Assessment of Health benefits from a nutrition program aimed at inmates with cardiovascular risk factors at Huelva prison

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ABSTRACT

Background: Diet and lifestyle are important factors in improving cardiovascular health and preventing chronic diseases.

Objectives: Assessment of changes brought about in cardiovascular risk (CVR) and metabolic syndrome (MS) after inclusion in a nutritional program.

Materials and methods: Intervention, nonrandomized prospective cohort study carried out at Huelva prison in a one year period. Information about quarterly and bi-annual anthropometric and blood biochemical variables was obtained to assess changes in diet. A descriptive analysis with LC 95% and pre-post study was also completed, using T-Student quantitative variables and Wilcoxon test averages. Qualitative testing was performed using the Chi-square test.

Results: The sample consisted of 139 subjects, 44 patients were lost in the follow-up study and 95 completed the program. Diet modification took place in 86.3% of the cases. We obtained significant improvements in weight, body mass, fat mass, abdominal perimeter and diastolic blood pressure rate index variables (Table 3). We see a reduction in high and low CVR vs. medium CVR according to features of Framingham and REGICOR (without significance), remaining stable in the SCORE model (Table 4).

Conclusions: Health education and proper diet improved anthropometric and biochemical parameters in these patients. This may imply a new tool in the health care repertoire that can be applied to other centers.

Key words: nutrition programs; food and nutrition education; primary prevention; anthropometry; body mass index; blood chemical analysis; diet; prisons.

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INTRODUCTION

Cardiovascular disease is a leading cause of disability, and substantially contributes to a significant raise in healthcare related costs [1]. The imprisoned population is burdened by important cardiovascular risk factors (CVRF) such as the abuse of some hazardous substances such as tobacco (in a percentage twice as high as the general population: 73.8% to 31%) [2], a high rate of alcohol use[3] or a history of cocaine abuse. All these CVRF can become worse with high rates of existing infectious pathology[4].

The NAOS Strategy (Strategy for Nutrition, Physical Activity and the Prevention of Obesity) was set up in 2005 by the Ministry of Health and Consumer Affairs in response to the Global Strategy on Diet, Physical Activity and Health implemented in 2004 by the World Health Organization as it became aware of the dramatic increase in obesity and its relationship with the main chronic conditions affecting health, specially cardiovascular diseases [5].

The relevance of dietary and lifestyle habits was defined among the main cornerstones of cardiovascular health in the Victoria Declaration on

Heart Health (Canada 1992) [6]. Some studies already alert to the relevance of dyslipidemia control as one of the most prevalent cardiovascular risk factors and its role in cardiovascular morbidity and mortality, by underscoring too that its control is being overestimated [7].

The importance of obesity lies in that at least 75% of type 2 diabetes mellitus cases, 33% of stroke and coronary disease, 50% of hypertension cases and 25% of osteoporosis can be directly attributed to it. In Spain the cost related to obesity can be estimated in around € 25,000 million every year (7% of the total health expenditure) and in some countries the costs related to an obese patient are 36% higher in medical spending and 77% higher in pharmaceutical expenditure. Together with hypertension, obesity can dramatically increase cardiovascular risk, reaching up to 20% if it is associated as well to diabetes and congestive heart failure [8]. The latest data from Spain shows a dramatic increase in childhood obesity, which is initiated at earlier ages every time [9].

It can be therefore stated, beyond any doubt, that six out of the seven main determinants of health are related to dietary habits and physical activity, both of which undeniably represent two mainstays in the treatment of these diseases.

Our centre, aware of all the aforementioned, decided in May 2009 to implement a nutrition consulting service and established a "Program for the improvement of dietary menus for inmates with a moderate or high cardiovascular risk, special diets and severe cachexia due to hepatitis C /human immunodeficiency virus (HCV/HIV)" which intended to act on the proposed line, aimed at not only providing information but modifying several habits in the approach of these patients. Therefore, the main objectives of this work were:

- To assess nutritional interventions carried out within the established program.
- To evaluate anthropometric and biochemical variables, cardiovascular risk and the existence of parameters defining the metabolic syndrome in all the patients included in the program, therefore assessing whether any modification takes place throughout the monitoring carried out.

MATERIALS AND METHOD

The design entails an intervention, prospective longitudinal nonrandomized cohort study throughout a one year period (May 1st 2009 to April 31st 2010) in the Prison of Huelva. The inclusion criteria considered were potential cardiovascular risk factors such as: diabetes, obesity, hypertension or dyslipidemia; cachexia due to HCV/HIV or patients in need of special diets (food intolerance, pregnancy, etc.)

