

## **Cardiovascular Prevention: Internet Resources for a Teaching Unit**

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### **Abstract**

In order to find stimuli for getting young students interested in the subject of Health, internet resources have been searched such as scientific contributions, atlases, images, diagrams and animations that help study cardiovascular prevention. The educational route is geared towards an increased awareness of the consequences of our behaviour on our health. The risk factors are determined to a great extent by behaviours learned in childhood and continued in adulthood, such as dietary habits, physical activity and smoking. The paper deals in particular with the primary prevention of heart attack and stroke. It can be noted, however, that compliance with its rules often produces benefits on other areas of health, for example bone growth and cancer prevention.

Key words: cardiovascular, prevention, risk factor, childhood.

### **Introduction**

The need has been felt to find stimuli for getting young students interested in the subject “Health”, helping them to attach the importance to this gift which nature has endowed them with, in the hope that this will encourage them to do their best to preserve it. For this reason Internet resources have been searched such as scientific publications, atlases, images, diagrams and animations that help study cardiovascular (CV) prevention through a study route where a “health-care” culture is promoted in the widest sense. According to the World Health Organisation, cardiovascular diseases made up 16.7 million or 29.2% of total global deaths (1) in the year 2003. In addition, at least 20 million patients survived CV diseases but obviously these cures required a great deal of clinical care. Most of the burden is attributed to stroke or myocardial infarction and four out of five of these deaths occurred in low and middle-income countries.

### **Aims of the teaching unit**

The subject is very complex and this paper is just an introduction to the study thereof. Prevention of stroke and myocardial infarction is the starting point of an educational route toward an increased awareness of the consequences of our behaviour on our health. They can be positive or negative. The risk factors are determined to a great extent by behaviours learned in childhood and continued in adulthood such as dietary habits and smoking.

### **Materials and methods**

Some WHO documents concerning CV diseases and their prevention are available, including an Atlas (2) with a great deal of information about the situation in the world and the changes happening. There is also the World Atlas of Tobacco (3). Some on-line animations help to better understand the mechanisms of certain (4-5) CV diseases, diabetes (6-7) and its relations with obesity, the relationship (8) between salt and blood pressure (BP). An important resource for sanitary education is Pubmed (9-10), a free digital database of

biomedical and life sciences journal literature which provides access to millions of papers. The Journal of the American Heart Association has published a guideline “Primary prevention of ischemic stroke” (11). This document reports 572 citations where abstracts are available, if not the complete text, for a deeper knowledge. The WHO has also published a document entitled “Avoiding heart attacks and strokes” (12). The documents mentioned in this paper, downloaded for free, have been the base of this manuscript.

The topics mentioned in the discussion were selected by the author for the interest that may have. In Pisa, every middle school has a computer lab. This allows for the use of images and animations to help during face to face explanation. When working in the classroom, with students that have a basic knowledge of anatomy and physiology, subjects such as physical activity, information about nutrition, smoking and blood pressure are the base of a teaching unit on cardiovascular prevention.

Other topics mentioned in this manuscript, are also included in the lesson, possibly to answer questions of students. Sometimes they have been included in other lessons. As example, the increased risk of stroke consequent to a low birth weight is information which can support a lesson on reproduction. Good health habits may help avoid having a low birth weight baby, whereas smoking, alcohol, drug addiction and poor diet will increase the risk (20). This may suggest a responsible behaviour to the prospective parents.

The information about the risk of stroke, greatly increased for drug users below 35 years, which allows us to understand how much more vulnerable are young people, is given in teaching units on consequences of drug addiction. The work of Magnus et al. (2008) helped the students appreciate the usefulness of gymnastics. In such cases the students, in addition to the explanation, have translated into Italian some lines from the related documents, during the English lesson, in order to reinforce the message. The students begin to learn the study of science through scientific papers. The internet resources mentioned may concern teachers of science, English, gymnastics and geography, of course depending on whether the colleagues are interested.

This teaching unit may cut across science, English, gymnastics and geography. When working in the class room, with students that have a basic knowledge of anatomy and physiology, the computer was used for the research and the reading of these documents. Then face to face explanations, discussion and verifications followed.

