PUBLIC OPINION ABOUT THE BENEFITS AND HARMS OF CHOLESTEROL

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Abstract. The cultural dogma is that cholesterol is an evil villain that needs to be eradicated for true health. Given the unflagging efforts of the medical establishment over the last few decades to lower cholesterol and corresponding media saturation of food and drug promotions boasting cholesterol-lowering effects, it is understandable that most consumers are not concerned about having cholesterol levels that are too low. The reports from aggressive cholesterol-lowering methods suggest that, for many patients, the potential cardiovascular benefits may come with unforeseen risks to physical, mental health and behaviour. The objective of the study was to assess public awareness about the benefits and harms of cholesterol. The tasks were to evaluate public knowledge about cardiovascular disease prevention program, healthy cholesterol levels and potential risks of dyslipidemia with increased or reduced cholesterol levels. The results indicated that the majority of respondents were not aware about the updated cardiovascular disease prevention program and recommended cholesterol levels; more than half of the respondents stated that cholesterol levels must be as low as possible; the majority of respondents were not aware that too low cholesterol levels are linked to depression, dementia, type two diabetes, cancer, aggressive behaviour and shortened life span.

Keywords: low cholesterol level risks; total cholesterol; triglycerides; high density lipoproteins; low density lypoproteins; cardiovascular risk; dyslipidemia

INTRODUCTION

Cardiovascular diseases are the leading cause of death worldwide and in Lithuania. In 2021 the most common causes of death for both genders were diseases of the circulatory system, 53.4 percent for females and 42.7 percent for males. The cardiovascular mortality was 820.3 per 100 000 average population. The largest part of deaths due to circulatory system diseases was caused by ischaemic heart disease (62.1 percent for males and 59.6 percent for females) and cerebrovascular diseases -19.8 percent for males and 24.8 percent for females (Health Information Centre of Institute of Hygiene, 2022). The cardiovascular disease prevention program has been implemented in Lithuania since 2006 (Ministry of Health of the Republic of Lithuania, 2005). Earlier, men aged 40-55 and women aged 50-65 could participate in the cardiovascular disease prevention program. Age limits for target population have been extended since May 1, 2023, and men and women aged between 40 and 60 (inclusive) may participate in the program (Ministry of Health of the Republic of Lithuania, 2023). The lipidogram, electrocardiogram, glucose and creatinine concentration test's results will assess the patient's cardiovascular risk and determine whether it is low, medium, high or very high. The frequency of the patient's participation in the program is updated and will also depend on the risks identified. If the risk of a cardiovascular disease is found to be low or moderate, the person will be invited to take part in the program again after 4 years. If the risk of these diseases is high, the next time the patient will be invited after 2 years, and if the risk is very high, after 1 year. In case of very high risk the cardiologist will further consult and examine the patient. The cultural dogma is that cholesterol is an evil villain that needs to be eradicated for true health. Given the unflagging efforts of the medical establishment over the last few decades to lower cholesterol and corresponding media saturation of food and drug promotions boasting cholesterol-lowering effects, it is understandable that most consumers are not concerned about having cholesterol levels that are too low. The reports from aggressive cholesterol-lowering methods suggest that, for many patients, the potential cardiovascular benefits may come with unforeseen risks to physical, mental health and behaviour. In case of dyslipidemia it is possible for cholesterol to be too low. However, this is much less common than high cholesterol. High cholesterol is strongly associated with heart disease, but low cholesterol may be a factor in other medical conditions, such as cerebral hemorrhage, cancer, suicide, injury, and non-coronary mortality (Nago, Ishikawa, Goto, & Kayaba, 2011). Cholesterol problems are usually associated with high cholesterol for a greater risk of cardiovascular disease. Cholesterol, a fatty substance, can clog the arteries and potentially cause a heart attack or stroke by interfering with blood flow through the affected artery. Serum total cholesterol and LDL-C level is associated with increased CVD mortality, but HDL-C level is inversely associated with CVD mortality (Jung, Kong, Ro, Ryu, & Shin, 2022). It is believed that low cholesterol levels influence depression by altering the metabolism of serotonin. Lower HDL-cholesterol, a known marker of cardiovascular risk, was associated with depression in type 1 diabetes (Melin et al., 2019).

The object of the study: Public opinion about the benefits and harms of cholesterol.

Objective of the study: to investigate public opinion and awareness about the benefits and harms of cholesterol.