The sole exclusion criterion was voluntary nonattendance to periodic controls or the lack of commitment with the program. 162 inmates initially pursued consultation and 23 were dismissed for not fulfilling inclusion criteria.

The initial sample for monitoring included 139 individuals: 9 women (6.5%) and 130 men (93.5%). Monitoring was completed in 95 cases since 29 inmates were not able to do so due to transfers to other prisons, and 15 refused to continue, once initiated.

The attendance to the nutrition consultation was carried out:

- Through derivation by other healthcare professionals on the development of their usual working activities (doctors and nurses).
- Through derivation by specialists (consulting internist or others).
- Through the inmate's own demand (prior application).

All inmates derived or those who pursued consultation were given an initial appointment without exception, where written informed consent was requested to take part in the study and medical history was gained together with a structured physical examination, which gathered anthropometric variables (weight, height, body mass index (BMI), abdominal perimeter, determination of fat mass ratio and blood pressure). Patients were informed on the possibility of a modified diet adapted to their individual circumstances, which included changing a general diet (the most usual) to a protection diet, soft diet, or a special one (diabetic, vegetarian, Muslim), according to the initial nutritional assessment. Appropriately calibrated and validated measuring tools were used, among which the following can be mentioned:

- Standard wall height meter ASIMED.
- Professional scale ASIMED MD-201 TB.
- Digital tensiometer SPENGLER TB-101.
- Tensiometer cuffs SPENGLER:
  - 12 x 23 cm. (normal sized arms).
  - 15 x 31 cm. (obese arms).
- Stethoscope (3M Littmann).
- Body Fat Monitor OMRON BF-306
- Tape measure MORETTI model: 4444.7

Later a blood sample was scheduled to be taken

after a 10 hour fast for the determination of several biochemical factors (blood sugar concentration, total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, glycated hemoglobin). Once the results were received the patient's basal state was assessed and in the second and consecutive visits anthropometric and clinical variables were assessed and the effect of a dietary change and its potential modification were evaluated. Three or six month periodic controls were carried out according to the patient's features to assess his/her evolution and an increase in physical activity was encouraged. The special diet consists of a menu which is served in a personalized closed isothermal tray with the name of the inmate. Therefore it is ensured that the included supplements reach the inmate, as well as granting that the tray is collected by its consignee and telling them apart. The preparation and nutritional balancing of such diet is strictly controlled by the nutritionist, who is the only responsible of including a patient in it. This allows an appropriate nutritional assessment of patients prior to their inclusion in the program. This ensures that patients who are really in need are included in the program and an appropriate monitoring is therefore granted. It can also be mentioned that no extra supplements were provided so that the menu was not nutritionally unbalanced. In order to carry out the control of this menu a monthly list of inmates included in it was provided to cooks and all modules.

So that data could be collected a special report paper was designed for it, by following the requirements established by the nutritionist and by creating a separate nutritional history apart from the clinical history so that potential issues concerning the inmates' personal information confidentiality could be avoided. These were stored apart from the centre's healthcare archives. Therefore, the sole information shared on paper were analytical results requested by the nutritionist throughout the program or those requested by other healthcare staff in the centre; since not sharing this information would be clearly detrimental for inmates because blood extractions would need to be repeated. Inmates expressly consented this.

In order to assess cardiovascular risk among the patients included in the study, the following variables were gathered in each one: age, gender, a family history of premature ischemic heart disease in first degree relatives (under 55 in males and under 65 in females), tobacco smoking throughout the last year, and a personal history of cardiovascular disease (acute myocardial infarction, angina, stroke or peripheral arterial disease).

