K), and dietary fiber (DF) (Figure 1). They also exceeded the limits for saturated fatty acids (SFA) and dietary cholesterol. However, due to large variations in measurements among the four hospitals, it is difficult to conclusively determine whether they consistently exceeded the recommended limits for sodium (Na), total fats (TF), and total carbs (TC). This finding is analogous to the results of a nutritional analysis study of blenderized enteral diets from four hospitals in the Philippines where variations and inconsistent levels of minerals, including Na, were observed.[38] These variations can be attributed to non-adherence to recommended hospital processes, as observed in the previous study.[17] Lack of cycle menus or standardized recipes was found in 37% of the hospitals, and as a result, decentralized procurement modes, such as "shopping," were practiced more, which may lead to inconsistencies in the foodstuffs and dishes being served to the patients. Further, unregulated procurement practices, such as "shopping," may favor processed foods, which generally have a higher market value than fresh food.[39] This may explain the Hospital A's use of high-Na canned products, which translated to a level of total Na in its therapeutic diet that was far higher than other hospitals that did not use any canned item. High-Na diets have long been associated with adverse cardiovascular health outcomes.[40] A large prospective cohort study also confirmed that reductions in total carbohydrates can lessen the risk of CVDs.[41] Thus, consistent with the DASH guidelines, Na and total carbohydrate intakes must be limited to 1500 mg/day and 55% of the total energy needs/day, respectively. As a result of this much stricter limit for TC, not all hospitals were able to meet it. This study's finding on the inadequacy of mineral provision is consistent with the results of a Brazilian's study where the therapeutic diets did not meet the DRIs for Ca, Mg, and K.[42] Additionally, hospital diets from previous studies did not also meet the requirements for Ca[17,36] and Mg.[36] The integration of specific recommendations for these minerals into the DASH diet was based on their blood-pressure lowering effects.[10] K and Ca both have roles on the renin-angiotensin-aldosterone system that promotes urinary excretion of sodium.[43,44] Adequate intake of Mg through diet is also associated with not only lowering of blood pressure but also regulating blood lipid values.[45] It can be noted that in this study, while all these minerals were inadequate compared to the DASH guidelines, only the requirements for Ca and K were met in the context of PDRI. Nevertheless, for individuals with high CVD risk, meeting the DASH guidelines would be more clinically beneficial to them than adhering to the lower amounts set by the DRIs. In the case of DF, the inadequacy of therapeutic diets was observed across all dietary standards. Looking at the menus individually, no hospital complied with the global recommended intake of 400 g[46] of fruits and vegetables daily. This result is consistent with the findings in other Philippine hospitals.[17] Incorporation of more portions of green-leafy vegetables would have helped meet the adequacy of not just DF but also the minerals and the cardioprotective inorganic nitrates.[47] This finding is of significant concern, as inadequate DF intake has been shown to be strongly associated with an increased risk of CVDs and has detrimental effects on cardiovascular health.[48]