Tasks of the study:
1. To reveal respondent's awareness about cardiovascular disease prevention programme.
2. To assess the opinion about negative cholesterol effects.
3. To evaluate awareness about positive cholesterol effects.
4. To investigate the knowledge about potential too low cholesterol level risks.
5. To evaluate main sources of information about cholesterol positive and negative effects.

THE RESEARCH METHOD

The research was quantitative. The questionnaire was created by the author, after analysing scientifical literature and was based on scientific information. It should be noted that the topic, especially about cholesterol benefits and the effects of too low cholesterol levels, have not been investigated in Lithuania, so the questionnaire was mainly based on findings and results of the foreign authors. The survey was conducted in June - September 2023. The survey enrolled randomly selected 86 respondents. The respondents were interviewed using social media and by direct contact. The data were obtained and analysed from 86 questionnaires. The data were evaluated and processed using the Microsoft Office Excel program.

THE RESULTS AND DISCUSSION

The data of the survey were obtained and analysed from 86 questionnaires. 66 respondents were female, 20 were male. The majority of respondents (77%) were females. The majority (72%) were persons between the ages of 18-39 years (see Figure 1).
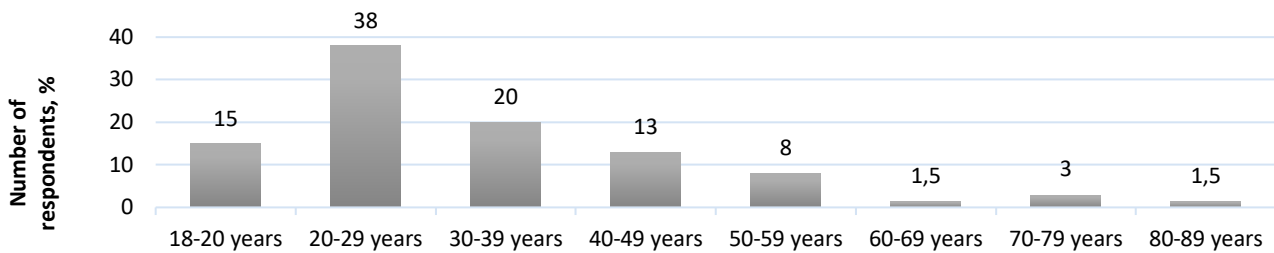

Figure 1. **The age**

The results of the survey revealed that majority of respondents had obtained secondary, less than one fourth had obtained high (master, doctor, bachelor, vocational bachelor) education (see Figure 2):
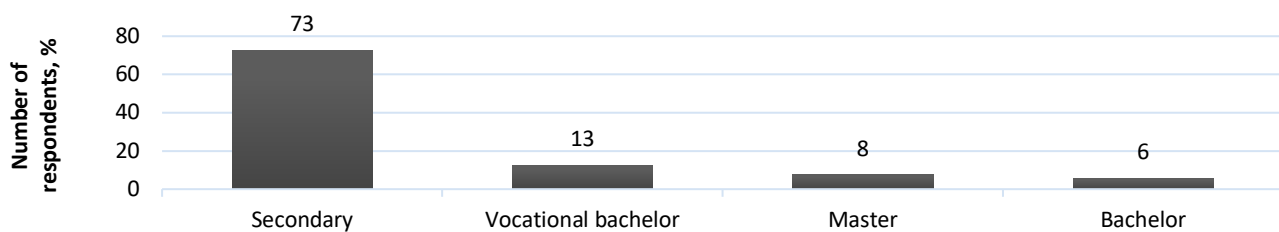

Figure 2. **The education**

As more than half of the respondents (53%) were young people, one third were students, more than one third were students and employees. More than half of respondents were employees (see Figure 3):
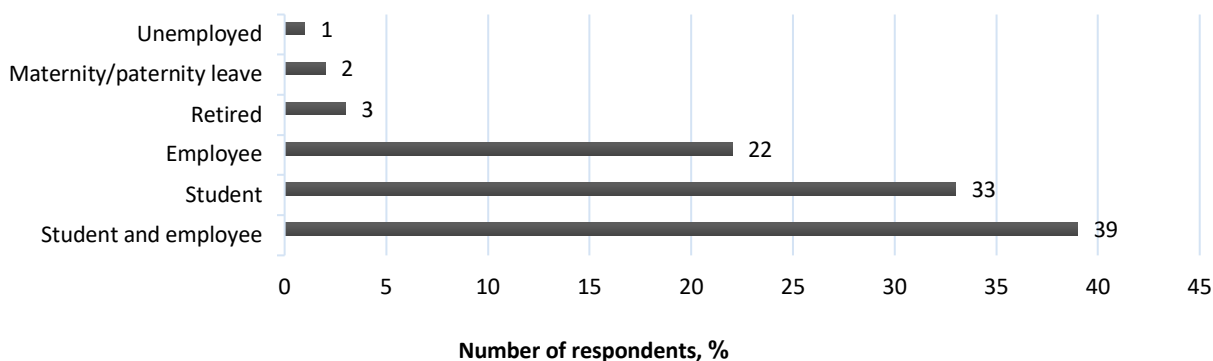
Figure 3. **The occupation**

