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ORIGINAL

Results of a health intervention program in 1094 bolivian mining workers

Resultados de un programa de intervención en salud en 1094 trabajadores de mineria bolivianos

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Abstract

Background: It is known that health intervention programs that include lifestyle changes usually have a beneficial effect on cardiovascular health. The aim of this study was to assess the impact of a health intervention program in Bolivian mining workers.
Materials and methods: A total of 1094 workers of a Bolivian mining company completed a healthy habits modification program that included diet, physical activity and smoking cessation during 2016 and 2019. The changes obtained in different scales related to cardiovascular risk such as vascular age, atherogenic indices, obesity and body fat were assessed.
Results: Significant improvements were observed both in the mean values and in the prevalence of altered values of all the scales analyzed in practically all the periods studied (2016-2017, 2017-2018 and 2018-2019).
Conclusion: The scales related to cardiovascular risk analyzed in this study have significantly improved after the implementation of this health intervention program.

Keywords: Health intervention programs, cardiovascular disease, obesity.

Resumen

Antecedentes: Se conoce que los programas de intervención en salud que incluyen cambios en el estilo de vida suelen tener un efecto beneficioso en la salud cardiovascular. El objetivo de este estudio fue valorar el impacto de un programa de intervención sanitaria en trabajadores de la minería boliviana.
Materiales y métodos: Un total de 1094 trabajadores de una empresa minera de Bolivia completaron un programa de modificación de hábitos saludables que incluía dieta, actividad física y abandono del consumo de tabaco durante los años 2016 y 2019. Se valoraron los cambios obtenidos en diferentes escalas relacionadas con riesgo cardiovascular como edad vascular, índices aterogénicos, obesidad y grasa corporal.
Resultados: Se observan mejorías significativas tanto en los valores medios como en la prevalencia de valores alterados de todas las escalas analizadas en prácticamente todos los periodos estudiados (2016-2017, 2017-2018 y 2018-2019).
Conclusión: Las escalas relacionadas con riesgo cardiovascular analizadas en este estudio han mejorado significativamente después de la implantación de este programa de intervención en salud.

Palabras clave: Programas de intervención en salud, enfermedad cardiovascular, obesidad.

Introduction

It is essential to know that the evaluation of any health program will make it possible to know and measure the results obtained, its possible usefulness and also its potential impact on health. It is not possible to know how a health intervention program will evolve if the appropriate evaluation methods are not available to establish strategies, implement changes, optimize available resources and facilitate decision-making based on the results obtained[1].

There are two possible ways to evaluate a health intervention program, one is the formative evaluation that will allow us to change and adjust the programs and the other is the summative evaluation that will assess the programs already completed. This summative evaluation will allow us to define important changes if necessary or to continue or modify the program according to the correlation that exists between the objectives that were set, the way in which they were executed and the results that were obtained[2,3].

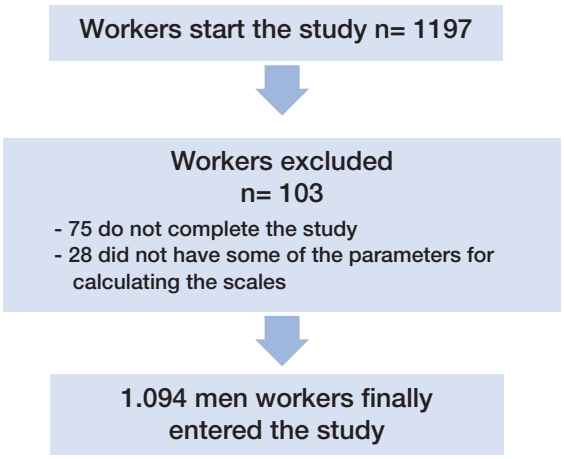
Knowing that the evaluation component of any program is fundamental, it is necessary that the people involved in the design and implementation plan from the beginning the evaluation methodology to be used[4,5].

The objective of this study is to evaluate the results of a health intervention program carried out in Bolivian mining workers.

Material and methods

Intervention study conducted in 1197 male workers of a mining company in Bolivia between the years 2016-2019. 103 workers were excluded from the study for different reasons (see flowchart in **Figure 1**) so the total number of people finally included in the study was 1094.

Figure 1: Flow chart of participants.



Four controls were carried out in 2016, 2017, 2018 and 2019. In each of the controls, the analytical, anthropometric, and clinical variables necessary to calculate the variables related to cardiovascular risk included in the study were determined.

