Personal and family factors associated with hypercholesterolemia in Peruvian public-school teachers, using binary logistic regression

Alberto Guevara Tirado [a]

Abstract

Objective: to determine personal factors related to hypercholesterolemia in Peruvian public-school teachers.

Methodology: descriptive study, based on secondary data from the 2021 national survey of 12075 teachers, 546 of whom reported having been diagnosed with hypercholesterolemia in the last year. The dependent variable was the presence of hypercholesterolemia in the last 12 months; the independent variables were: age, sex, overweight, living relative who resigned from employment, relative who dropped out of school, relative who moved away from home, caring for older adults, caring for chronically ill relatives, type of work regime. Pearson's Chi-square test was performed, as well as bivariate linear regression tests which included Cox and Shell test, Nagelkerke's R-square and omnibus test.

Results: it was found that the personal factors that predicted hypercholesterolemia were age, close relative who recently moved, relative who dropped out of school, caring for a relative with chronic diseases, teacher caring for elderly relatives, type of work regime, and overweight.

Conclusions: personal factors are associated with hypercholesterolemia in Peruvian public-school teachers. The state, in addition to the proportion of dyslipidemia screening campaigns, should provide psychological and family support services to school teachers nationwide.

Keywords: hypercholesterolemia; family structure; teachers; logistic models; Chi-Square distribution.

Resumen

Objetivo: determinar los factores personales relacionados con la hipercolesterolemia en docentes de colegios públicos peruanos.

Metodología: estudio descriptivo, basado en datos secundarios procedentes de la encuesta nacional docente del año 2021 realizada a 12075 profesores de los cuales 546 refirieron haber sido diagnosticados de hipercolesterolemia el último año. La variable dependiente fue la presencia de hipercolesterolemia en los últimos 12 meses, las variables independientes fueron: edad, sexo, sobrepeso, familiar con quien vive que renunció al empleo, familiar que abandonó los estudios, familiar que se mudó del hogar, cuidar de adultos mayores, cuidar de parientes enfermos crónicos, tipo de régimen laboral. Se realizó la prueba de Chi-cuadrado de Pearson, así como las pruebas de regresión lineal bivariada la cual incluyó la prueba de Cox y Shell, el R cuadrado de Nagelkerke y la prueba ómnibus.

Resultados: se encontró que los factores personales que predijeron la hipercolesterolemia fueron: la edad, familiar cercano que se mudó recientemente, familiar que abandonó los estudios, cuidar a familiar con enfermedades crónicas, docente que cuida de familiar adulto mayor, el tipo de régimen laboral, sobrepeso.

Conclusiones: factores personales están asociados a la hipercolesterolemia en docentes de colegios públicos peruanos. El estado, además de la proporción de campañas de despistaje de dislipidemias, debe proporcionar servicios de apoyo psicológico y familiar en profesores de escuelas a nivel nacional.

Palabras clave: hipercolesterolemia; estructura familiar; maestros; modelos logísticos; distribución de Chi-Cuadrado

Introduction

Hypercholesterolemia is an increase in plasma cholesterol concentration (1). Cholesterol is a macromolecule transported in the blood by lipoproteins (2) with important functions in the body such as being part of cell membranes and being a precursor of steroid hormones and bile acids (3). There are multiple causes of hypercholesterolemia like hereditary diseases, diabetes, hypothyroidism, pancreatitis, nephropathies, hepatopathies, medications like antiretrovirals and contraceptives (4), however, sedentary lifestyle and unhealthy nutritional habits (consumption of junk food) (5) are the most common etiological factors worldwide (6) and with a high prevalence in the Peruvian population of up to 19.60% (7). It is an important risk factor for

the development of cardiovascular diseases such as myocardial infarction, ischemic and hemorrhagic stroke and peripheral arteriopathy (8).