Recommended cholesterol levels for healthy/low risk persons, according to updated cardiovascular disease prevention program (Ministry of Health of the Republic of Lithuania, 2023) are:

Total cholesterol (TC): < 5.2 mmol/L;

Triglycerides (TG): < 1.7 mmol/L;

LDL: < 2.6 mmol/L; may also depend on a person's cardiovascular risk;

HDL: ≥ 1.6 mmol/L.

The evaluation of respondent's knowledge about cardiovascular disease prevention program revealed that the majority of respondents were aware about lipidogram cholesterol fractions, more than half of respondents knew that one of tests performed during the cardiovascular disease prevention program is lipidogram, less than half knew the recommended total cholesterol level for healthy or low risk people, only one fourth of respondents knew the updated male and female age interval for participating in the cardiovascular disease prevention program (see Figure 4):
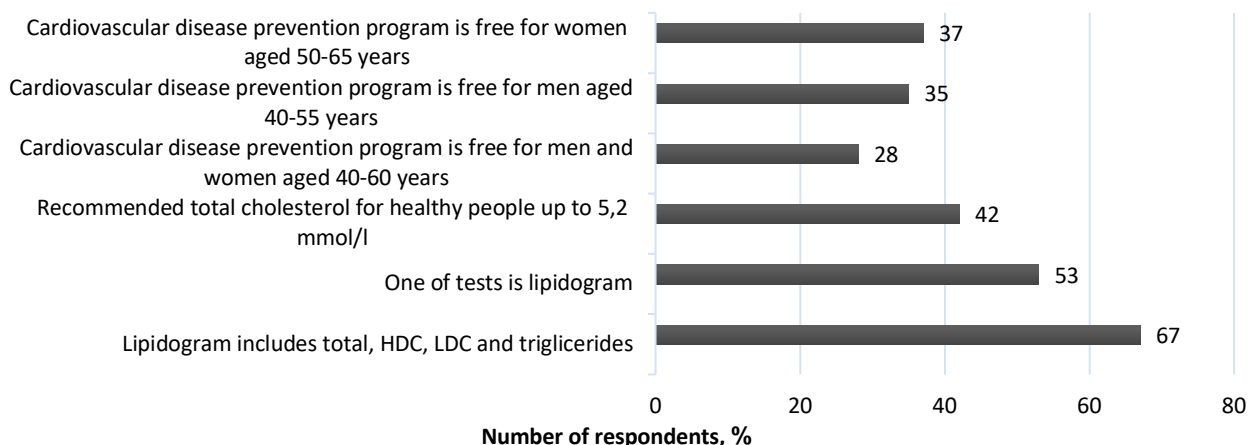