Parameters included in the study

The different measurements (anthropometric, clinical, and analytical) were performed by health personnel from the participating occupational health units after homogenizing the measurement techniques.

Weight (in kilograms) and height (in cm) were obtained with a SECA 700 measuring scale with a capacity of 200 kg, which incorporated a SECA 220 telescopic measuring rod with millimetric division and a 60-200 cm interval.

Abdominal circumference were measured with a SECA model 200 tape measure with the person in a standing position with their feet together and trunk erect, abdomen relaxed, and upper limbs hanging on both sides of their body.

Blood pressure was obtained with an OMRON M3 automatic sphygmomanometer with the person in the supine position after 10 minutes of rest. Three measurements were taken at one-minute intervals and the mean of the three was obtained. Blood tests were obtained after 12 hours of fasting. Samples were sent to reference laboratories. Glycemia, total cholesterol and triglycerides use automated enzymatic methods, and the values are expressed in mg/dl. HDL was determined by precipitation with dextran sulfate Cl2Mg, and values are also expressed in mg/dl. LDL was calculated using the Friedewald formula (provided that triglycerides were less than 400 mg/dl). Values are expressed in mg/dl.

Friedewald formula: LDL= total cholesterol – HDL – triglycerides/5

The different atherogenic indices have different cutoff points[6]:

Total cholesterol/HDL-c index: low risk: < 5, moderate risk: between 5 and 9 and high risk: > 9 in men. LDL-c/HDL-c ratio: low risk: < 3 and high risk ≥ 3. Triglycerides/HDL-c ratio is considered high risk from 3%. Cholesterol-HDL-c index: high risk as from 130.

BMI is calculated by dividing weight by height in meters squared. Obesity is considered to be over 30.

CUN BAE[7] (Clínica Universidad de Navarra Body Adiposity Estimator) The formula is:

-44.988 + (0.503 x age) + (10.689 x gender) + (3.172 x BMI) - (0.026 x BMI2) + (0.181 x BMI x gender) - (0.02 x BMI x age) - (0.005 x BMI2x gender) + (0.00021 x BMI2 x age).

Where male sex equals 0 and female sex equals 1.

The CUN BAE cut-off points for obesity are from 25% in men and 35% in women.

An interesting concept that can also be applied to vascular ages, which we will see below, is avoidable lost life years (ALLY)[8] which can be defined as the difference between chronological age (CA) and vascular age (VA).

ALLY = Vascular age – Chronological age

As the meaning of ALLY is different according to the value of the CA, the ratio of ALLY to CA is defined as the ratio of avoidable lost life years (RALLY).

RALLY = ALLY / Chronological age

In order to calculate vascular age with the Framingham model[9], we used age, sex, HDL-c, total cholesterol, systolic blood pressure values, antihypertensive treatment, smoking, and diabetes. The scale can be calculated from the age of 30 years.

Since there are no cut-off points for vascular age, high values are set at five years of age and older.

A smoker was a person who regularly consumed at least 1 cigarette/day (or the equivalent in other types of consumption) in the previous month, or had stopped smoking in the preceding 12 months.

Protocol of intervention.

The intervention protocol included dietary advice to improve nutritional habits. Different levels of physical activity were recommended according to the characteristics of each worker. Smoking cessation was facilitated. Oral and written information on each of these activities was given at each of the visits.

Workers could visit the occupational health unit whenever they needed to increase adherence to the program.

Statistical analysis

A descriptive analysis of the categorical variables was performed, calculating the frequency and distribution of responses for each of them. For quantitative variables, the mean and standard deviation were calculated, and for qualitative variables, the percentage was calculated. The paired samples T-test was used to assess the difference in means. The McNemar test was used to assess the difference in proportions. Statistical analysis was performed with the SPSS 27.0 program, with an accepted statistical significance level of 0.05.

Ethical considerations and aspects

The study was approved by the Clinical Research Ethics Committee of the La Paz. All procedures were performed in accordance with the ethical standards of the institutional research committee and with the 2013 Declaration of Helsinki. All patients signed written informed consent documents before participating in the study.

Results

An improvement is observed in the mean values of all the parameters analysed, vascular age, atherogenic indices, BMI and CUN BAE as the programme progresses. The differences observed between each of the periods are always statistically significant except for RALLY for vascular age between 2018-2019. The full data are presented in **table I**.