## Discussion

**Stroke** is a neurological deficit due to an interruption of cerebral blood flow, usually caused by a blockage or bleeding. Some of its risk factors are not modifiable and it is important to know them, since they identify who is at highest risk of a stroke and may benefit from rigorous prevention. Aging, male sex and low birth weight (<2500 g), are statistically associated with greater risk; other factors have some influence, including genetic and racial ones. A BP higher than 90/140 mm Hg is the first modifiable risk factor, the hypertension acting on the walls of the arteries can cause bleeding. Many doctors advise if possible to have an even lower BP (Author’s note). To a certain level it is asymptomatic and many people have undiagnosed hypertension. A lower risk of stroke is associated with an increased consumption of fruits and vegetables. This applies to a lower sodium intake and an increased consumption of potassium as well. A diet not too rich in fat is generally associated with a lower risk. Many studies have shown a direct relationship between physical inactivity and the risk of stroke. Physical activity, even moderate, carried out on a daily basis for 30

minutes, already provides a detectable benefit. Activities more intense and of longer duration, carried out gradually and under medical supervision, can provide greater benefits. Constant practice of physical activity reduces BP, blood levels of triglycerides, sugar and LDL cholesterol, and raises the blood level of HDL cholesterol. Further benefits are reduction of excess weight, stress and anxiety. It has been suggested that physically active students demonstrate higher performance at school and adopt more readily other healthy behaviours (avoiding alcohol, tobacco and drug use).



Photo 1

Considering all age groups, on average tobacco use doubles the risk, but for young people the increase of risk is even greater. Smoking can potentiate the effects of other risk factors. With women who neither smoke nor use oral contraceptives (OC) as reference group in 1 study, the risk of stroke was 1.3 times greater for smokers not using OC. The use of OC among non-smokers increased on average the risk of 2.1 times. But when smokers used OC, it increased by 7.2 times showing a synergistic effect (the “expected” risk without interaction would have been about 2.7 times greater). This happened in the past with first generation OC. Today, with modern low-dose hormone OC, even assuming that the risk persists, it is considered very minor. The relationship between use of alcohol and risk of stroke is expressed by a "J-shaped" curve. In particular, a low wine consumption is statistically associated with increased HDL cholesterol, reduced platelet aggregation, lower concentration of plasmatic fibrinogen and therefore a lower risk situation, as compared to what happens in abstainers. But high consumption of alcohol is very risky since it can lead to high BP, hypercoagulability, reduced cerebral blood flow and a greater likelihood of atrial fibrillation. Alcohol can induce dependence and its abuse is a major public health problem. In terms of education alcohol is a very sensitive issue since notoriously other factors come into play such as dangerous driving, interactions with other substances, etc... Young people and pregnant women should be particularly careful of the abuse of alcohol (Author’s note). Use of drugs including cocaine, amphetamines and heroin is associated with increased risk of stroke as it can lead to sudden changes of the BP, embolisation, increased blood viscosity, aggregation of platelets and vasculitic-type changes. A study considering all the age groups showed that