Figure 4. **The awareness about cardiovascular disease prevention program**

High prevalence of dyslipidemia remains a major problem in Lithuania. 9 out of 10 people have dyslipidemia, 1 out of 10 - severe dyslipidemia. Severe dyslipidemia is associated with higher frequency of other cardiovascular risk factors (Kutkienė et al., 2018). As it is shown in the Figure 5, the majority of respondents avoided fats, but not sugar in their diet. It was confirmed that a diet with a greater proportion of sugar increased CVD risk via negative changes in metabolic profiles including body weight, waist circumference and lipid parameters, whereas low sugar diet produced the positive effects. A restriction of sugar intake to lower than 10% energy intake is vital to reduce CVD risk (Ahmad, Isherwood, Umpleby, & Griffin, 2020). Discussing the results of lipidogram and possible treatment or the diet of the respondents revealed that the majority consumed as little fat as possible in their diet, less than half reported that lipidogram test had been performed in one year period, for half of respondents cholesterol levels were normal, less than half stated that their total cholesterol and LDL levels were increased, one third reported that they had increased levels of total cholesterol and triglycerides, the minority (7%) were taking antilipidemic drugs (see Figure 5):
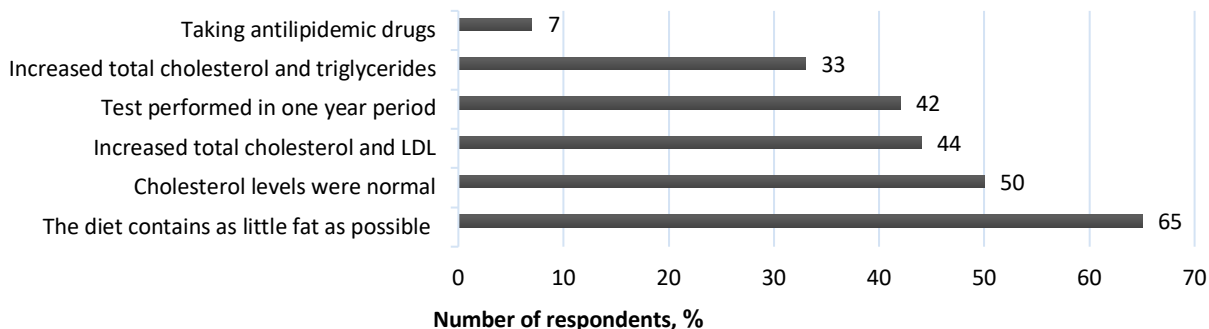
Figure 5. **Lipidogram results and treatment**

Smoking only about one cigarette per day carries a risk of developing coronary heart disease and stroke much greater than expected: around half that for people who smoke 20 per day. No safe level of smoking exists for cardiovascular disease (Hackshaw, Morris, Boniface, Tang, & Milenković, 2018). It was estimated that women with severe dyslipidemia were smoking nearly four times more than men in Lithuania. What is more, women with severe dyslipidemia in comparison with men had arterial hypertension more often, they were more obese and less physically active. These findings support the theory, that atherosclerosis is a polyetiological chronic disease, when all factors act synergistically (Kutkienė et al., 2018). The results of the survey indicate that more than half of respondents were aware about high cholesterol cardiovascular risk and smoking and high cholesterol links, less than half stated that „cholesterol the less the better", that high level of triglycerides can cause harm, one third were aware about negative effects of high level of low density lipoprotein (see Figure 6):
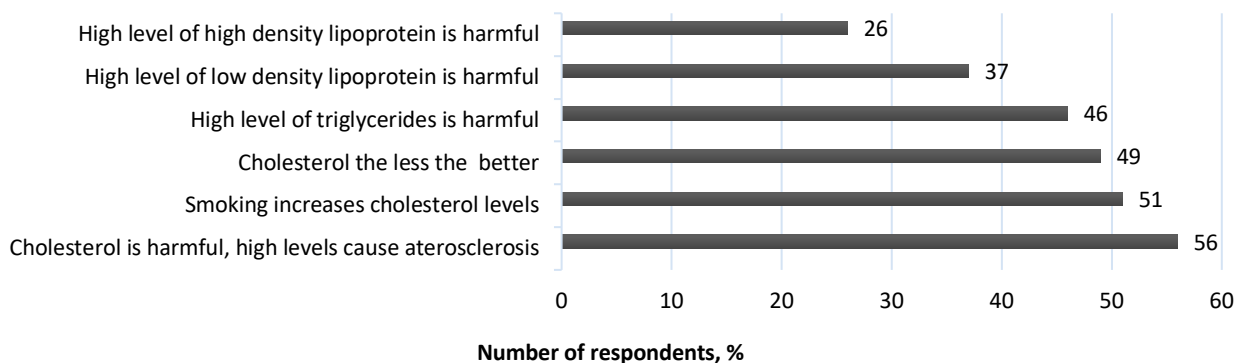

Figure 6. **The awareness about cholesterol negative effects**

Cholesterol is a major component of plasma membrane in mammalian cells. In addition to its structural requirement, cholesterol is important for other cell functions as bile acid and hormone biosynthesis, embryonic development, and cell proliferation (Fernández, del Val T. Lobo, Gómez-Coronado, & Lasunción, 2004). Cholecalciferol, the form of vitamin D named D3, is synthetized in the skin from 7-dehydrocholesterol upon irradiation with ultraviolet waves in the range of ultraviolet B light.7-dehydrocholesterol is part of the metabolic pathway that controls the synthesis of cholesterol in human cells. By absorbing ultraviolet radiation, which can be ionizing, 7-dehydrocholesterol turns into pre-vitamin D3, which, in turn, because of its molecular instability, converts to cholecalciferol (Christakos, Dhawan, Verstuyf, Verlinden, & Carmeliet, 2016). The serotonin1A receptor belongs to the superfamily of G protein-coupled receptors (GPCRs) and has been shown to require membrane cholesterol for its organization, dynamics and function (Patra et al., 2015).

