Chapter 6

Discussing health in high school: coronary artery disease (CAD) and its relation to gene, sedentary lifestyle and nutrition

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ABSTRACT
The work in question is related to the "XXIII Scientific Exhibition" held in the School of Basic Education linked to the Integrated Regional University - URI where academics guided by the regent of the discipline of Biology stimulate high school students to perform scientific work that provides opportunities for research, scientific development and protagonism. The relevant points of the work are in the research and understanding carried out between the relationship of genetic and environmental factors and their actions in the development of Coronary Artery Disease (CAD); besides the perception regarding the learning opportunities of this work for high school students. To this end, a bibliographic research was conducted from the search of articles published between 2021 and 2022 found in the "PubMed" database, being discarded articles whose objective and results/conclusion were not consistent with the central idea of the work. Regarding the research it was concluded that genes are important factors for the possibility of the development of such diseases, however, a good diet and the practice of physical exercises appear as limiting factors for CAD to manifest, considering their influence on the body, because it is proven that genes contribute very little to the action of coronary heart disease. In relation to the student's protagonism, it was observed that the research provided scientific knowledge, the opportunity to dialogue with scholars, and the incentive to research, understanding that it is an essential factor for the development of criticality, autonomy, competence, and learning in a significant way.

Keywords: Genes. Cardiovascular diseases. High School. Protagonism.

1 INTRODUCTION

The real and meaningful learning should be related to the teenager's daily life, so the schools use tools for the students to understand the importance of scientific research, relating the contents developed in different disciplines with those seen in the Universities and with the National High School Exam (ENEM).

These tools are related to the "Scientific Initiation Exhibitions", which aim to provide the development of the protagonism through research and investigation, living concrete, creative and

innovative experiences, appropriating scientific concepts and values in their own observations, as well as promoting the socialization of the researched results.

This research should contribute to instigate and enhance knowledge, starting from the following premise:

> When talking about research, there is a question that needs to be clarified from the beginning: the concept "research" is not univocal, and it is from this that we start defining our understanding and emphasizing that doing research is not an exclusive activity of doctors, professionals from academia, scientists, among others, but it constitutes a task of launching ourselves to new discoveries from something that intrigues us, worries us (NOGARO; CERUTTI, 2016, p.67).

Thus, this research aimed to work with coronary artery disease (CAD), a disease that develops in the arteries that supply the heart, called coronary arteries, which is addressed in high school textbooks, studied in health courses, common in everyday conversations of adults, which occurs due to a process called atherosclerosis, in which atheroma plaques (fat) are deposited in the arteries, obstructing the blood passage and forming the atherosclerotic plaques (SWEIS,2020; JIVAN 2020).

The initial idea came from the possibility of establishing a relationship between the factors that influence the development of CAD, highlighting the action of multiple genes, obesity, dietary factors, sedentary lifestyle, hypertension, smoking, and high low-density lipoprotein (LDL) levels.

In order to have this perception, research in Genetics was sought, which makes it clear that genetic inheritance can help the development of diseases, but there is a range of pathogens that are more linked to external factors and not to genetic action, being called multifactorial (MARCHESI, 2020).

This literature review presents the relationship of CAD to genetic and environmental factors; it also discusses the importance of scientific research in high school and the different opportunities that this work can bring to the student.

2 THEORETICAL FRAMEWORK

To understand the relationship that exists between genes, environment and everyday life, we chose a disease that brings many questions, which is expressed in textbooks and manifests itself in conversations of families, the CAD. It is essential to demonstrate to the community the importance that genetics and lifestyle have on the health of the population.

Thus, Gottlieb et al (2007) show that genes play an important role in the formation of CAD, however, it is of primary attention to highlight the action of these other factors, which alone do not represent much danger, but when they come together can cause catastrophic results in the individual's health. Genetics does not determine the expressiveness or not of CAD, because the genetic contribution in this disease is relatively low, considering that it is not a syndrome. However, it still plays a risk factor, because it can influence the development of this pathogen in a silent way.