Public school teachers face problems inherent to the pedagogical work, as well as those concerning the socioeconomic reality, including drastic changes in educational methodology due to the consequences of the new coronavirus pandemic (9), which hinders the proper transmission of knowledge to students, which can be aggravated by the lack of educational materials and support staff; low motivation and interest of students, which generates feelings of frustration in teachers (10); undisciplined students, which leads to situations of confrontation and even violence against teachers, increasing stress (11); low economic remuneration, the main cause of stress due to its impact on family stability (12); uncertainty and confusion due to the limited training and updating they receive from the state, as well as the lack of recognition by society, which can cause teachers to feel undervalued and underappreciated (13).

Adverse personal factors can generate worry and a state of chronic stress, which, from the pathophysiological aspect, causes overactivation of the hypothalamic-pituitary-adrenal axis (14), increasing the concentration of serum cortisol (15), generating hyperglycemia, as well as an increase in lipolysis causing an increase in blood lipids (16), hypertriglyceridemia and hypercholesterolemia (due to the increase of low density lipoproteins) (17). Therefore, the objective of this research was to determine the adverse personal factors related to hypercholesterolemia in public school teachers in Peru. The results allow us to determine which personal factors are a risk for cardiovascular health in this population group and thus go deeper into this problem beyond purely clinical and laboratory aspects.

Methodology

a. Study design and population.

Descriptive, retrospective and cross-sectional study based on a secondary analysis of the 2021 national teacher survey database. This survey was conducted by the National Institute of Statistics and Informatics (INEI by its acronym in Spanish) with the objective of obtaining a representative sample of teachers from all departments and regions of Peru, which makes this a bimetallic sampling by clusters and households. The total survey population was 12075 teachers of all ages and both sexes, of whom 546 had hypercholesterolemia in the last 12 months.

b. Variables and measurements

The dependent variable was hypercholesterolemia, which was categorical, and the way in which the presence of this disorder was determined was based on the telephone consultation carried out in the national teacher survey, in which the teacher was asked if he or she had been diagnosed with arterial hypertension by a health professional in the last 12 months prior to the survey. The independent and categorical variables were: gender (male, female), overweight (yes, no), type of work regime (appointed, contracted), care of the elderly (yes, no), care of chronically ill family members (yes, no), care of family members who quit their jobs (yes, no), care of family members who quit their studies (yes, no), family members who became independent from the teacher's home (yes, no). The only numerical independent variable was age (years). The database of the National Institute of statistics and informatics was accessed in the section corresponding to the 2021 national teacher survey, downloading the file and then selecting the variables of interest for the research.

c. Statistical analysis

The variables were dichotomized in tables. In the inferential analysis, binary logistic regression was performed, which is used to determine the association between a dichotomous dependent variable and one or more predictor or explanatory variables; this required the omnibus test of coefficients of the model, which must have a statistically significant value ($p<0.05$) to be able to interpret the regression model, as well as the Cox and Snell R^2, which is a generalized coefficient of determination that estimates the proportion of variance of the dependent variable (24), and the Nagelkerke R^2, a correction of the Cox and Snell R^2 for complete coverage of the range between 0 and 1 (25). An alpha value equal to 0.05 was considered as the cut-off point for statistical significance. The SPSS statistics 25 program for Windows was used for the analysis and processing.

d. Ethical considerations

The information came from anonymized data from secondary sources so informed consent was not required.

Results

There were 12075 teachers in the national survey, of whom 546 reported having hypercholesterolemia diagnosed in the last 12 months prior to the survey. The omnibus test of the model corresponding to step 3 showed a Chi-square of 895.773, with a degree of freedom of 8 and a p value of 0.001, so the test was statistically significant; therefore, we proceeded with the regression analysis (Table 1).

Table 1. Omnibus test of logistic regression model coefficients

	Chi-square	gl	Sig.
Step	-1.755	1	0.185
Block	895.773	8	0.000
Model	895.773	8	0.001

Source: Own elaboration based on data from the national teacher survey of the Peruvian Ministry of Education (MINEDU)

According to the Cox and Snell R-squared value, hypercholesterolemia in the population studied can be predicted by 8% with the variables analyzed, while with the result obtained from the Nagelkerke R-squared, prediabetes can be predicted by 16% with the variables analyzed (Table 2).