The results of the survey show that less than half of the respondents knew that cholesterol is required to build cell membrane and for the synthesis of various hormones, though only one fourth knew the benefits for the immune system, serotonin transporting in the brain and vitamin D synthesis (see Figure 7).
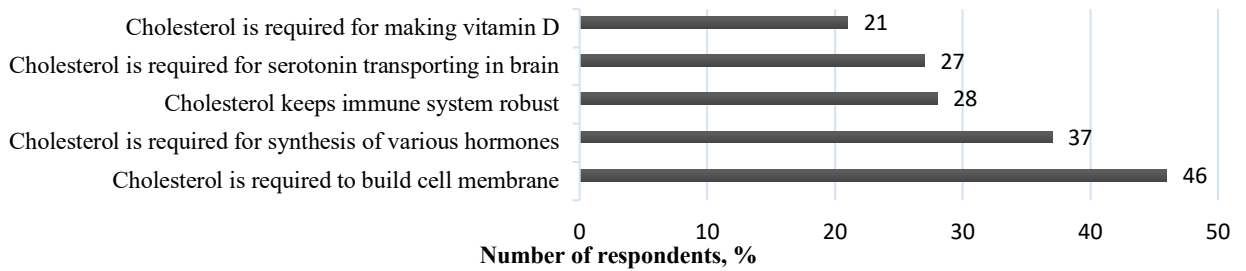
Figure 7. **The awareness about the benefits of cholesterol**

Dyslipidemia can be associated with too low cholesterol. Low total cholesterol is associated with increased risk of major adverse cardiovascular events (MACE) in older men without ischaemic heart disease (IHD) who are not taking statin therapy but not in those on statins (Gnanenthiran et al., 2020). The total cholesterol level range associated with the lowest mortality was 5.4-7.2 mmol/L, irrespective of concomitant diseases or health status. The association between low total cholesterol levels and a high risk of all-cause mortality was confirmed in a Belgian cohort of adults 80 years and older (Turusheva, Vaes, Degryse, & Frolova, 2020). The significant association was observed between lower LDL-C and higher risk of intracerebral hemorrhage when LDL-C was <70 mg/dL, and the association became nonsignificant when LDL-C ≥70 mg/dL (Ma et al., 2019). Low cholesterol may be a factor in other medical conditions, such as cerebral hemorrhage, cancer, suicide, injury, and non-coronary mortality. It was confirmed the highest risk of the lowest cholesterol group for hemorrhagic stroke, heart failure (excluding myocardial infarction), and cancer mortality significantly higher than those of the moderate cholesterol group, for each cause of death (Nago et al., 2011). It was estimated that LDL-cholesterol lowering by pharmacotherapy or genetic variation causes increased risk of type 2 diabetes, whereas HDL-cholesterol raising may be protective (Higuchi, Izquierdo, & Haeusler, 2018). The risk of all-cause dementia in the general population and in statin non-users was increased in those with LDL-C level in both the lowest and the highest quintiles, showing an inverted J-shaped relationship. Although there was a seemingly paradoxical association between low LDL-C level and dementia risk in statin non-users (Lee et al., 2022). It is believed that low cholesterol levels influence depression by altering the metabolism of serotonin. The serotonin1A receptor belongs to the superfamily of G protein-coupled receptors (GPCRs) and is a potential drug target in neuropsychiatric disorders (Patra et al., 2015).