It should be questioned how much this relationship is part of everyday life, because in times of

processed foods or "*fast foods*" it would be a way to contribute for adolescents to understand the importance of healthy lifestyle habits, making choices that can make a difference in adult life. Diet enters as one of the main factors to be considered when dealing with the onset of CAD. The intake of HDL and LDL are agents that are directly related to CAD, because LDL is the cholesterol that accumulates in the walls of the coronary arteries, thus causing the development of fatty plaques called atheroma (HENNING, 2021).

To avoid fatty plaques, it becomes necessary to take care of the diet, this being the main focus to prevent the development of CAD, a fact glimpsed by Khera and Kathiresan (2017). In this context, the consumption of unprocessed foods becomes crucial for health, because processed foods have high saturated fat content when compared to unprocessed foods, a fact observed in the studies of Sekhar et al. (2021).

Scientific initiation works may contribute to discussions about adolescent health, to the development of habits and attitudes, to the choice regarding diet or the option of physical exercise, since we live in times when childhood obesity is becoming more and more rampant. We must also discuss health in its different nuances, because we live in a time when the media valorizes the body, a fact that can have serious consequences for an adolescent. Providing the discussion or instigating knowledge about CAD can be a stimulus to change habits.

In this context, Moss (2015, p.16) collaborates "Our culture has turned against cigarette advertising campaigns, but we do nothing while food companies do exactly the same thing. And we could claim that the damage to public health caused by a poor diet is comparable to that caused by tobacco"

Another factor to be discussed refers to the lack of regular physical exercise, because exercises are part of a clinical process that is called "cardiac rehabilitation". This process consists of the practice of exercises, behavioral change regarding the disease, psychological support to the patient, and education about the risk factors for CAD, as advocated by Yamamoto *et al.* (2010).

Changes in lifestyle, such as inadequate eating patterns associated with a sedentary lifestyle, alcohol abuse, and smoking, contribute to the development of diseases. Regarding food, the most prominent change is the supply of processed foods, with high energy density, at the expense of saturated fats and simple carbohydrates, to the detriment of natural foods, which have lower caloric value and are sources of micronutrients and fiber (DE JESUS; HADDAD, 2017).

3 METHODOLOGY

The XXIII Scientific Initiation Exhibition, involving interdisciplinarity, the community and the media, took place from October 29 to 31, 2022 and had as its theme: "Transforming our world: the 2030 agenda for Sustainable Development". The high school students chose their mentors and the school supervision provided the *template* for the production of the article, a model of a *banner* for presentation and the choice of the panel, formed by university professors who evaluated the work. After the choice of the supervisor, a student of the 6th semester of the Medicine course of the University of Rio Grande (FURG) and a student of the 8th semester of the Nursing course of the URI were invited to act as co-supervisors.

The literature review was performed by consulting the *PubMed database*, through the combination of the keywords "*coronary artery disease*," "*polygenic risk*," *"diet," and "exercise*. For this work, a *WattsApp* group was created, where the students, assisted by the university professor, guided the student researchers, as well as face-to-face meetings. Articles and papers published between 2021 and 2022 were selected. In the first search, 7 papers that matched the descriptors were chosen and, after reading their objectives and abstracts, 5 papers were selected to compose this review. In addition, a study from the year 2017 was used, in view of its relevance and correspondence with the objectives of this work. For the discussion, a table describing the selected works and their contributions was made; besides taking into consideration the testimonies of the student researchers in the work and their relevance to learning.

4 RESULTS AND DISCUSSIONS

Initially, (table 1) will be shown the result of the research related to CAD, the selected articles and their main information. After that, the testimonies of the students involved in the research will be presented, with the respective analysis.

Table 1 - Presents the article, authors, objective, and conclusion.

Article	Authors	Goal	Conclusions
Genetics of Coronary Artery Disease: Discovery, Biology and Clinical Translation	KHERA, A. V.; KATHIRESAN, S., 2017.	Understand the genetic drivers of CAD, the role of human genetics in catalyzing drug discovery efforts for CAD, and the promises and challenges of integrating genetic information into routine clinical practice.	It was perceived that genetic factors such as hypercholesterolemia have a strong action on CAD, with familial hypercholesterolemia being the main monogenic factor of CAD. It is believed that the family genetic analysis, focusing on the levels of LDL cholesterol, promotes an easy mapping of a possible CAD, opening paths for early treatment.