Table 2. Binary logistic regression model overview

Logarithm of the likelihood -2	Cox and Snell R-squared	Nagelkerke R-squared
6851,386[a]	0.088	0.160

Source: Own elaboration based on data from the national teacher survey of the Peruvian Ministry of Education (MINEDU)

After step 3, it was found in the binary logistic regression model that the named work regime, stress, family member who moved to the teacher's home, child who dropped out of school, caring for a chronically ill relative, caring for an elderly relative, overweight and age were personal factors that were significantly associated with hypercholesterolemia in teachers (Table 3). The variables eliminated in previous steps as they did not contribute to the model were gender (p= 0.252) and the fact that a relative in the household had lost his or her job (p= 0.184)

Table 3. Association between personal factors and hypercholesterolemia in Peruvian teachers through binary logistic regression

	B	Standard error	Wald	gl	Sig.	Exp (B)
Employment status: contract	0.350	0.075	21.980	1	0.002	1.419
Family member moved into your home	0.231	0.078	8.663	1	0.003	1.260
Child dropped out of school	0.201	0.080	6.355	1	0.012	1.223
Cares for chronically ill relative	0.325	0.069	22.113	1	0.009	1.385
Cares for an elderly person	0.286	0.069	17.290	1	0.011	1.331
Overweight	1.253	0.067	351.272	1	0.009	3.496
Age	0.034	0.004	79.591	1	0.000	1.034

Source: Own elaboration based on data from the national teacher survey of the Peruvian Ministry of Education (MINEDU)

Discussion

The binary logistic regression model found that age, overweight, caring for an elderly relative, caring for a chronically ill relative, having children who dropped out of school, having an immediate family member who moved home, stress, and the named work regime were associated with the development of hypercholesterolemia, and the model explained 16% of the variability of prediabetes according to Nagelkerke's R^2. Likewise, the variables, according to the omnibus test, were apt to predict this disorder. Although the main factors related to hypercholesterolemia are a sedentary lifestyle and eating junk food or food rich in lipids and carbohydrates (18), it is increasingly accepted in different studies that stressors in work and family life contribute to the onset or exacerbation of hypercholesterolemia in adults belonging to the economically active population (19), In this sense, school teachers would not be exempt from these alterations, so the identification of as many stressors as possible is relevant to address the possible psychosocial component of hypercholesterolemia.

Being a contract teacher was a factor associated with hypercholesterolemia, increasing the probability of presenting this cholesterol elevation with respect to teachers under appointment; in this context, the elevation of stress-related hormones, such as cortisol, (20) may be constant due to the uncertainty of being able or not to get a job, since the teaching contract modality under the Peruvian state regulations through the ministry of education establishes that teachers can work with a contract for only one year, This is an important reason for teachers to be concerned about their future

and that of their families, in addition to the implications related to having to adapt repeatedly to new work environments (22).

Age and overweight are factors that have been related to the development of hypercholesterolemia. Age is a known risk factor for different types of dyslipidemias, including hypercholesterolemia (23); in men, the risk increases from the age of 20 years and women usually have this risk from around the age of 40 years, attributed to the decrease in estrogen levels (24). In this sense, stress in itself (25), the onset and development of the working stage (26), unhealthy diet rich in junk food and alcoholic beverages (27), as well as biological factors, which are exacerbated as age increases, are directly proportional to the elevation of low-density lipoproteins (28). Overweight is a widely known factor directly related to hypercholesterolemia, because adipose tissue with greater volume generates the release of cytokines such as interleukin-6 and tumor necrosis factor alpha, affecting neuroendocrine functions and general energy metabolism, which includes cholesterol (29).

