Impaired carbohydrate tolerance as a risk factor for ischemic heart disease among the population of the Fergana Valley of the Republic of Uzbekistan

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Abstract. In the Fergana Valley of the Republic of Uzbekistan, where about 70% of the population is engaged in agriculture, epidemiological studies on IHD in connection with the combination of risk factors among rural men and women of working age have not been carried out, which makes it impossible to fully assess the epidemiological situation in our region. The aim of the research was to study the epidemiological conditions in relation to IHD in connection with ICT and other risk factors. To identify IHD and risk factors, we chose a continuous method of epidemiological examination using the Rose questionnaire, blood pressure measurements, ECG decoding according to the Minnesota code, glucose tolerance test, anthropometric and biochemical studies. When analyzing the prevalence of IHD in the quintile distribution of risk factors among men and women, a high correlation was found with an increase in blood glucose levels on an empty stomach and 2 hours after exercise. To determine the group for the prevention of IHD, we used a logistic model that allows us to calculate the individual risk, considering the presence and potential of risk factors. Evaluation of the informativeness of each risk factor showed that both in men and women, ICT has the highest prognostic value for IHD. In a mass survey of the rural population of the Fergana Valley, to identify IHD and the contingent "threatened" in relation to IHD, it is necessary to widely conduct a carbohydrates tolerance test.

1 Introduction

In 2015, non-communicable diseases (NCDs) accounted for 79% of all deaths in Uzbekistan, exceeding the global NCD mortality rate of 71%. According to the latest data from 2015, an Uzbek citizen is more than 1 in 4 likely to die prematurely (under age 70) from the four major NCDs (cardiovascular disease (CVD), diabetes, chronic respiratory disease, or cancer) (26,9%), with a much higher probability for men (32.9%) than for women (21.4%) (WHO, 2017a). This fact provides a good opportunity to make progress

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towards the United Nations Sustainable Development Goals of reducing premature deaths from NCDs by one third by 2030 [1].

The total damage caused by NCDs to the economy of Uzbekistan amounted to 9.3 trillion. soms, which is equivalent to 4.7% of GDP in 2016. 30% of health care spending is spent on NCDs (13% for CVD, 7% for cancer, 6% for chronic respiratory diseases, 4% for endocrine and metabolic diseases (mainly diabetes mellitus). In 2016, the share of total spending on health care on the treatment of the four main groups of NCDs amounted to 2.1 trillion soms.

According to the WHO technical report, the concept of prediabetes or early disorders of carbohydrate metabolism includes IGT and impaired fasting glycemia (IFG). According to epidemiological studies, 314 million people in the world have "prediabetes" (8-14% in the adult population), in 20 years their number will increase by 1.5 times and amount to about 500 million. In 2007, Russian national multicenter epidemiological study was launched (7 large cities, a total of 10,000 respondents selected at random) to identify 20 risk factors (RF), which included the determination of the level of glycemia on an empty stomach and 2 hours after taking 75 g of glucose. According to the results of the first completed study in the city of Cheboksary, 8.3% of respondents (1800 people aged 30-69 years) had hyperglycemia, of which 4.5% had IGT. In most adult populations, IGT is twice as common as IFG. According to European experts, the prevalence of IGT ranges from 10 to 25%. It has also been shown that the prevalence of DM and IGT diagnosed based on postprandial hyperglycemia (PH) is higher in women than in men. However, the frequency of type 2 diabetes and fasting hyperglycemia is higher in men than in women [2].

According to British scientists, only 39% of patients suffering from hypertension have normal glucose tolerance, while 10% have IFG, and 22% have IGT. The number of persons with newly diagnosed type 2 DM is twice as high compared to 17 diagnosed type 2 DM [3-6].