Analysing respondent's awareness about too low cholesterol effects, the obtained data revealed that the majority of respondents had no information about low cholesterol risks for type two diabetes, shortening of life span, depression, dementia, cancer and aggressive behaviour (see Figure 8).
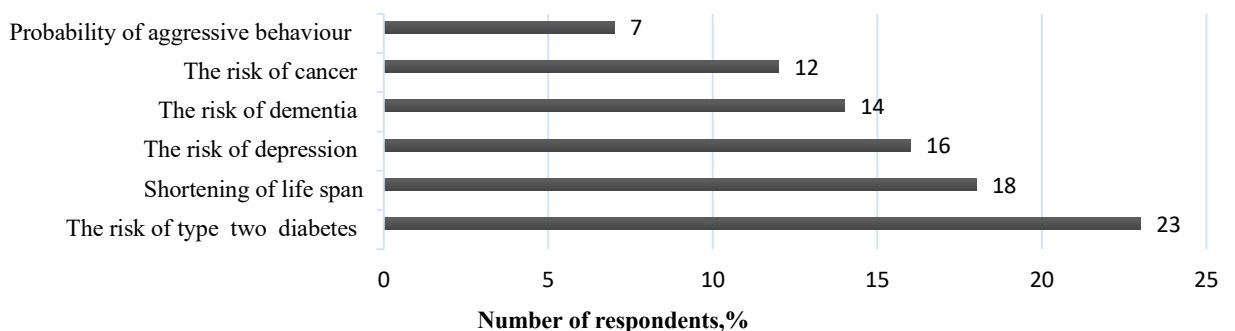

Figure 8. **The effects of too low cholesterol level**

Since 2006, when the cardiovascular disease program was established in Lithuania, the society was constantly educated about the risks of high cholesterol level and prevention of the cardiovascular disease. The results of the survey revealed that the main respondent's sources of information were internet, family doctor's provided information and the questionnaire they were interviewed (see Figure 9).
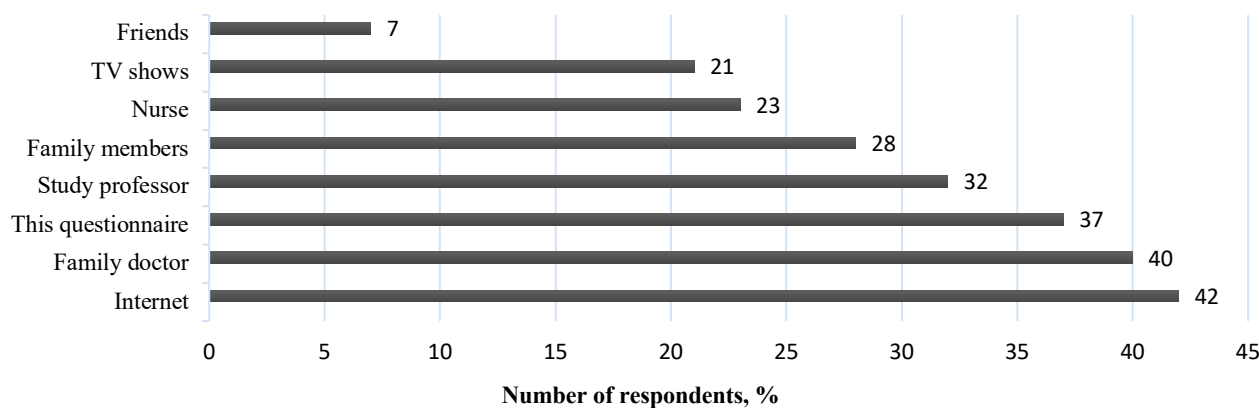
Figure 9. **The sources of information**

The findings of the study imply that public education about the benefits of cholesterol and dyslipidemia potential risks is insufficient. Being the frontline care providers in close relationships with the patients, primary health care specialists have a unique opportunity to increase patients' awareness and perception of dyslipidemia, both when cholesterol level is too high and too low, health risks and prevention measures. Family doctors and community nurses should educate patients more actively, more informational measures are required to ensure better public awareness especially after the update of cardiovascular disease prevention program.

The study has some limitations. The number of investigated respondents was small, and the majority of enrolled respondents were young people, only one fourth of them in the age interval having been participated or participating in the cardiovascular disease prevention program and possibly being more educated in this field. All these factors limit the generalizability of our study findings. More informational measures are required to ensure better public awareness, especially young people, about the discussed problem in the future.

CONCLUSIONS

1. The results indicated that more than half of respondents were not aware about the updated cardiovascular prevention program and recommended cholesterol levels. Less than half reported about lipidogram performed in one year period and stated that their cholesterol levels were increased.
2. More than half of respondents stated that cholesterol levels must be as low as possible and were aware about high cholesterol cardiovascular risks.
3. Less than half of respondents stated that cholesterol is essential for cell membrane and various hormones synthesis. The majority were not aware about other beneficial cholesterol effects.
4. The majority of respondents were not aware that too low cholesterol levels are linked to depression, dementia, type two diabetes, oncological diseases, aggressive behaviour and shortened life span.
5. The main informational sources were internet, family doctor's provided information and the questionnaire respondents were interviewed.

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