Situations involving severe disruption of the daily family environment, such as moving a family member, children dropping out of school, and caring for elderly or chronically ill family members have been associated with hypercholesterolemia, which could be attributed to an increase in the emotional and physical burden of intensifying efforts to provide economic and psychological stability to the other family members (30). In this sense, moving a family member increases the number of members and decreases the space in the home, the abandonment of the children's studies creates uncertainty in the teacher, especially if this abandonment entailed an economic investment, in addition to the feeling of lost time. Caring for older adults and chronically ill family members implies that the teacher, in addition to the work schedule, the development of materials and class sessions outside working hours, must assume the responsibility, physical, psychological and economic, of providing better care and quality of life to family members in need, increasing the pressure and resulting in an increase in stress that leads to an increase in cholesterol levels.

However, hypercholesterolemia in Peruvian public school teachers was not related to the fact that a family member in the household lost his or her job, probably because the teacher may still feel that he or she is able to support the household while the work situation of the family member is positively reversed, which is also reflected in the fact that being male or fema-

le was not related to hypercholesterolemia, since the teaching profession, unlike jobs with a greater predominance of men or women, is a profession that is exercised without gender differences (31). Therefore, not all personal factors are necessarily associated with the risk of developing hypercholesterolemia, so it is important to identify them.

The limitations of the study were related to those inherent to the nature of the study: as it is a secondary source of surveys, it is likely that there are information biases since there could be teachers who preferred to omit that they had hypercholesterolemia and, since a laboratory analysis was not performed to confirm the diagnosis, there could be more cases than those reported in this article.

In conclusion, personal factors and those related to family aspects are associated with hypercholesterolemia in Peruvian public school teachers. Given the fact that the findings represent modifiable risk factors, it is urgent to develop public policies aimed at improving the living and working conditions of teachers, for example, with contractual improvements, as well as the massification of efficient social, psychological and financial support programs, which will subsequently represent an extra burden or stressor in this population group, reducing their quality of life and teaching performance, affecting in the short and long term, the interaction and quality of teaching of schoolchildren.

References

1. Ibrahim MA, Asuka E, Jialal I. Hipercolesterolemia [Internet]. Publicación de StatPearls; 2023 [citado el 19 de junio de 2023]. Disponible en: https://www.ncbi.nlm.nih.gov/books/NBK459188/

2. Chang Calderín O, Figueredo Villa K, Murillo Pulgar TJ. Hipercolesterolemia en el adulto mayor. Rev Cuba Med Gen Integral [Internet]. 2020 [citado el 19 de junio de 2023];36(3). Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21252020000300011

3. Guijarro C, Cosín-Sales J. Colesterol LDL y aterosclerosis: La evidencia. Clin Investig Arterioscler [Internet]. 2021;33 Suplemento 1:25–32. Disponible en: https://www.sciencedirect.com/science/article/pii/S021491682100005X

4. Huff T, Boyd B, Jialal I. Physiology, Cholesterol [Internet]. StatPearls Publishing; 2023 [cita-

do 19 de junio de 2023]. Disponible en: https://www.ncbi.nlm.nih.gov/books/NBK470561/

5. Bazán N, Echandía N, Gatica M, Laiño F, Valenti C. Niveles de actividad física y sedentarismo en personal de la salud. Rev Fac Cs Méd UNR [Internet]. 2021 [citado 19 de junio de 2023];1:122–9. Disponible en: https://fcmcientifica.unr.edu.ar/index.php/revista/article/view/28

6. Al-Zahrani J, Shubair MM, Al-Ghamdi S, Alrasheed AA, Alduraywish AA, Alreshidi FS, et al. The prevalence of hypercholesterolemia and associated risk factors in Al-Kharj population, Saudi Arabia: a cross-sectional survey. BMC Cardiovasc Disord [Internet]. 2021;21(1):22. Disponible en: http://dx.doi.org/10.1186/s12872-020-01825-2

7. Vega A, Alejandra S. Prevalencia de dislipidemias en pacientes de un policlínico de Lima-Perú, antes y durante la pandemia por Covid-19 [Internet]. Universidad Nacional Federico Villarreal; 2022 [citado 19 de junio de 2023]. Disponible en: https://repositorio.unfv.edu.pe/handle/20.500.13084/6407

