

Brief Report

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Brief Report

Influence of Adherence to A Mediterranean Diet on Descompensation in Patients With Chronic Heart Failure

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Abstract: Background: Chronic Heart failure (CHF) constitutes a major health problem, representing the leading cause of hospitalization in people over 65 years old. Several studies have associated the Mediterranean diet with a cardioprotective function, improving prognosis in patients with high cardiovascular risk. Our main objective is to determine whether greater adherence to the Mediterranean diet is associated with a lower severity of CHF, depending on the number of heart failure decompensations and complications of the disease. **Methods:** The study was a single-center retrospective cohort study conducted at the Virgen del Rocío Hospital (Seville). Adherence to a Mediterranean diet was determined by the Mediterranean Diet Adherence Screener (MEDAS) in patients with chronic heart failure in a state of clinical stability, and their cardiac and analytical profiles were evaluated. **Results:** Seventy-two patients were included (35 with high adherence to the Mediterranean diet and 37 with low adherence). The average age was 81.29 ± 0.86 years. A trend towards fewer cardiac decompensations ($1,49 \pm 0,14$ vs $1,92 \pm 0,17$), $p = 0,054$) and lower NT-proBNP values ($2897,02 \pm 617,16$ vs $5227,96 \pm 1047,12$; $p = 0,088$) was observed in patients with high adherence compared to those with low adherence to the Mediterranean diet. **Conclusions:** Our results suggest that patients with CHF and high adherence to the Mediterranean diet have a tendency towards improved cardiac profile, indicated by fewer decompensations and lower NT-proBNP levels. Future clinical trials are needed to substantiate these hypotheses.

Keywords: heart failure; Mediterranean Diet; adherence

1. Introduction

Chronic Heart failure (CHF) is the leading cause of hospitalization in patients over 65 years old and presents a high readmission rate within 30 days post-discharge [1]. The prevalence of HF is estimated at 1-2% of the adult population in developed countries, increasing proportionally with age, reaching over 10% in patients over 70 years old [2].

Diet plays a fundamental role in lifestyle, but recommendations for HF are not well defined. Most evidence is based on sodium restriction in these patients, which is difficult to interpret due to the variability in study designs. Lara K. et al. [3] demonstrated that a diet based on plant products is associated with a lower risk of HF and hospitalizations for it, contrary to those with a high intake of red and processed meats, sugary drinks, and refined flours, who present a higher risk of this disease. The Mediterranean diet has been associated with a reduction in cardiovascular events, as shown in the CORDIOPREV study [4], which associated a 33% lower incidence of cardiovascular events compared to a low-fat diet in patients with prior coronary disease after 7 years of follow-up.

The primary objective of this study was to determine if greater adherence to a Mediterranean diet model is associated with a lower severity of HF, indicated by fewer cardiac decompensations in the previous 12 months, a better functional class according to the New York Heart Association (NYHA) scale, a better perceived quality of life according to the Spanish version of the Kansas City

Cardiomyopathy Questionnaire (KCCQ), and lower plasma concentrations of biomarkers of congestion (NTproBNP and CA125) compared to low adherence to a Mediterranean diet.

2. Methods

The present registry was a single-center retrospective cohort study conducted in the comprehensive Internal Medicine Unit at Virgen del Rocío Hospital (Seville).

Patients with a previous diagnosis of chronic Heart Failure followed up in specialized clinics, clinically stable for at least 1 month from the last cardiac decompensation, were included. Patients with other advanced or uncontrolled chronic pathologies or those with a Barthel index < 60 points were excluded.

The primary variables included the number of cardiac decompensations in the 12 months before to study inclusion (including hospitalizations, emergency care, or intravenous diuretic use in specialized clinics), the degree of dyspnea assessed through the NYHA scale, and the 12-item short form of the Kansas City Cardiomyopathy Questionnaire (KCCQ), and the determination of serum biomarkers (NTproBNP and CA125). Secondary variables included anthropometric measurements, gender, age, treatments for managing cardiovascular risk factors, and previous comorbidities. Adherence to a Mediterranean diet was determined using the MEDAS questionnaire [5]. A score ≥ 9 points corresponded to high adherence to the Mediterranean diet.