In a study conducted at the State Scientific Research Center for PM, it was shown that 37% of patients suffering from hypertension are diagnosed with IGT, of which 32% have all the main components of the metabolic syndrome (MS). Three large epidemiological studies have defined the current understanding of the natural course of heart disease in diabetes [2]. The Framingham study showed that even after adjusting for age, smoking, blood pressure levels, and total blood cholesterol levels, having diabetes increased the risk of IHD in men by 66% and in women by 203%. The Whitehall Study noted an increased risk not only in overt diabetes, but also in subclinical forms of glucose intolerance. The MRFIT (Multiple Risk Factor Intervention Trial) study, which included a large number of middle-aged men (n = 5163), provided more detailed information on the interaction between diabetes and other risk factors in determining coronary risk. This study found that DM is a risk factor independent of total cholesterol, smoking, and blood pressure ($p < 0.0001$). It was also noted that in men with diabetes, the presence of other risk factors significantly increases 12-year cardiovascular mortality [3-7].

At present, the promotion of public health as a political and strategic direction in health care in a progressively developing society is gaining more and more recognition. The results of major foreign and domestic studies, mainly devoted to the epidemiology and prevention of IHD and risk factors, indicate that using epidemiological methods of detection, a significant reduction in morbidity, disability, and mortality from them can be achieved. Therefore, in the last decade, the attention of many epidemiologists and public health organizers has been riveted to the search for the most effective methods of combating chronic non-communicable pathology.

The prevalence of IHD and risk factors in different countries and among different populations varies. This necessitates the study of the characteristics and development of

chronic non-communicable diseases, considering the level of prevalence of the main risk factors in various climatic and geographical conditions among various populations.

The development and implementation of any preventive program requires a comprehensive study of the epidemiological conditions of a particular pathology. In the Fergana Valley of the Republic of Uzbekistan, where about 70% of the population is engaged in agriculture, epidemiological studies of IHD in connection with a combination of risk factors such as impaired carbohydrate tolerance (ICT), arterial hypertension (AH), hyperuricemia (HU), dyslipidemia (DLP), pesticide residues in blood, overweight (BMI) and smoking among rural men and women of working age have not been conducted, which makes it impossible to fully assess the epidemiological situation in our region. All the above led to the need for this study.

The purpose of the research was to study the epidemiological conditions in relation to IHD in connection with ICT and other risk factors for the possibility of planning multifactorial prevention on this basis in rural areas of the Republic of Uzbekistan.

Research objectives.

1. To determine the prevalence of ICT and other major risk factors for IHD among rural men and women of working age.

2. Determine the prevalence of IHD.

3. To study the relationship between the prevalence of IHD and the level of common risk factors.

4. Describe the distribution of the population into groups for primary, secondary, and tertiary prevention.

5. Develop measures for primary, secondary, and tertiary prevention of IHD among the rural population. Materials and methods of research.

2 Material and research methods

The object of the survey were workers and employees of both sexes aged 20-59, united according to the principle of working in one institution in one district of the Fergana region. The examination was carried out by 540 men and 539 women aged 20-59 years, which accounted for 82% of the total number of workers and employees of the specified age, which allows us to consider the data we received reliable.

To identify IHD and risk factors, we chose a continuous survey method. When conducting a standard questionnaire for the identification of IHD, the following data were recorded: gender, age, marital status, education, profession, information on the Rose questionnaire for the detection of angina pectoris (AP), previous infarction, intermittent claudication, smoking, heredity, and the presence of concomitant diseases. AP was diagnosed with a positive response to the Rose Questionnaire. A history of myocardial infarction was diagnosed in the presence of severe pain penetrating the anterior part of the chest and lasting 30 minutes or more, for which the patient went to the doctor and myocardial infarction was diagnosed. The diagnosis of IHD was established according to strict, non-strict and extended criteria. The following categories correspond to defined IHD (according to strict criteria): AP, definite myocardial infarction (AMI) with ECG data according to the Minnesota code - 1-1 to 1-2-7 without 1-2-8; The painless form of IHD is 4-1.2 and 5-1.2 without 3-1 and 3-3. Possible IHD (according to non-strict criteria) includes: a history of myocardial infarction; ECG signs according to MK - 1-2-8.1-3.4-3.5-3.4-1.2 and 5-1.2 in the presence of 3-1 and 3-3.6-1.7- 1.8-3 with the exclusion of non-cortical diseases (thyrotoxicosis, rheumatism).