Obesity and Obesity-induced Inflammatory Disease contribute to Atherosclerosis: A Review of the Pathophysiology and Treatment of Obesity	HENNING, R. J., 2021.	To research and relate obesity to the formation of atherosclerosis, studying the ways that being overweight relates to the development of CAD. As well as researching ways to mitigate the effects that obesity can cause, and perhaps ways to treat it	Visceral adiposity is a severe chronic inflammatory condition that contributes to vascular atherosclerosis. Obese patients produce the adipokines leptin, resistin, interleukin, and chemotactic proteins that attract monocyte and macrophage to the adipose tissue causing inflammation and platelet aggregation responsible for endothelial dysfunction and myocardial fibrosis. Weight loss with diet and exercise, medication, and bariatric surgery will be able to reduce inflammatory adipokines, oxidative stress, and abnormal lipid metabolism. A multidisciplinary approach with obese patients involving lifestyle changes, pharmacological or surgical interventions is essential. Research on inflammatory and anti-inflammatory adipokines should be continued to facilitate the understanding of adipokines with cardiovascular disease.
Monogenic and Polygenic Models of Coronary Artery Disease	MUSE, E. D. *et al*, 2021.	Review and analyze how advances in genome sequencing have broadened the understanding of monogenic and polygenic contributions to CAD and how these insights can be used in order to create polygenic risk estimates, to improve risk stratification for diseases such as CAD.	CAD, being a hereditary disease, is being increasingly mapped by the advances in genomic medicine, which allows the identification with greater precision of people genetically susceptible to this condition. With this, it is possible to act early and in a personalized manner in the prevention of CAD.
Food for Thought or Feeding a Dogma? Diet and Coronary Artery Disease: a Clinician's Perspective	SEKHAR, A. *et. al*, 2021.	Provide an overview of nutritional studies evaluating the association of dietary saturated fat and meat intake with the development of CAD and discuss the implications of recent data.	Trans fats and processed meats are directly related to increased cardiovascular risk. Unsaturated fat is preferred, but there are limitations in studies on the outcome of saturated fat intake. A high intake of refined carbohydrates, which have a high glycemic index, is also found to be associated with the worst cardiovascular disease data.

Association between Food and Nutrients Intakes and Coronary Plaque Vulnerability in Patients with Coronary Heart Disease: An Optical Coherence Tomography Study	WANG, W. *et al*, 2021.	To explore how dietary intake is linked to CAD treatment and its association with coronary plaque vulnerability, the main mechanism for coronary disease progression, using OCT(optical coherence tomography).	Dietary factors have been shown to be associated with atherosclerotic plaque vulnerability. Salt intake is the major dietary risk factor for plaque vulnerability. On the other hand, intake of vegetables, fruits, dietary fiber, folate and vitamin C are dietary protective factors and are inversely related to plaque vulnerability.
Exercise Training and Interventions for Coronary Artery Disease	FÉRNANDEZ-RUBIO, H. *et al*, 2022.	Perform a brief specific analysis of the results that patients with CAD can achieve by performing resistance, strength or inspiratory muscle training.	Physical exercise is an effective therapy for primary and secondary prevention of CAD, attenuating some pathophysiological processes and promoting improvements in functional capacity and muscle strength. The study shows that the most important parameter to be considered seems to be the total caloric expenditure, and not so much the modality itself.

Source: Prepared by the authors.

It should be considered that 2 selected articles bring the discussion of the relationship of CAD with genetics. Khera *and* Kathiresan (2017) demonstrate the importance of understanding genetic factors as a challenge to integrate this content into clinical practice, noting that hypercholesterolemia has a strong action on CAD and Muse *et al.*,(2022) note that CAD is a hereditary disease, hence the importance of understanding nutrigenomics.

We understand that discussing the action of the gene in the organism is a very intriguing factor, because genes have penetrance and expressivity as a characteristic, factors that can suffer oscillations, contributing to the understanding of epigenetics, which according to Moalem (2016) is characterized as the study of how genetic traits 'can change and be changed in a single generation, and even be transmitted to the next generation. Following this reasoning we understand that the environment will be able to act on gene expressivity:

> Some genes are activated by external triggers or random factors. In this process, proteins act as master sensors, turning genes, or even combinations of genes, on or off. Like the score of a symphony, the genome contains the information for the development of these proteins, which often causes this score to be described differently, suffering the influence of the environment (KEAN, 2013, p.56).