Statistical analysis was conducted using SPSS (version 23.0 for Windows) (SPSS Inc., Chicago, IL, USA). Descriptive statistics are detailed as number (and percentages (%)) for qualitative variables; and as mean (standard deviation [SD]) for quantitative variables depending on the distribution. The distribution of quantitative variables was evaluated using the Kolmogorov-Smirnov test. To detect differences between groups, Chi-square tests (Fisher's test when necessary) and Student's t-test (Mann-Whitney U test in case of non-normal distribution) were used. Differences were quantified using the Odds Ratio and the difference in means (or ranks) with 95% confidence intervals. The level of statistical significance was set at $p < 0.05$ for two tails. The project was approved by the Clinical Research and Ethics Committee of the Virgen del Rocío - Virgen Macarena University Hospital (1653-N-23, 24/01/2024).

3. Results

Of the 371 patients consecutively evaluated in medical consultations, 129 were excluded for not meeting the inclusion criteria or declining participation. Seventy-two patients were included, of which 37 had low adherence to a Mediterranean diet and 35 had high adherence. The average age was 81.29 ± 0.86 years, and 59.7% were women. There was a higher number of patients with chronic kidney disease and type 2 diabetes, as well as lower LDL cholesterol concentrations in patients with low adherence ($p < 0.05$). The rest of the baseline characteristics and the comparison between both groups are shown in **Table 1**.

Table 1. Study population characteristics based on a low or high adherence to a Mediterranean diet.

	All patients n=72	Low adherence n=37	High adherence n=35	p value
Age (years)	81,29 \pm 0,86	80,95 \pm 1,11	81,66 \pm 1,33	0,456
Gender: Female, n (%)	43 (59,7)	18 (48,6)	25 (71,4)	0,049 *
DM2, n (%)	39 (54,2)	25 (67,6)	14 (40)	0,019 *
Coronary heart disease, n (%)	21 (29,2)	13 (35,1)	8 (22,9)	0,252
Arteriopatía, n (%)	6 (8,3)	4 (10,8)	2 (5,7)	0,434
COPD, n (%)	16 (22,2)	6 (16,2)	10 (28,6)	0,208
Liver disease, n (%)	6 (8,3)	1 (2,7)	5 (14,3)	0,076
CKD, n (%)	41 (56,9)	26 (70,3)	15 (42,9)	0,019 *
Barthel	89,1 \pm 1,39	89,32 \pm 2,08	88,86 \pm 1,86	0,515

Systolic blood pressure (mmHg)	127,16 ± 2,2	126 ± 3,31	128,4 ± 2,9	0,589
Diastolic blood pressure (mmHg)	65,65 ± 1,7	65,59 ± 2,32	65,71 ± 2,52	0,972
BMI	28,48 ± 0,63	27,77 ± 0,69	29,24 ± 1,08	0,256
Abdominal circumference (cm)	103,2 ± 1,31	103,39 ± 1,51	103 ± 2,19	0,731
MEDAS	8,51 ± 0,26	6,81 ± 0,22	10,31 ± 0,24	<0,001 *
Reduced LVEF, n (%)	19 (26,4)	11 (29,7)	8 (22,9)	0,508
AF, n (%)	52 (72,2)	27 (75)	25 (73,5)	0,888
Time to decompensation - inclusion (days)	116 ± 13,31	105,81 ± 18,64	126,69 ± 19,14	0,219
Haemoglobin (g/dL)	12,93 ± 0,23	12,88 ± 0,33	12,99 ± 0,33	0,816
LDL (mg/dL)	84,9 ± 4,75	71,89 ± 6,79	98,65 ± 5,88	0,004 *
HDL (mg/dL)	43,02 ± 2,02	38,78 ± 3,18	47,51 ± 2,24	0,112
TG (mg/dL)	112,23 ± 7,01	110,35 ± 12	114,22 ± 7,05	0,782
Ferritin (ng/mL)	199,18 ± 25,51	178,47 ± 29,26	221,08 ± 42,54	0,640
Creatinine (mg/dL)	1,37 ± 0,07	1,50 ± 0,12	1,26 ± 0,08	0,239
Glomerular Filtrate (mL/min/1,73m²)	48,35 ± 2,6	46,39 ± 4,02	50,9 ± 3,60	0,352
hsCRP (mg/mL)	11,95 ± 2,17	15,75 ± 3,81	7,80 ± 1,61	0,732