Hypertension was defined for those patients under treatment and/or those whose systolic blood pressure was ≥ 140 mmHg or diastolic blood pressure was ≥ 90 mmHg twice upon examination. Previously diagnosed diabetic patients and /or those whose blood glucose concentration was ≥ 126 mg/dl in the after-fast venous sample, confirmed by at least an additional control according to the criteria of the American Diabetes Association (ADA) were considered diabetic. The consideration of dyslipidemia was based upon patients under hypolipidemic treatment or with one of the following results in the blood test: Total Cholesterol (Tot-Chl) ≥ 200 mg/dl, low density lipoprotein cholesterol (LDL-c) ≥ 115 mg/dl or triglycerides (TG) ≥ 150 mg/dl. The waist circumference was measured and results of over 102 cm in men and 88cm in women were considered a dangerous abdominal perimeter. The definitions of overweight (BMI between 25 and 29,9 kg/m2), obesity (BMI ≥ 30 kg/m2), as well as the upper limits of normal ranges for the variables assessed were chosen according to those recommended by the European Guidelines on Cardiovascular Disease Prevention in Clinical Practice. Metabolic syndrome was defined as stated by the 2002 criteria of the Third Report of the Expert Panel (ATPIII) of the National Cholesterol Education Program (NCEP) [10] and the 2205 criteria of the International Diabetes Federation (IDF) [11]. Finally, the estimate of suffering a cardiovascular event in the next 10 years was determined according to Framingham functions, using categories established by the Wilson prediction model [12] and REGICOR criteria [13] (Gerona Heart Registry), the Framingham algorithm adapted to the Spanish population and the risk of suffering fatal cardiovascular disease according to SCORE low risk charts [14] (Systematic Coronary Risk Evaluation) which correspond to countries such as Spain.

In order to evaluate cardiovascular risk based on each of the regression equations according to the aforementioned procedures, as to evaluate Metabolic Syndrome, an Excel algorithm was developed to allow its quantification in each participant. In order to make a qualitative estimation, low risk was considered under 14%, moderate between 15 and 20% and high over 20%. As for the SCORE charts, the risk of suffering a fatal coronary event was considered when it was over 5%.

The statistical analysis was based upon SPSS v.15.0, by carrying out a descriptive analysis of the sample through the determination of mean values with corresponding 95% confidence intervals and percentiles 25, 50 and 75 for quantitative variables.

Qualitative variables were expressed through absolute and relative frequencies. A comparison was carried out between variables at the beginning and at the end of monitoring; the means of quantitative variables were examined through Student's t- test for related samples (pre and post measures) and similarly, medians are compared through the Wilcoxon signed-rank test. Qualitative variables are compared through a non-parametric test such as the chi-squared Pearson's distribution. For those percentage comparisons with sizes under 5 in any of the boxes we use Fisher's exact test. An alpha significance level under 0.05 was adopted in all cases. Approval was sought for the execution of this study to the Support Unit of the General Directorate of Penitentiary Institutions, as stated by the legal terms included in the Circular Order 7/99 on "Works, studies and research carried out in prisons".

RESULTS

139 patients initiated monitoring: 9 women (6.5%) and 130 men (93.5%), yet only 95 completed it: 7 women (7.4%) and 88 men (92.6%). The average stay within the program was 6.6 months 95% CI (6.1 to 7.2), although it must be noted that percentile 75 (P75) was 9.5 months with a maximum monitoring of 12 months. Admission to the program was mostly done through derivations by healthcare professionals: 108 (77.7%), since only 31 were admitted on their own demand (22.3%).

The main social and demographic features of the sample can be examined on Table 1. Similarly, among clinical and diagnostic characteristics (Table 2) no significant differences are observed according to who has performed the derivation to the program, except for diabetic patients, who were derived by healthcare professionals in 92.6% of cases (p=0.001).

The diet was modified in 120 cases (86.3%), by removing the vegetarian and Muslim diets and by giving a relevant role to the special diet in 61.2% of cases, to the detriment of the general diet which dropped from 62 % to 8%. Other diets such as protection or soft diets have experienced a slight increase as Figure 1 shows. We understand this as a result of the inclusion of a nutritionist in the team, which has allowed the rearrangement of inmates within available menus, so that an improved nutritional assessment has been possible in accordance to the benefits expected of such change. In the comparison of clinical variables within the study, between the beginning and the end of it, we can significantly ascertain that there is a weight loss of 1.4 kg; a BMI decrease of 0.5 kg/cm2; a fat mass percentage decrease of 0.7%, a reduction of the abdominal circumference of 2.5 cm and an average reduction of diastolic blood pressure of 1.2 mm Hg; no significant differences were observed among the rest of variables assessed (see Table 3), although most of them are also improved.

The comparison of cardiovascular risk (see Table 4), carried out by means of Framingham functions by Wilson's categories, denotes that between the initial and the final assessment there has been a slight decrease of the number of patients at high risk, while the number of patients at low risk has lightly increased and the number of patients at average risk has not suffered any changes, although with no statistical significance (p=0.934).