Another fact demonstrated by Moalem (2016, p.69) is to understand that "your thoughts are always impacting your genes, which need to change over time to align your cellular machinery within the expectations you have set and the experiences you have had."

Along these lines Muse *et al.* (2021) note that CAD is increasingly related to genomic medicine, which according to Romboli and Viola (2017) consists of the science that studies the influence of nutrients on the expression of genes and their products in altering phenotype, that is, in informing gene expression, which allows the understanding of the influence of dietary components on metabolic pathways.

And they also contribute by stating that about 80% of cases of coronary heart disease, 90% of cases of type 2 diabetes and ⅓ of cancers can be avoided by changes in eating habits and maintenance of an ideal body weight, associated with physical activity (ROMBOLI; VIOLA, 2017). As for environmental factors, selected authors report that visceral adiposity is a determining condition for inflammation of the arteries (HENNING, 2021). Each one-point increase in the Body Mass Index (BMI) of an overweight individual causes a 10% increase in the risk of atherosclerosis and CAD (WANG *et al.*, 2021).

They report that trans fat and processed meats are directly related to increased cardiovascular risk (SEKHAR *et. al.*,2021), that dietary factors are associated with atherosclerotic plaque vulnerability, especially salt intake (WANG *et al.*, 2021), that vegetable, fruit, dietary fiber, folate and vitamin C intake are dietary protective factors and are inversely related to plaque vulnerability (WANG et al., 2021).

It is observed that nutrition is directly related to CAD, but this is not the only factor. Férnandez-Rubio *et al.* (2022) emphasize that physical exercise is an effective therapy for primary and secondary prevention of CAD, attenuating some pathophysiological processes and promoting improvements in functional capacity and muscle strength. It can be seen that all the selected authors make it clear that nutrition and lifestyle habits are directly related to CAD. The risk factors are obesity, high level of cholesterol (LDL), hypertension, smoking, and alcohol. Therefore, a change in lifestyle habits, and not only in nutrition, can promote better quality of life; besides having an impact on the factors that contribute to chronic diseases (SARTI; TORRES, 2017).

A healthy diet has huge impacts on the control and prevention of various diseases, but it needs to be complete and varied, in order to provide not only the essential nutrients but also the bioactive substances that will improve the functioning of the body (SALVADOR, 2017). One should still consider that we are the ones who invent our lifestyle, and it is within our power to change it. We don't need to wait for the invention of a magic pill or a low-calorie French fry, it is already clear that the changes that will minimize the risks of CAD depend on each person. These changes include: not smoking, exercising regularly, limiting total intake of calories, alcohol, salt, saturated and trans fats, sugar, soft drinks, processed foods, among others (DIAMOND, 2014).

As with most complex diseases. an individual's risk of developing CAD is modulated by the interaction between genetic and lifestyle factors (KHERA *et al.*, 2017), with some of the most eminent risk factors for this disease being chronic elevation of blood pressure, hypercholesterolemia, diabetes, age, obesity, smoking, and sedentary lifestyle (FÉRNANDEZ-RUBIO *et al.*, 2022).

Regarding the students' perception, here follows the transcript of the statements of those involved in the research:

"Our scientific initiation exhibition stood out among the other works, because we were able to conclude our main objective with excellence - to demonstrate that CAD does not have a great influence due to genes, having a greater probability of development from external factors, such as sedentary lifestyle. This experience gave us a greater knowledge in the area of Biology, as well as corroborated to understand how scientific research occurs. I am very grateful to the teacher Cisnara Amaral and the students Eduarda and Luana, who helped us and collaborated with the accomplishment of our work with quality and in a pedagogical way. Finally, I would like to say that I was very happy to receive the award for outstanding work, which certainly rewarded all the effort that my group put into this work. A.M.A