The number of patients with each characteristic is shown together with the percentage (%) or the mean values ± standard error. We used unpaired t test for quantitative variables and χ^2 for categorical variables. DM2 (diabetes mellitus 2); COPD (chronic obstructive pulmonary disease); CKD (chronic kidney disease); (Chronic Obstructive Pulmonary Disease); CKD (Chronic Kidney Disease); BMI (Body Mass Index); BMI (Body Mass Index); BMI (body mass index); MEDAS (Mediterranean Diet Adherence Screener); LVEF (ventricular ejection fraction); AF (atrial fibrillation); LDL (low-density lipoprotein); HDL (high-density lipoprotein); LVEF (left ventricular ejection fraction) (low-density lipoprotein); HDL (high-density lipoprotein); TG (triglycerides); hsCRP (ultra-sensitive C-reactive protein). *p < 0.05 HF Patients and high adherence to Mediterranean diet vs HF Patients low adherence to Mediterranean diet.

Regarding treatments, patients with high adherence had lower use of lipid-lowering drugs; the rest of the therapeutic groups can be seen in the **Table 2**. The number of HF decompensations was 1.92 ± 0.17 in the low adherence group, 1.49 ± 0.14 ($p = 0.054$) in the high adherence group, while HF hospitalization was 1.27 ± 0.17 in the low adherence group, 1.00 ± 0.10 , in the high adherence group, $p=0.188$).

Table 2. Baseline medication based on a low or high adherence to a Mediterranean diet.

	All patients n=72	Low adherence n=37	High adherence n=35	p value
Antihypertensive, n (%)	67 (93,1)	36 (97,3)	31 (88,6)	0,145
ACEI / ARAII, n (%)	35 (48,6)	20 (54,1)	15 (42,9)	0,342
ARNi, n (%)	8 (11,1)	5 (13,5)	3 (8,6)	0,505
Calcium antagonist, n (%)	9 (12,5)	5 (13,5)	4 (11,4)	0,789
Beta-blocker, n (%)	62 (86,1)	31 (83,8)	31 (88,6)	0,557
Diuretic, n (%)	70 (97,2)	37 (100)	33 (94,3)	0,140
Loop diuretic, n (%)	64 (88,9)	34 (91,9)	30 (85,7)	0,404
iSGLT2, n (%)	53 (73,6)	25 (67,6)	28 (80)	0,232
ARM, n (%)	34 (47,2)	19 (51,4)	15 (42,9)	0,471

Thiazide, n (%)	13 (18,1)	8 (21,6)	5 (14,3)	0,419
Acetazolamide, n (%)	1 (1,4)	1 (2,8)	0 (0)	0,321
Lipid-lowering drugs, n (%)	42 (58,3)	26 (70,3)	16 (45,7)	0,035 *
Statin, n (%)	41 (56,9)	25 (67,6)	16 (45,7)	0,061
Fibrate, n (%)	1 (1,4)	1 (2,8)	0 (0)	0,327
Other	10 (13,9)	4 (10,8)	6 (17,1)	0,437
Antidiabetic, n (%)	20 (28,2)	11 (29,7)	9 (26,5)	0,760
Metformin, n (%)	11 (15,5)	6 (16,2)	5 (14,7)	0,861
GLP1, n (%)	9 (12,7)	4 (10,8)	5 (14,7)	0,622
Insulin, n (%)	10 (14,1)	5 (13,5)	5 (14,7)	0,885

The number of patients taking each drug is shown alongside the percentage (%). We used unpaired t test for quantitative variables and χ^2 for categorical variables. ACEI (Angiotensin Converting Enzyme Inhibitors); ARA II (Angiotensin Converting Receptor Antagonists); ARNi (Angiotensin-Nepriislylin Receptor inhibitors); iSGLT2 (inhibitors of the sodium-glucose cotransporter type 2); ARM (mineralocorticoid receptor antagonists); GLP1 (Glucagon-like peptide type 1). * $p < 0.05$ HF Patients and high adherence to Mediterranean diet vs HF Patients low adherence to Mediterranean diet.