The comparison by means of the REGICOR model reveals a decrease of patients at low and high risk, in favor of an increase of moderate risk patients yet without any significance (p=0.096).

The comparison based upon the low risk SCORE model for the determination of fatal cardiovascular risk revealed no differences between the initial and the final control.

As far as the assessment of the metabolic syndrome is concerned (see Table 4), significant decrease takes place between those cases initially considered as metabolic syndrome as stated by the IDF criteria and those detected in the final control (p=0.021). According to the ATP III criteria the number of those considered as metabolic syndrome significantly drops in the final assessment although such decrease is not statistically significant (p=0.451).

DISCUSSION

The implementation of an improvement program for the preparation of menus for inmates at moderate or high cardiovascular risk, with special diets or cachexia due to HIV/HCV infections, by means of our centre's nutrition consultation, has entailed healthier alternatives for participating inmates, among which the following can be underlined:

Alternatives relative to the preparation of diets: for example an improved balancing and preparation of the special menu, the incorporation of whole-wheat bread to menus or olive oil for cooking, with important references to its healthiness [15].

After the Conference on Health Education [16], which has been held ever since 2007 and which includes several lectures and/or workshops on different issues of interest concerning health education, a

new intervention step has been achieved through the promotion of the attendance and participation of inmates to such conference, as well as through improved information which is delivered on healthy habits and nutrition [17].

The number of inmates burdened by metabolic syndrome parameters has dropped [18], and a clear improvement can be observed in those who followed a special diet (those who initially presented the worse analytical and anthropometric values).

Healthcare related burden in medical consultation has also decreased, since most of the cases related to diets have been derived to the nutritionist. This can be contrasted by different members of the staff and verified by the great number of applications received.

It has generated an appropriate relocation of users in different diet models by optimizing its use and enabling a stricter monitoring.

Significant decrease concerning the use of uncontrolled hyperproteic supplements was observed, by introducing more appropriate products in the centre's stores for special groups such as diabetic patients.

The main limitation observed to implement this initiative has been the difficulty in integrating such a program in the system, without proper institutionalization and with the lack of previous references of a similar project. It would have been

Variables°		Total n=139 (100%)	On demand n=31 (22.3%)	Through derivation n=108 (77.7%)
Age (95% CI)		44.7 (39.9 to 46.9)	43.4 (39.9 to 46.9)	45.1 (42.9 to 47.3)
Gender	Male:	130 (93.5%)	28 (90.3%)	102 (94.4%)
	Female:	9 (6.5%)	3 (9.7%)	6 (5.6%)
Type of Admission	First:	57 (41.0%)	13 (41.9%)	44 (40.7%)
	Readmission:	82 (59.0%)	18 (58.1%)	64 (59.3%)
Marital status	Single:	49 (35.3%)	8 (25.8%)	41 (38.0%)
	Married:	40 (28.8%)	9 (29.0%)	31 (28.7%)
	Divorced:	29 (20.9%)	12 (38.7%)	17 (15.7%)
	Separated:	14 (10.1%)	1 (3.2%)	13 (12.0%)
	Widower:	6 (4.3%)	1 (3.2%)	5 (4.6%)
	Other:	1 (0.7%)	0 (0.0%)	1 (0.9%)
Ethnic group	Caucasian:	114 (82.0%)	24 (77.4%)	90 (83.3%)
	Gypsy:	12 (8.6%)	4 (12.9%)	8 (7.4%)
	Maghrebi:	9 (6.5%)	0 (0.0%)	9 (8.3%)
	Hispanic:	3 (2.2%)	3 (9.7%)	0 (0.0%)
	Asian:	1 (0.9%)	0 (0.0%)	1 (0.9%)
Previous work status	Unemployed:	15 (10.8%)	3 (9.7%)	12 (11.1%)
	Primary sector:	13 (9.4%)	3 (9.7%)	12 (11.1%)
	Secondary sector:	16 (11.5%)	3 (9.7%)	13 (12.0%)
	Tertiary sector:	88 (63.3%)	22 (71.0%)	66 (61.1%)
	Pensioner:	7 (5.0%)	0 (0.0%)	7 (6.5%)