8. Hackam DG, Hegele RA. Cholesterol lowering and prevention of stroke: An overview. Stroke [Internet]. 2019;50(2):537–41. Disponible en: http://dx.doi.org/10.1161/STROKEAHA.118.023167

9. Robinson LE, Valido A, Drescher A, Woolweaver AB, Espelage DL, LoMurray S, et al. Teachers, stress, and the COVID-19 pandemic: A qualitative analysis. School Ment Health [Internet]. 2023;15(1):78–89. Disponible en: http://dx.doi.org/10.1007/s12310-022-09533-2

10. Kumari J, Kumar J. Influence of motivation on teachers' job performance. Humanit Soc Sci Commun [Internet]. 2023 [citado 19 de junio de 2023];10(1):1–11. Disponible en: https://www.nature.com/articles/s41599-023-01662-6

11. Kropáč J, Buchtová T, Chudý Š. The new teacher and discipline factors. Cogent Educ [Internet]. 2023;10(1). Disponible en: http://dx.doi.org/10.1080/2331186x.2023.2170081

12. Collie RJ, Mansfield CF. Teacher and school stress profiles: A multilevel examination and associations with work-related outcomes. Teach Teach Educ [Internet]. 2022;116(103759):103759. Disponible en: https://www.sciencedirect.com/science/article/pii/S0742051X22001330

13. Kärner T, Höning J. Teachers' experienced classroom demands and autonomic stress reactions: results of a pilot study and implications for process-oriented research in vocational education and training. Empir Res Vocat Educ Train [Internet]. 2021;13(1). Disponible en: http://dx.doi.org/10.1186/s40461-021-00113-3

14. O'Connor DB, Thayer JF, Vedhara K. Stress and health: A review of psychobiological processes. Annu Rev Psychol [Internet]. 2021;72(1):663–88. Disponible en: http://dx.doi.org/10.1146/annurev-psych-062520-122331

15. Cay M, Ucar C, Senol D, Cevirgen F, Ozbag D, Altay Z, et al. Effect of increase in cortisol level due to stress in healthy young individuals on dynamic and static balance scores. North Clin Istanb [Internet]. 2018 [citado 19 de junio de 2023];5(4):295–301. Disponible en: http://dx.doi.org/10.14744/nci.2017.42103

16. Zhu L, Zhang Y, Song L, Zhou Z, Wang J, Wang Y, et al. The relationships of shift work, hair cortisol concentration and dyslipidaemia: a cohort study in China. BMC Public Health [Internet]. 2022 [citado 19 de junio de 2023];22(1):1634. Disponible en: http://dx.doi.org/10.1186/s12889-022-14038-3

17. Assadi SN. What are the effects of psychological stress and physical work on blood lipid profiles? Medicine (Baltimore) [Internet]. 2017 [citado 19 de junio de 2023];96(18):e6816. Disponible en: http://dx.doi.org/10.1097/MD.0000000000006816

18. Schoeneck M, Iggman D. The effects of foods on LDL cholesterol levels: A systematic review of the accumulated evidence from systematic reviews and meta-analyses of randomized controlled trials. Nutr Metab Cardiovasc Dis [Internet]. 2021;31(5):1325–38. Disponible en: https://www.sciencedirect.com/science/article/pii/S0939475321000028

19. Sanchez-Gomez M, Giorgi G, Finstad GL, Alessio F, Ariza-Montes A, Arcangeli G, et al. Economic stress at work: Its impact over absenteeism and innovation. Int J Environ Res Public Health [Internet]. 2021 [citado 20 de junio de 2023];18(10):5265. Disponible en: http://dx.doi.org/10.3390/ijerph18105265

20. Thau L, Gandhi J, Sharma S. Physiology, Cortisol [Internet]. StatPearls Publishing; 2022 [citado 20 de junio de 2023]. Disponible en: https://www.ncbi.nlm.nih.gov/books/NBK538239/