No differences were observed in KCCQ scores (67.35 ± 3.32 in the low adherence group, 69.92 ± 3.24 in the high adherence group, $p = 0.524$) or in NYHA scores ($p = 0.207$).

The average levels of NTproBNP were 4094.87 ± 627.28 pg/mL (5227.96 ± 1047.12 in patients with low adherence vs. 2897.02 ± 617.16 in patients with high adherence, $p = 0.088$), while CA125 values were 43.06 ± 8.81 U/mL (53.30 ± 16.32 vs. 33.28 ± 5.44 , $p = 0.973$).

4. Discussion

The results of this study suggest that HF patients following a Mediterranean diet tend to have a better cardiac profile, indicated by fewer decompensations and lower NTproBNP levels, without statistically significant differences compared to HF patients with low adherence to a Mediterranean diet. Additionally, our study shows that these patients have a lower risk of type 2 diabetes or chronic kidney disease, with lower use of lipid-lowering drugs, although they had higher LDL cholesterol levels.

The MEDIT-AHF study [6], an observational study that included 991 patients with a previous diagnosis of acute heart failure, observed after 1 year of follow-up that the number of HF decompensations was not significantly related to the Mediterranean diet ($p = 0.49$). However, the hospitalization rate for HF was lower in the Mediterranean diet adherence group compared to the non-adherent group, with a 26% risk reduction.

The benefits of the Mediterranean diet on the body could influence the reduction in HF decompensations suggested in this study. This has justified the reduction in the number of hospitalizations in other studies, although the specific mechanism involved in these hypotheses is not defined. The Mediterranean diet has demonstrated cardiovascular benefits through the consumption of fruits, vegetables, and monounsaturated fats from extra virgin olive oil and nuts, which help reduce insulin resistance, improve serum glucose, increase HDL cholesterol levels, reduce blood pressure, and decrease oxidative stress. At the cardiac level, it has been observed that it can improve diastolic function on echocardiography and cardiorespiratory fitness measured by maximum oxygen consumption, potentially improving cardiac contractility [3,7–10].

Furthermore, a sub-analysis of the PREDIMED study [10], which included 930 patients with high cardiovascular risk, also observed a decrease in inflammatory markers and prognostic biomarkers in the development of HF, such as NT-proBNP, in patients adhering to the Mediterranean diet. This study found a significant reduction in this marker associated with Mediterranean diet adherence in the group supplemented with extra virgin olive oil ($p = 0.029$) and the group consuming nuts ($p = 0.006$). These results translate into a lower risk of hospitalization in HF patients, as NT-proBNP has proven to be very useful for assessing the risk of readmission and short-term mortality. Studies have

shown that variability in its values indicates the severity and prognosis of HF after treatment, so a decrease is associated with a lower risk of rehospitalizations [11,12].

Among the limitations of this study are its cross-sectional design and a small population size, requiring clinical trials to demonstrate the relationship between the Mediterranean diet and HF.

5. Conclusions

Our results suggest that high adherence to the Mediterranean diet in patients with CHF tends to improve the cardiac profile, indicated by fewer decompensations and lower NT-proBNP levels, without differences in hospitalization needs for HF, degree of dyspnea, or functional capacity. Future clinical trials are needed to substantiate these hypotheses.

Author Contributions: JJT and CjdJ were responsible for conception and design of the study. JJT, AVM, MGG, LMG, RAS, BBF, MJGC, ARM, MBW. JJT, AVM, MGG, LMG, RAS, BBF, MJGC, ARM, MBW were responsible for analysis and interpretation of data and drafting the article. JJT and MBW final approval of the version to be submitted. All authors have read and agreed to the published version of the manuscript.

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Abbreviations:

- | | |
|---------------|---|
| 1) CA125 | carbohydrate antigen 125 |
| 2) CHF | Chronic Heart Failure |
| 3) CORDIOPREV | CORonary Diet Intervention with Olive oil and cardiovascular PREvention |
| 4) KCCQ | Kansas City Cardiomyopathy Questionnaire |
| 5) MEDAS | Mediterranean Diet Adherence Screener |
| 6) MEDIT-AHF | Mediterranean Diet in Acute Heart Failure |
| 7) NtproBNP | amino terminal pro-brain natriuretic peptide |
| 8) NYHA | New York Heart Association |

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