"I am passionate about works and studies about medicine and the human body, I love learning and being able to pass on what I know to people and somehow help them. Producing the Scientific Exhibition was fantastic! I had the opportunity to venture into clinical cases and other literature reviews, which made me understand the dimension that human life is. I realized that the more we study, the more we have to learn, and when done in a group, we can discuss our findings and learn from each other. Even though I am an adolescent, I found myself in moments having discussions above my age group and with extremely important themes. The work done made me aware not only of how laborious and rewarding scientific work is but made me sure of the profession I want to follow!" E.F.M

"The scientific initiation exhibition we held, with the supervision and assistance of Professor Cisnara Amaral and the students, was extremely impactful in terms of presentation to a new reality. The methods proposed for the research conducted differed greatly from the classic school models, being a more scientific and reliable approach to the reality of scientific research. To realize, then, that our effort and hard work in performing this work was rewarded, with the award for outstanding activity, was extremely gratifying, encouraging me even more to perform external research in the areas of my personal interest, as well as increasing my taste for reading and researching things unknown to me until then". J.P.S.S.

It is noted that the research provided scientific knowledge, since the referential performed and the discussion occurred in partnership with the students of health courses and guiding teacher. It provided an interdisciplinary opportunity, since it demonstrated the importance of English for academic knowledge, the oral presentation of the work, and the perception of the rules of a scientific study. In "liquid times", we need new ways of thinking about education, since the challenges of teaching grow with the changes in the world pointing to the creation of a teaching culture that has research as an educational principle to overcome the reproductionism and accumulation of content transmitted in a not very significant way (NOGARO; CERUTTI, 2016).

Still Nogaro and Cerutti (2016, p.68) contribute "stripping away the "academic", pomp-coated sense of research becomes necessary for it to be incorporated into the practice of the basic education teacher and in the life of the student."

It should be emphasized the change of habits that can cause in relation to diet and exercise, determining factors to prevent CAD; the mastery of concepts studied in Genetics that do not make much sense, and that related to a disease can establish parameters that stimulate learning. Learning with understanding is more likely to promote transfer than simply memorizing information from a text or an expository lecture (WIGGINS; McTIGHE, 2019).

Regarding the orality and presentation of the work, it was observed that it won as "outstanding work" (figure 1) fact that will serve as a stimulus to students to understand the importance of research,

using knowledge in their daily lives, making analogies, reflective thinking, autonomy to make decisions and criticality regarding lifestyle habits. Besides the recognition that genetics or environmental factors are related, that everything in our body is related, including our perceptions and thoughts. That we experience times of choices, which can positively or negatively affect our health and that of our family members.

Figure 1 - Certification and award medal.

Source: Authors' personal file.

5 CONCLUDING REMARKS

In relation to the research on CAD and environmental factors, one notices that a complexity of factors related to each other may cause the expression of the disease. Among the environmental factors, lifestyle stands out, especially in relation to fat consumption, unbalanced diet, sedentary lifestyle, and obesity. The high consumption of fats, especially trans fats and saturated fats, and refined carbohydrates with high glycemic index favor the creation of atherosclerotic plaques, which are responsible for causing CAD. Similarly, the intake of salt is the main dietary risk factor for plaque vulnerability, in contrast to the intake of fruits and vegetables, which has the opposite action.

It is noted that sedentary lifestyle and obesity lead to the accumulation of fatty plaques in the arteries, causing CAD. Obese people produce adipokines and some proteins that attract monocytes and macrophages to the adipose tissue, causing inflammation and aggregation of atheroma plaques. Another problem associated with obesity is sedentariness. With the practice of physical exercises, the atheroma plaques can regress, increasing the blood flow in the arteries and decreasing the risks of the disease.

Still The genetic influence on the development of CAD is still noticeable, but it has been proven that genes have little action in the development of these diseases, because they have variable expressivity and act by turning proteins on and off, and suffer demonstrably from environmental action.

Regarding the contribution to high school students, it was observed that the practice of scientific initiation can corroborate to sharpen the taste for research, interdisciplinarity, academic experience, meaningful learning, protagonism in relation to habits and attitudes, scientific literacy, the mastery of contents that make little sense, choices regarding diet and physical exercise as a prerequisite for health.