Table 1: Social and Demographic features according to derivation to nutritionist

Variables		Total n=139 (100%)	On demand n=31 (22.3%)	Through derivation n= 108 (77.7%)	Significance (p)
Hypertension	Yes	53 (38.1%)	10 (32.3%)	43 (39.8%)	0.445
	No	86 (61.9%)	21 (67.7%)	65 (60.2%)	
Diabetes	Yes	54 (38.8%)	4 (12.9%)	50 (46.6%)	0.001
	No	85 (61.2%)	27 (87.1%)	58 (53.7%)	
Hyperlipidemia	Yes	77 (55.4%)	15 (48.4%)	62 (57.4%)	0.373
	No	62 (44.6%)	16 (51.6%)	46 (42.6%)	
Previous Heart Disease	Yes	24 (17.3%)	6 (19.4%)	18 (16.7%)	0.727
	No	115 (82.7%)	25 (80.6%)	90 (83.3%)	
HIV infection	Yes	31 (22.3%)	5 (16.1%)	26 (24.1%)	0.349
	No	108 (77.7%)	26 (83.9%)	82 (75.9%)	
HCV infection	Yes	48 (34.5%)	8 (25.8%)	40 (37.0%)	0.246
	No	91 (65.5%)	23 (74.2%)	68 (63%)	
Drug abuse	Yes	50 (36.0%)	8 (25.8%)	42 (38.9%)	0.181
	No	89 (64.0%)	23 (74.2%)	66 (61.1%)	
Body Mass Index	Normal	37 (26.6%)	6 (18.2%)	31 (29.2%)	0.874
	Overweight	52 (37.4%)	19 (57.6%)	33 (31.1%)	
	Obesity	50 (36.0%)	8 (24.2%)	42 (39.6%)	
Smoking	Yes	100 (71.9%)	21 (67.7%)	79 (73.1%)	0.555
	No	39 (28.1%)	10 (32.3%)	29 (26.9%)	
Methadone treatment	Yes	30 (21.6%)	4 (12.9%)	26 (24.1%)	0.184
	No	109 (78.4%)	27 (87.1%)	82 (75.9%)	

Table 2: Clinical features according to derivation to nutritionist.

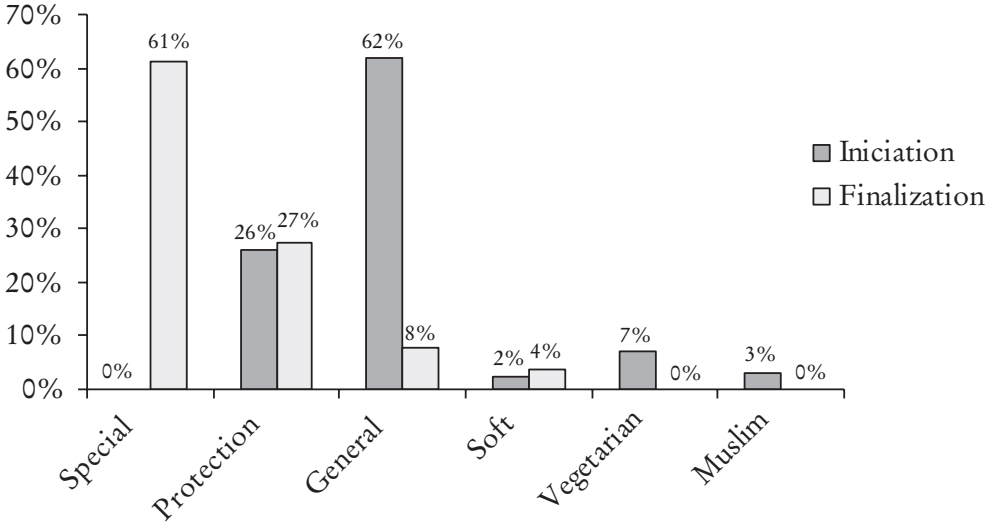

Figure 1: Dietary modifications.