Cross-referencing the data with the TLC dietary guidelines further confirmed the excess provision of SFA and dietary cholesterol by the hospitals. This is consistent with the results of other studies.[25,36,49] A previous study found that the SFA content of their hospital menu was around 22 g before COVID-19, which closely aligns with the mean SFA of 24 g calculated in this study.[36] A comparative analysis of five Israeli hospital diets unveiled that none of the these institutions have also met the recommendations of the American Heart Association during that time, with a mean cholesterol content of 450 mg, which is also close to the computation in this study.[49] Inspecting the individual diets in this study reveals that serving whole milk and whole eggs in the menus greatly contributed to the SFA and cholesterol. For these reasons, both the DASH and TLC standards recommend the consumption of fat-free or low-fat dairy products, which are not a significant source of SFA. There is a slight difference in the recommendations for egg consumption between the DASH and TLC guidelines. The DASH recommends limiting egg yolk intake to no more than 4 per week, while the TLC recommends a stricter limit of 2 egg yolks per week.[9,12,13] Nevertheless, both guidelines emphasize the importance of restricting the consumption of high-cholesterol egg yolks. Indeed, there is strong evidence to suggest that limiting consumption of SFA leads in clinically significant reductions in LDL-cholesterol (LDL-c) levels, and consequently adverse cardiovascular events.[50] Cutting down on animal foods that are high in SFA for at least two years also leads to reductions in adverse CVD outcomes.[51] Meta-analyses of RCTs also associate high intakes of dietary cholesterol with elevated LDL-c levels.[52] In terms of the unsaturated fats, namely monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), their computed levels in this study were also suboptimal. All hospitals did not meet the set recommendations of 18% and 10% of the energy requirements for MUFA and PUFA, respectively. These are aligned with the TLC guidelines indicating that up to 35%, 20%, and 10% of the calories for total fats, MUFA, and PUFA, respectively, can be implemented if the total carbohydrates are limited to 50% of the energy needs.[13] The observed imbalance in the provision of these fatty acids in the menus of these hospitals can be attributed to the inclusion of SFA-rich food items and the relatively limited use of MUFA and PUFA-rich ingredients such as soy, fatty fish, and canola oil. This finding is unfortunate, since therapeutic diets for CVDs must contain a higher ratio of unsaturated to saturated fat, as current evidence shows that replacing SFA with MUFA and PUFA can lead in significant reductions in LDL-c.[50] Meanwhile, significant variations in the measurements for TC and TF are further confirmed when data are compared with the TLC guidelines. Widely scattered menu nutrient calculations among hospitals were also noted in the study of Singer.[49]

It is also possible that insufficient training or lack of opportunities for capacity building for registered nutritionist-dietitians (RNDs) and other staff members of the Nutrition and Dietetics Service (NDS) department might have contributed to the inconsistencies of therapeutic meals in energy and nutrient provision. Previous research conducted in public hospitals nationwide found that 32% of the RNDs interviewed received less than a year frequency of training, and half of the cooks and foodservice workers did not receive any training at all.[17] Moreover, the perception of many of these hospitals that their menus complied with nutritional requirements despite objective data suggesting otherwise indicates a potential lack of awareness of dietary recommendations. Not being particularly aware and meticulous in these recommendations may introduce variations in the recipes prepared and served to the patients and explain the discrepancies in nutrient compositions. These findings underscore the need for additional training opportunities for hospital staff. This is supported by previous research showing significant improvements in meeting dietary recommendations following staff training initiatives.[25]

This study has several limitations that should be acknowledged. Firstly, the small sample size of only four hospitals limits the generalizability of the findings. The findings may not be representative of all hospitals in the country or reflect the diversity of therapeutic diets provided across different settings. Additionally, with a limited number of observations, the statistical power of the study is also limited, making it difficult to detect significant differences or associations between variables. It is important to interpret the results with caution as they may not be applicable to a larger population or other healthcare settings. The present study only explored the provision of nutrients at the menu level, and it is different from actual intake. As several studies have shown, there were significant differences in the levels of nutrient provisions and nutrient consumption due to factors such as high plate wastage and low patient appetite.[17,26-30] It is likely that the calculated levels of nutrients presented in this study do not reflect the actual consumption of patients. Thus, it is important to pair menu nutrient analysis with actual intake measurements in future studies. Despite these limitations, being the first investigation into the quality of therapeutic diets in the Philippines, it serves as an important foundation for future research in this area. The findings of this study have provided valuable insights and initiated an impetus to further explore this research problem. Indeed, future research with a larger and more diverse sample is needed to confirm and generalize the findings in a broader context.

CONCLUSION

All four hospital therapeutic diets met the requirements for proteins, simple sugars, vitamin B6, folate, and vitamin B12 as per the PDRI, but they all fell short on the recommended energy intake and dietary fiber. As per the CVD-specific guidelines, the DASH and TLC, they were not compliant with most components, as their adequacy ratios were consistently below the recommendations for calcium, magnesium, potassium, MUFA, PUFA, and dietary fiber. Their provision of SFA and dietary cholesterol also exceeded the recommended limits. Conclusive findings for total carbohydrates, total fats, and sodium cannot be drawn due to large variations in their compositions among the hospitals. Further research is needed to confirm and clarify these findings and boost its utilization for possible policy development to improve Nutrition and Dietetics services in Philippine hospitals.

Statement of Authorship

Both authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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