Measurement of blood pressure was carried out twice on the right arm in a sitting position of the subject with a mercury sphygmomanometer. The value of blood pressure was registered with an accuracy of 2 mm Hg. The presence of hypertension was evidenced

by SBP ≥ 160 mm Hg, DBP ≥ 90 mm Hg., also in the presence of normal blood pressure if the subject has taken antihypertensive drugs for the last 2 weeks.

To identify ICT, a survey was conducted among 20% of a representative subsample of 235 people, including 120 men and 115 women. The glucose tolerance test was carried out according to the method proposed by WHO, with a load of 75 g of glucose. Criterion ICT - fasting blood sugar is normal or more than 100 mg%; blood sugar 1 hour after the load 180 mg% and an obligatory sign - blood sugar 2 hours after the load js = 130 mg%. Determination of the level of uric acid and cholesterol in serum, blood was carried out on the auto analyzer "Beckman" made in the USA. The normal criterion for uric acid is 0.12-0.46 mmol/l, for cholesterol - 3.68-6.47 mmol/l. The concentration of triglyceride in the blood serum was determined by the method of "Bio-La-Teot", hypertriglyceridemia corresponds to a value > 1.82 mmol/l. Determination of persistent: organochlorine pesticides in blood serum was carried out on a gas chromatograph "Цвет-Ю6". The biomass index was calculated using the formula: weight (kg): height (m2), BMI corresponded to the Quetelet's index value of 30.0. Those who smoked at least one cigarette a day were considered smokers. All methods of instrumental and biochemical research are standardized in the laboratories of the clinic. Mathematical processing of the material was carried out on an EM type "Wang2200" manufactured in the USA using a software package.

3 Results

The prevalence of ICT in a representative subsample in the general population was 14.0% of the examined, of which among men - 15.8%, among women - 12.2%. Of all the people with ICT, only five people knew about the presence of carbohydrate pathology in them, i.e., only 15.1% of persons with ICT were aware that they had high blood sugar. The frequency of ICT increased with age in both men and women from 8.3% and 7.8%, respectively, in 20-39 years to 33.3% and 28.0% in 40-59 years, respectively ($p < 0.001$).

An analysis of the prevalence of ICT in the population, depending on the presence and absence of other risk factors, showed that ICT among persons with HCH is detected in 56.2% of men and 75.0% of women, and with a normal level of cholesterol - 6.1% and 8.0%, respectively, the difference is significant. In men with HTG, ICT was detected in 37.4%, without HTG - in 9.0% ($p < 0.05$), in women - in 22.2% and 12.8%, respectively ($p < 0.05$). In men with HU, the frequency of ICT was 66.6%, without HU - 9.1% ($p < 0.001$), in women - 33.3% and 13.0%, respectively ($p < 0.05$). In both men and women, ICT is 3.5 times more likely to be detected among people with BMI than with a normal Quetelet's index (in men - 35.7% and 9.9%, respectively, $p < 0.01$, in women - 25.9% and 7.9% respectively $p < 0.05$). There were no smokers among women, among men among smokers ICT was detected in 19.0%, among non-smokers - in 8.3% ($p < 0.001$). Among men with pesticide residues in blood, ICT occurs 2 times more often than among men without pesticide residues in blood (12.9% and 6.2%, respectively). In women, the incidence of ICT in the presence and absence of pesticide residues in blood is almost the same (18.0% and 20.0%, respectively). Evaluation of the prevalence of hypertension in the presence and absence of risk factors showed a significant relationship between the incidence of hypertension and ICT in both men and women. So, in men, AH was detected among persons with ICT in 42.1%, without ICT - 10.8%, among women - 50.0% and 10.0%, respectively ($p < 0.001$).

One of the objectives of our study was to establish the true prevalence of IHD among the rural organized population of the Ferghana Valley to further plan their prevention. The prevalence of IHD according to the expanded criteria in our study will be 3.8% in the general population, of which among men - 5.2% and among women - 2.6%, including

certain IHD among men was detected in 2.4%, among women - in 1.1% and possible IHD - 2.8% and 1.5%, respectively. The frequency of IHD in both men and women significantly increased with age from a minimum value of 20-29 years (for men - 2.3% and for women - 1.4%) to a maximum at 40-59 years (13.7% and 11.3%, respectively, $p < 0.001$).