drug addiction increases the risk of stroke by 6.5 times. Still according to this study but considering only the age groups below 35 years, the risk is 11.2 times greater, allowing us to understand how much more vulnerable are young people. Among the pathologies associated with an increased risk of stroke, there is type 2 diabetes. It was also observed that in a group of diabetic patients with mean BP 87/154, the risk was 44% higher than in a group with mean BP 82/144. **Myocardial infarction** is caused by an interruption of blood flow to the heart muscle. This is frequently caused by the accumulation of fatty deposits (atheroma) on the inner walls of arteries. The arteries become more rigid and their section decreases, with increased likelihood that a possible blood clot blocks them. If a blockage takes place in the arteries of the brain, the stroke occurs, if it happens in the coronary arteries, the myocardial infarction is the consequence. Overweight and obesity are statistically associated with a high CV risk. The body mass index is calculated by dividing the weight in kilograms by the square of height in meters, ideally it should be between 18.5 and 24.9. A person is considered overweight when the index is between 25 and 29.9 and obese beyond this value. Abdominal obesity is achieved with waist circumference exceeding 102 cm for men and 88 cm for women. This is associated with the presence of visceral fat harmful for metabolism. In this regard there are some differences among human races (Author's note). Type 2 diabetes is a metabolic disorder which hampers the release of glucose from the blood to the cells that use it. The result is a high level of fasting glycaemia, beyond 126 mg/dl (=7 mmol/l), that can accelerate the formation of atheroma resulting in narrower and harder arteries, with a greater risk of stroke and myocardial infarction. Diabetes up to a certain level is asymptomatic and many people do not know that they have it. Being overweight, physical inactivity, a diet rich in fat and sugars but low in fibre as well as abuse of alcohol all increase the risk of Type 2 diabetes. It occurs generally among adults, but now the number of young people with this pathology is increasing in many countries. According to the World Health Organisation, BP exceeding 90/140 mm Hg, besides damaging the arteries leads to a stressing situation for the heart. Being overweight, smoking, alcohol abuse, salty foods as well as physical inactivity increase BP. High levels of triglycerides (>150 mg/dl) and LDL cholesterol (>115 mg/dl), favour the formation of atheroma or plaques of cholesterol, with consequent CV risks. The HDL cholesterol should exceed 40 mg/dl in men and 46 mg/dl in women. This is beneficial because it has the opposite effect to LDL.

**Among the strategies set by WHO for the prevention of CV diseases are included:**

- Consuming limited amounts of foods containing saturated fats.
- Eating omega-3 contained in certain fish and certain vegetable oils (remembering, however, that every fat, saturated or not, when taken in excessive amounts promotes overweight.)
- Having a fibre rich diet hence oriented towards fruit, vegetables, legumes and whole grains.
- Practising a physical activity, even moderate such as walking, housework or gardening, for at least 30 minutes a day, possibly continued on a daily basis. Physical inactivity increases the risk of coronary heart disease and ischemic stroke by around 1.5 times.
- Avoiding smoking and abuse of alcohol. The risks are much higher in people who started smoking before the age of 16.
- Maintaining a regular body weight. Obese children are very likely to remain obese into adulthood and to develop CV diseases and diabetes.
- Limiting salty foods and sugar. Many preserved, canned prepared foods very often contain a lot of added salt; this notoriously raises BP. Generally simple sugars, unlike

the complex ones, are rapidly absorbed into the bloodstream and contribute to high postprandial blood glucose.



Photo 2

**The glycemic index of a food** indicates how quickly a given amount of sugars present therein enters the bloodstream hence causing a more or less sharp increase in postprandial glycaemia. Every food has its own index, depending on the type of fibre and of sugar it contains, on the acidity, which affects the stomach emptying rate as well as on other components.

According to Kaye Foster-Powell et al. (2002) the index is influenced by industrial processes and the type of cooking method; even botanical differences (e.g. between different varieties of rice) explain different glycemic indexes. A prolonged use of carbohydrate rich foods, with a high glycemic index, is associated with an increased risk of type 2 diabetes and CV disease. **A heavy workload**, especially if coinciding with situations where the employee has little power to decide, according to Hintsanen Mirka et al. (2005), determines in the long period in the most sensitive individuals a thickening of the carotid walls as a consequence of BP rise. This is known to be associated with increased CV risk.

**The effect of yoga on risk factors for CV disease** was studied by Kyeongra (2007), reviewing 32 scientific papers published in recent decades. Even observing that further research would be necessary, he concludes that this practice can produce benefits with regards to blood lipids, overweight, glycaemia, BP. After reviewing 150 papers, Kim and Heather (2007) confirm these conclusions adding that yoga can also reduce the effects of stress, anxiety, depression, sleep disorders and other factors, further contributing to CV prevention.

According to many yoga teachers different positions may have therapeutic effects, but in certain specific situations there can be also (13) contraindications (Author's note).

The effect of laughter on blood sugar was observed by Hayashi et al. (2003). On a group of volunteers including 19 diabetic (type 2) not in therapy and 5 healthy individuals, glycaemia was measured before and 2 hours after a meal of 500 kcal. The first day, after the meal, the volunteers attended a monotonous conference. The next day, after the meal, they attended a comic comedy that caused intense laughter.