REFERENCES

DE JESUS, A.C.S.; HADDAD, M. **Papel dos alimentos na nutrição e saúde pública.** *In:* SARTI, F.M.;TORRES, E.A.F.S.(Orgs). Nutrição e Saúde pública. Barueri, SP: Manole: 2017.

DIAMOND, J. **O mundo até ontem:** o que podemos aprender com as sociedades tradicionais. Rio de Janeiro: Record, 2014.

FÉRNANDEZ-RUBIO, H. *et al.* Exercise Training and Interventions for Coronary Artery Disease. **Journal of Cardiovascular Development and Disease**, v.9, n.131, p. 1-15, 2022.

GOTTLIEB, M. G. V. *et al*. Genetics aspects of aging and related diseases: a complex network of interactions between genes and environment. **Rev. Bras. Geriatr. Gerontol.**, v.10, n.3, p.273-283, 2007.

HENNING, R.J.Obesity and Obesity-induced Inflammatory Disease contribute to Atherosclerosis: A Review of the Pathophysiology and Treatment of Obesity. **Am J Cardiovasc Dis**, v.11, n. 4 p. 504-529, 2021.

KEAN, S. **O polegar do violinista**: e outras histórias da genética sobre amor, guerra e genialidade. Rio de Janeiro: Zahar, 2013.

KHERA, A. V., KATHIRESAN, S. Genetics of Coronary Artery Disease: Discovery. Biology and Clinical Translation. **Nature Review Genetics**, v.18, p.331-344, 2017.

MARCHESI, J.A.P. **Como a genética transformou o mundo**. 1ª ed. Jaboticabal, Edição Independente, 2020.

MOALEM, S. **Herança:** como os genes transformam nossas vidas e como a vida transforma nossos genes. Rio de Janeiro: Rocco, 2016.

MOSS. M. **Sal, açúcar, gordura:** como a indústria alimentícia nos fisgou. 1ª ed. Rio de Janeiro: Intrínseca, 2015.

MUSE, E. D. *et al.*Monogenic and Polygenic Models of Coronary Artery Disease. **Curr Cardiol Rep**, v. 23, n. 107, p. 1-12, 2021.

NOGARO, A.; CERUTTI, E. **As TICs nos labirintos da prática educativa**. Curitiba: CRV, 2016.

ROMBOLI, P. B.; VIOLA, R.R. **Nutrigenômica na promoção da saúde humana.** *In:* SARTI, F.M.; TORRES, E.A.F.S.(Orgs). Nutrição e Saúde pública. Barueri, SP: Manole: 2017.

SALVADOR, L. C. **Substâncias bioativas em alimentos**. *In:* SARTI, F.M.; TORRES, E.A.F.S.(Orgs). Nutrição e Saúde pública. Barueri, SP: Manole: 2017.

SEKHAR, A. *et al.* Food for Thought or Feeding a Dogma? Diet and Coronary Artery Disease: a Clinician's Perspective. **Curr Cardiol Rep**, v. 23, n.127, p.1-8, 2021.

SARTI, F.M.; TORRES, E.A.F.S. **Nutrição e saúde pública:** produção e consumo de alimentos. Barueri, SP: Manole, 2017.

SWEIS, R. N.; JIVAN, A. **Considerações gerais sobre a doença arterial coronariana (DAC)**. Manual MSD. Disponível em: Manual MSD Versão Saúde para a Família (msdmanuals.com), acesso em set 2022.

YAMAMOTO, S. *et al*. A. Efeitos do treinamento de resistência na força muscular, capacidade de exercício e mobilidade em pacientes de meia-idade e idosos com doença arterial coronariana: uma meta-análise. **J. Cardiol**.,v.68, p.125-134,

WANG, W. *et al.* Association between Food and Nutrients Intakes and Coronary Plaque Vulnerability in Patients with Coronary Heart Disease: An Optical Coherence Tomography Study. **Nutrition, Metabolism & Cardiovascular Diseases**, v. 31, n. 1, p. 201-208, 2021.

WIGGINS, G.; McTIGHE, J. Planejamento para a compreensão: alinhando currículo, avaliação e ensino por meio do planejamento reverso. 2ªed. Porto Alegre: Penso, 2019.