VARIABLES (n=95)	INITIAL CONTROL				FINAL CONTROL				COMPARISON		
	Mean (95% CI)	Percentiles			Mean (95% CI)	Percentiles			Mean difference		Medians: Wilcoxon
		P_{25}	P_{50}	P_{75}		P_{25}	P_{50}	P_{75}	(95% CI)	(p)	(p)
Weight (kg)	86.3 (83.2 to 91.3)	43.0	82.6	100.4	84.9 (80.9-89.7)	72.4	81.4	94.4	1.4 (0.5-2.4)	0.004	0.009
BMI (kg/cm^2)	28.6 (27.6 to 30.0)	24.8	27.6	32.0	28.2 (26.9 to 29.5)	24.8	26.9	31.5	0.5 (0.1 to 0.8)	0.005	0.012
Fat mass (%)	28.6 (27.1 to 30.5)	21.1	28.4	35.2	27.9 (25.6 to 29.2)	22.9	28.3	32.9	0.7 (-0.2 to 1.2)	0.122	0.001
Abdominal circumference (cm)	101.3 (998.2 to 104.5)	89.0	100.0	111.3	98.8 (95.1 to 101.3)	87.0	98.5	108.3	2.5 (1.6 to 3.4)	0.0001	0.0001
Total Cholesterol (mg/dl)	194.7 (178.1 to 204.0)	152.7	183.5	214.3	191.8 (183.6 to 203.5)	159.3	187.5	212.8	-2.9 (-7.1 to 13.0)	0.562	0.538
HDL Cholesterol (mg/dl)	40.1 (38.3 to 42.5)	32.0	38.0	46.8	42.1 (39.9 to 45.5)	33.0	39.0	49.0	-1.9 (-3.9 to 0.1)	0.063	0.063
LDL Cholesterol (mg/dl)	124.7 (109.6 to 135.2)	87.0	112.0	138.0	122.1 (113.8 to 133.4)	89.0	118.0	145.0	-2.7 (-6.6 to 11.9)	0.572	0.638
Triglycerides (mg/dl)	162.5 (137.6 to 163.4)	101.0	141.0	186.0	172.4 (124.8 to 209.7)	90.0	132	174	-9.9 (-50.1 to 30.4)	0.626	0.058
Glucose (mg/dl)	129.9 (116.3 to 142.1)	86.0	98.0	142.0	130.6 (115.7 to 143.2)	88.0	105.0	141.0	-0.7 (-9.6 to 8.1)	0.873	0.678
Glycated Hemoglobin (%)	6.5 (6.1 to 6.8)	5.3	5.6	7.1	6.5 (6.1 to 6.8)	5.3	5.6	7.0		0.626	0.860
Systolic Blood Pressure (mmHg)	132.0 (128.8 to 136.4)	120.0	130.0	140.0	130.8 (126.9 to 134.5)	120.0	130.0	140.0	1.2 (-1.9 to 4.3)	0.441	0.461
Diastolic Blood Pressure (mmHg)	78.3 (76.2 to 80.8)	70.0	80.0	80.0	74.7 (72.4 to 76.6)	70.0	70.0	80.0	3.6 (1.4 to 5.9)	0.002	0.002

BMI: Body Mars Index

Table 3: Anthropometric and clinical variable comparison.

		Initial Control	Final Control	Significance
FRAMINGHAM	Low:	55 (57.9%)	57 (60.0%)	P=0.934
	Moderate:	19 (20.0%)	19 (20.0%)	
	High:	21 (22.1%)	19 (20.0%)	
REGICOR	Low:	92 (96.8%)	90 (94.7%)	P= 0.096
	Moderate:	1 (1.1%)	5 (5.3%)	
	High:	2 (2.1%)	0 (0.0%)	
SCORE (Low risk)	Fatal Low:	88 (92.6%)	88 (92.6%)	P=1.000
	Fatal High:	7 /7.4%)	7 (7.4%)	
Metabolic Syndrome (IDF)	Yes:	53 (55.8%)	37 (38.9%)	P=0.021
	No:	42 (44.2%)	58 (61.1%)	
Metabolic Syndrome (ATP III)	Yes:	37 (38.9%)	32 (33.7%)	P=0.451
	No:	58 (61.1%)	63 (66.3%)	

Table 4: Cardiovascular risk and metabolic risk assessment (n=95).

interesting to carry out a study with a control group to assess what statistical artifact is represented HIV dyslipidemia or the increase of other pathologies in HCV infected patients; this is not ruled out for future reviews.

One other problem faced has been the loss of inmates due to several causes such as transfer to other facilities, therefore we have been unable to complete the study process and potential improvements initially experienced have been frustrated.

Last, we would like to note that the program's assessment has been limited in time, monitoring has only included a one year period.

As a conclusion, we have observed this as a highly positive experience, recommendable and which can be extrapolated to other centers, since it would definitely support the control of cardiovascular disease and the treatment of other infectious diseases such as HIV and HCV. On the other hand, it would entail a useful tool for the healthcare team of any prison, by enabling an improved provision of healthcare to our patients, an updated prison healthcare system and a diversified and specialized assistance.

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