Both healthy individuals and those with diabetes, as expected, always had a rise in postprandial blood glucose, obviously sharper in the latter. But when they had attended the monotonous conference the glycaemia rose by 6.8 mmol /l in diabetic and 2.0 mmol /l in healthy subjects, whereas in the case of comic comedy the blood glucose rose by only 4.3 mmol /l in diabetic and 1.2 mmol /l in healthy subjects. The Authors attributed the difference to an accelerated consumption of glucose by the muscles involved in the action of laughing, but speculate that the laughter has also acted on the neuroendocrine system limiting the rise of glycaemia.

**According to WHO childhood obesity is an epidemic** (14) concerning Industrial and Third World countries, at least for certain population groups. Some countries are facing the double burden of obesity and malnutrition.

The WHO provides much guidance on how to deal with obesity in schools. Here is suggested, inter alia, the use of a school garden to develop awareness about food origins (15-16).

Safe non-motorized modes of transportation (17-18) from house to school are also encouraged. An initiative that goes in this direction is the project "Walking bus" which is now popular in several countries. Children walk to school in groups according to fixed routes, meeting points and timetables, accompanied by trained volunteers. Municipalities or local sanitary institutions may support it. Students perform physical activity, learn to move correctly in the town and contribute to reducing traffic and pollution.



Photo 3

A teaching unit on CV prevention may seem broad and demanding, it can be noted however, that compliance with its rules, often produces benefits on other areas of health. For example, exercise also promotes bone development by reducing the risk of fractures. According to a work of Magnus et al. (2008) who reviewed 105 papers published on this topic, weight

bearing and impacts stimulate an increase of bone mineral content in the skeletal parts involved in the exercises. The results may have a different intensity depending on age, nutrition, sex, and as for the exercises performed, their quality, quantity and frequency. Even the development of bone size is positively associated with physical activity. A review by La Vecchia and Bosetti (2006) suggests that an alimentary style beneficial for the prevention of various cancers is very similar to that which prevents CV diseases. According to a research conducted in 10 European countries with over 478,000 people by Norat et al. (2005), colorectal cancer is less common among people consuming the largest amounts of fish. The opposite occurs among people with the highest intake of red meat and preserved meat. This suggests similarities between the dietary habits which prevent colorectal cancer and a diet which prevents CV diseases. A document of WHO focusing on prevention of cancer, in addition to emphasising the importance of stopping the childhood obesity epidemic (19), provides further indications which still have many similarities to the ones which prevent CV diseases. **Intensive lifestyle changes with subsequent increase of CV disease** have been observed recently in several Countries. According to Ding and Malik (2008), in China the prevalence of obesity, the consequence of a diet with a high glycemic index, today richer in saturated fats, and of lesser physical activity related to modernization, are contributing to the spread of diabetes and CV risks. According to Gill et al. (2002), in some countries of the western Pacific area obesity and diabetes are rapidly spreading with consequent damage for the population. The reasons given for this change are the abandonment of fishing and manual activities in agriculture, the diffusion of alcoholism and use of high fat foods, the frequent use of sugary drinks and cakes. In addition the spread of private transport and violence discourages walking. **A project launched in North Karelia in 1972 as a response** to the high mortality from CV diseases and then extended to the whole of Finland, according to Puska (2002), was the first among a series of projects based on the involvement of the whole community. This activity lasting 25 years has involved various public services over and above the actual health institutions, for example, schools, NGOs, mass media, supermarkets, food industries, agriculture etc... Even some environmental changes have been part of the strategy.

The consumption of vegetal foods and fats, initially limited, became much more common, there was a decrease in the use of animal fat and total consumption of cigarettes. Physical activity during leisure time increased as well. As a result, (e.g. among middle-aged men), there has been a decrease of 73% in the annual rate of mortality for heart disease. The general conditions of health in the adult population have improved the mortality rate for lung cancer has decreased by over 70%. Many other countries have followed with similar aims.

**Photo 1-2-3 Separate cycle facilities and pedestrian lanes encourage safe non-motorised modes of commutation, hence physical activity.**

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