An analysis of individual forms included in a certain IHD showed that in men, in the structure of a certain IHD, AP prevails (61.5%), then in terms of the frequency of the painless form of IHD (23.7%) and certain MI (7.7%), while in women the picture is reversed: definite MI (0%), painless form of IHD (66.6%) and AP (33.3%). In both men and women, IHD is significantly more common in the presence of HTU, AH and BMI than in their absence. In men, a high prevalence of IHD was found among people with ICT, HCH and HTG (38.0% and 4.3%; 25.5% and 3.4%; 19.0% and 3.9%, respectively, $p < 0.001$), in women also in the presence of these risk factors, IHD is more common than in their absence (ICT - 8.0% and 1.9%, BMI - 5.4% and 2.2%, GU - 2.3% and 0, respectively), but the difference is not significant. The incidence of IHD was higher in individuals with pesticide residues in blood than without pesticide residues in blood (in men - 6.3% and 3.1%, respectively, in women - 5.1% and 1.1%, respectively, $p < 0.05$). IHD among smoking men was detected more often than among those who do not smoke (6.1% and 3.5%, respectively), but the relationship is not significant. There were no smokers among women with IHD.

With a combination of 3 or more risk factors both among men and women, the incidence of IHD increases significantly than with the presence of 2 risk factors, 1 risk factor and in the absence of risk factors (in men - 55.5%, 22.2%, 14.8% and 7.41%, respectively; in women - 35.7%, 21.4%, 21.4% and 25.4%, respectively).

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When analyzing the prevalence of IHD in the quintile distribution of risk factors among men and women, a high correlation was found with an increase in blood sugar levels on an empty stomach and 2 hours after exercise. In men, the highest incidence of IHD was found in the 5th quintile of the ICT distribution (15.6%), and the lowest incidence of IHD was found in the 1st quintile (2.6%) ($p < 0.001$). In women in the 5th quintile (4.2%), the frequency differs little from the frequency in the 1st quintile (4.1%).

To determine the group for primary, secondary, and tertiary prevention of IHD, we used a logistic model that allows us to calculate the individual risk, considering the presence and potential of risk factors. The evaluation of the informativeness of each RF showed that both in men and women, the highest prognostic value for IHD has NTU (4.86 and 5.19, respectively). Hyperuricemia in men has a higher prognostic value than in women (2.21 and 0.61, respectively). Smoking has the least informativity in both populations.

Using the model, the level of individual risk of developing IHD was established and on this basis a percentile distribution was built, and the entire population of men and women was divided into 3 groups according to the degree of risk of developing IHD: I) moderate risk group (86.-.9; %); 2) high-risk group (10.3%) and 3) diseased group (3.6%). With age, the number of high-risk individuals and cases increases, while the proportion of moderate-risk individuals decreases. In all age groups, among persons with a high level of risk of developing IHD, men predominate than women. In the group of patients, if there are more men at the age of 20-29, then at the age of 40-59 the number of sick women is more than men. This may be due to the sharp accumulation of pesticides in women after 40 years of age. Thus, this analysis, focusing on the level of risk of IHD, made it possible to form groups of active multifactorial prevention, based on which differentiated recommendations should be developed on primary, secondary and tertiary prevention of IHD among the rural population.

4 Conclusion

1. Impaired carbohydrate tolerance in the rural population of the Ferghana Valley studied by us was detected in 14.0% of the surveyed, of which men - 15.8%, women - 12.2%.

2. A positive relationship of ICT with the prevalence of IHD and other risk factors (arterial hypertension, hypercholesterolemia, hypertriglyceridemia, BMI, hyperuricemia, pesticide residues in blood) were revealed.

3. Both in men and women, among all risk factors, ICT has the highest predictive value for the development of IHD.

4. During a mass examination of the rural population of the Ferghana Valley to identify IHD and the contingent "threatened" in relation to IHD, it is necessary to widely carry out a test of tolerance to carbohydrates.

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