Table I: Mean values of the different parameters in each of the years of the study and differences observed between them.

	year 2016 Mean (SD)	year 2017 Mean (SD)	year 2018 Mean (SD)	year 2019 Mean (SD)	dif (2016-17) Mean (p-value)	dif (2017-18) Mean (p-value)	dif (2018-19) Mean (p-value)
ALLY vascular age	2.04 (6.26)	-0,65 (5.32)	-1.18 (6.25)	-1.55 (4.77)	2.69 (<0.0001)	0.53 (0.001)	0.37 (0.01)
RALLY vascular age	0.046 (0.15)	-0.019 (0.12)	-0.032 (0.14)	-0.037 (0.10)	0.065 (<0.0001)	0.013 (0.001)	0.05 (0.082)
Total cholesterol/HDL-c	5.32 (1.50)	4.97 (1.28)	4.69 (1.35)	4.26 (0.97)	0.35 (<0.0001)	0.27 (<0.0001)	0.43 (<0.0001)
LDL-c/HDL-c	3.52 (1.18)	3.34 (1.06)	3.11 (1.08)	2.75 (0.74)	0.18 (<0.0001)	0.23 (<0.0001)	0.36 (<0.0001)
Triglycerides/HDL-c	5.29 (3.78)	4.97 (3.35)	4.62 (3.03)	4.15 (2.82)	0.32 (0.001)	0.35 (<0.0001)	0.47 (<0.0001)
Total cholesterol-HDL-c	164.28 (42.86)	157.67 (37.20)	154.03 (43.17)	150.21 (38.47)	6.61 (<0.0001)	3.63 (0.001)	3.83 (<0.0001)
BMI	27.46 (3.21)	27.05 (3.27)	26.86 (3.26)	26.70 (3.30)	0.41 (<0.0001)	0.18 (<0.0001)	0.17 (<0.0001)
CUNBAE	26.89 (4.53)	26.45 (4.68)	26.33 (4.65)	26.17 (4.88)	0.44 (<0.0001)	0.12 (0.006)	0.16 (0.007)

Table II: Prevalence of elevated values of the different parameters in each of the study years and differences observed between them.

	year 2016 %	year 2017 %	year 2018 %	year 2019 %	dif (2016-17) % (p-value)	dif (2017-18) % (p-value)	dif (2018-19) % (p-value)
ALLY vascular age ≥ 5	27.4	12.6	11.8	5.9	14.8 (<0.0001)	0.8 (0.529)	5.9 (<0.0001)
Total cholesterol/HDL-c moderate-high	54.8	46.3	40.5	35.3	8.5 (<0.0001)	5.8 (<0.0001)	5.2 (<0.0001)
LDL-c/HDL-c high	64.5	60.4	53.3	42.7	4.1 (0.004)	7.1 (<0.0001)	10.6 (<0.0001)
Triglycerides/HDL-c high	72.2	68.3	67.5	62.5	3.9 (0.002)	0.8 (0.591)	5.0 (0.001)
Total cholesterol-HDL-c high	79.8	79.4	70.5	70.4	0.4 (0.817)	8.9 (<0.0001)	0.1 (0.968)
BMI obesity	20.4	17.5	15.9	15.1	2.9 (<0.0001)	1.6 (0.048)	0.8 (0.281)
CUNBAE obesity	66.6	62.3	60.9	60.0	4.3 (<0.0001)	1.4 (0.125)	0.9 (0.282)

Table II shows the prevalence of altered values and the differences observed in each of the periods analysed, in all cases an improvement is observed as the programme progresses, although the differences observed are not always statistically significant.

Discussion

Both the mean values and the prevalence of elevated values of all the variables included in the study improve over the course of the health intervention programme carried out in Bolivian mining workers.

Similar data to ours were found in the study by Sammito[10] in German soldiers in which a decrease in BMI values was observed after an intervention programme. Other authors such as Liu, on the other hand, in a study conducted in 2015 in 2660 Taiwanese, observed no differences in BMI values before and after the lifestyle intervention[11].

A study conducted in a Spanish population[12] , although focusing particularly on physical activity, showed an improvement in anthropometric parameters as well as in lipid profile and cardiovascular risk. Similar results were obtained in a Croatian study[13].

We have not found any studies assessing the effect of a health intervention programme on atherogenic indices or vascular age, so we cannot compare our results with those obtained by other authors.

The strengths of the study include the large sample size (more than 1000 workers), the variety of scales calculated and the long duration of the programme (3 years).

The limitations of the study are that it was carried out in a specific geographical area and in a working population, which makes it impossible to generalise the results to other countries and to the general population. Another limitation is that a control group without intervention has not been established.

Interests conflict

The researchers declare that they have no conflict of interest.

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