21. Gálvez Suarez E, Milla Toro R. Evaluación del desempeño docente: Preparación para el aprendizaje de los estudiantes en el Marco de Buen Desempeño Docente. Propós represent [Internet]. 2018 [citado 20 de junio de 2023];6(2):407. Disponible en: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S2307-79992018000200009

22. Quispe OFB, Sánchez RMS, Saavedra EFC, Rosales EMA, García CEC. Estrés laboral y clima organizacional en docentes peruanos. Medisur [Internet]. 2020 [citado 20 de junio de 2023];18(6):1138–44. Disponible en: https://medisur.sld.cu/index.php/medisur/article/view/4621

23. Senarath U S, Katulanda P K, Fernando D F, Kalupahana N K, Partheepan K P, Katulanda G K, et al. Undiagnosed diabetes, hypertension, and hypercholesterolaemia in an overweight or obese population: implications for cardiovascular disease risk screening programme. Ceylon Med J [Internet]. 2020 [citado 20 de junio de 2023];65(3):46–55. Disponible en: https://pubmed.ncbi.nlm.nih.gov/34800931/

24. Ortega-Sánchez D, Sanz de la Cal E, Ibáñez Quintana J, Borghi B. Editorial: Gender equality and women's empowerment in education. Front Educ [Internet]. 2022;7. Disponible en: http://dx.doi.org/10.3389/feduc.2022.833977

25. Gawlik KS, Melnyk BM, Tan A. Associations between stress and cardiovascular disease risk factors among Million Hearts priority populations. Am J Health Promot [Internet]. 2019 [citado 20 de junio de 2023];33(7):1063–6. Disponible en: https://pubmed.ncbi.nlm.nih.gov/31079467/

26. Dochi M, Suwazono Y, Sakata K, Okubo Y, Oishi M, Tanaka K, et al. Shift work is a risk factor for increased total cholesterol level: a 14-year prospective cohort study in 6886 male workers. Occup Environ Med [Internet]. 2009 [citado 20 de junio de 2023];66(9):592–7. Disponible en: https://pubmed.ncbi.nlm.nih.gov/19690156/

27. Hosseini M, Yousefifard M, Baikpour M, Fayaz M, Koohpayehzadeh J, Rafei A, et al. Age, period and cohort analysis of high cholesterol levels in Iranian adults over a 20-year period. J Diabetes Metab Disord [Internet]. 2019 [citado 20 de junio de 2023];18(2):289–99. Disponible en: https://pubmed.ncbi.nlm.nih.gov/31890653/

28. Maștaleru A, Cojocariu AS, Oancea A, Leon-Constantin M-M, Roca M, Zota IM, et al. Eating habits in patients with familial hypercholesterolemia from north-eastern Romania. Nutrients [Internet]. 2022 [citado 20 de junio de 2023];14(15):3124. Disponible en: https://pubmed.ncbi.nlm.nih.gov/35956302/

29. Ridker PM, MacFadyen JG, Glynn RJ, Bradwin G, Hasan AA, Rifai N. Comparison of interleukin-6, C-reactive protein, and low-density lipoprotein cholesterol as biomarkers of residual risk in contemporary practice: secondary analyses from the Cardiovascular Inflammation Reduction Trial. Eur Heart J [Internet]. 2020 [citado 20 de junio de 2023];41(31):2952–61. Disponible en: https://pubmed.ncbi.nlm.nih.gov/32221587/

30. Mohamed F, Seedat F, Raal FJ. Novel therapies for familial hypercholesterolemia. Curr Opin Endocrinol Diabetes Obes [Internet]. 2021 [citado 20 de junio de 2023];28(2):188–95. Disponible en: https://pubmed.ncbi.nlm.nih.gov/33278127/

31. Elahi NS, Abid G, Contreras F, Fernández IA. Work-family and family-work conflict and stress in times of COVID-19. Front Psychol [Internet]. 2022;13:951149. Disponible en: http://dx.doi.org/10.3389/fpsyg.2022.951149