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Effects of Salt Intake on Blood Pressure in Banovici Coal Mine Workers

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ABSTRACT

Introduction: High blood pressure is the cause of almost 13 % of all deaths in the world. DASH (Dietary Approaches to Stop Hypertension) is „gold standard" in diet recommended by American Society of Hypertension, American Heart Association and Dietary Guidelines for Americans 2010 for reduction many CV risk factors including hypertension. Non-pharmacological treatment of hypertension through DASH dietary program with reduction of salt intake can significantly reduce high values of blood pressure and decrease general cardiovascular risks. **Goal:** The aim of this research is to determine the prevalence of hypertension among miners in Banovici coal mine and amount of salt taken in meals during work time. **Material and methods**: We inspected the medical documentation and registers for all employees in coal mine Banovici in order to provide calculation of hypertension prevalence. Based on reports and company standards on grocery usage and average amount of salt used in preparation of one meal in coal mine kitchen, we have calculated the average consumption of salt of one employee per meal. **Results:** There are 2700 of employees in coal mine Banovici with average life age of 46 years. From them 694 (25.7%) miners have arterial hypertension. Also 707023 kg of salt is being spent for preparation of meals in coal mine kitchen on yearly basis. Employees take between 4-9 grams of salt per one meal excluding the salt contained in bread. **Conclusion**: the amount of salt intake per one meal in the coal mine kitchen is larger from daily doses recommended by ACC/AHA.

Key words: hypertension, salt, coal miners, risk factor.

1. INTRODUCTION

The basis for cardiovascular events is atherosclerosis as result of sclerotic process. Atherosclerotic disease of coronary arteries causes more than 50% of deaths in US (1). Causes of atherosclerosis are high pressure, increased level of cholesterol and triglycerides in blood, diabetes, smoking, stress and decreased physical activity as well as increased alcohol intake.

Increased blood pressure is leading factor for mortality which counts for almost 13% of all deaths in world (2). Arterial hypertension is defined as the value of blood pressure above 140/90 mm/Hg, or the presence of increased blood pressure in level where the patient is exposed to increased risk of damaging of target organs in several cardiovascular areas including retina, brain, heart, kidneys as well as large vascular vessels. The connection between blood pressure and cardiovascular risk is positive, strong and linear (3) and most of cardiovascular disorders can be avoided with small reduction of blood pressure including those with prehypertension (4). Therefore, almost every reduction of blood pressure is useful for health, and small lowering of blood pressure can result in significant decrease of mortality, significant health benefits and reduction of health insurance costs (2,5,6). Reduction of systolic blood pressure for 10 mm/Hg results with reduction of larger cardiovascular diseases by 20% to 25% with more explicit reduction of stroke than coronary diseases (7). Every lowering of diastolic blood pressure for 2 mm/Hg in USA could lead to reduction of hypertension incidence for 17%, coronary disease risk for 6% and stroke risk for 15%. It could prevent 67000 coronary diseases and 34000 strokes every year (8). In Great Britain scientists estimate that decrease of systolic blood pressure for 5 mm/Hg can decrease hypertension incidence by 50% (9). It is expected that until the end of 2025 prevalence of hypertension in world will be ≥29% (10). Having in mind these facts, additional efforts are needed (including non-pharmacological approaches) in order to decrease this large burden in public health sector. Proper dietary program is very important but also improvement of underestimated treatment of arterial hypertension and other cardiovascular risks.

DASH (Dietary Approaches To Stop Hypertension) is „gold standard" in dietary recommended by American Society of Hypertension (11), American Heart Association (12) and Dietary Guidelines for Americans 2010 (13) for reduction of many CV risk factors including hypertension, dislipidemy, overweigh and increased level of glucose in blood (14). DASH dietary program puts stress on usage of fruit, vegetables, low fat milk products and proper use of integral flour products, fish, chicken and

nuts. DASH diet is rich in Sodium, Magnesium, Calcium and antioxidants (15). In combination with sodium limitation (salt) in diet (DASH/SRD), this diet decreases blood pressure, vascular inflexibility and systematic oxidative stress in those who are sensitive in salt but without cardiac insufficiency (16). Apart from standard DASH diet, there is also DASH Sodium reduction diet. According to standard DASH diet (recommended by Dietary Guidelines for Americans) , daily intake of sodium is up to 2.3 g (5.75 g of salt) (13) and in salt- reductive DASH diet (recommendations of American Heart Association) daily intake of Sodium is up to 1.5 g (3.75 g of salt) (12). Both versions of DASH diet are aiming to decrease the amount of Sodium in food in comparing to the amount of Sodium that is taken in by traditional food, in which values can be drastically larger.

It is known that increased consummation of Sodium (Na) is related to increased blood pressure (17) while decreased consummation of Sodium decreases blood pressure (18, 19). Sodium is primary chemical ingredient of kitchen salt, but its presence is also evident in milk, meat and clamps (naturally) and as ingredient in many spices such as soya sauce, fish gravy, industrial food like bread, meat and snacks. Diet consisted with industrial food rich in Sodium and without enough fruit and vegetables, increases risk of hypertension and other cardiovascular diseases and stroke, what is confirmed by meta analysis in 13 coronary studies (20). Sodium is inevitable for plasma volume support, acido-base balance, transition of neural impulses and normal cell functioning (21), and it is estimated that minimum daily intake is 200-500 mg (22). The outlook of randomized controlled testing provided conclusion that decrease of Sodium intake decreases blood pressure in adults with or without hypertension (23,24,25), but reduction of blood pressure was higher in those with hypertension (26). Reduction of sodium in food is one of the cheapest ways to fight against hypertension and their consequences. In past several years, the holistic approach in evaluation of cardiovascular risks was chosen which would help in rationalization and individualization of antihypertensive treatment (27).

2. PATIENTS AND METHODS

Study included 2700 employees of Coal Mine Banovici with average age of 46 years, out of which 693 are employees in underground mine pit. The insight in medical documentation provided us the number of miners with hypertension, diabetes mellitus and number of miners who had stroke. The next step was receiving of data about „warm meal" from relevant departments in coal mine, what it is consisted of and amount of used salt for its preparation..

3. RESULTS

There are 2700 employees in Coal Mine Banovici with average life age 46.25 ± 6.53 and 694 (25.7%) of them are with evident hypertension, 85 (3.1%) with cardiac and 57 (2.11%) with post-stroke condition. We found 153 (9%) cases with diabetes mellitus type 2. The number of such cases is definitely larger regarding the fact that this is a labor active population and there are a lot of cases with permanent consequences after cardiovascular situations who left our ambulance and were early retired and the number of cardiovascular situations with lethal outcome is not low since we do not operate with precise data. We have noted that the number of young people with hypertension of II and even III in their 30s is larger. As shown on Table 1, 707023 kg of salt is being spent for preparation of warm meals on yearly basis in coal mine Banovici.

Product	Total amount /year (peaces)	Usage of salt (kg, g)	Usage of meat (kg)	Usage of oil (l)
Burek (total)	77258	231774	4635.5	1158.8
Burek (per portion)		3 g	60 g	0.015
Cooked meals	42 769	427.69	5132.28	1283.07
Cooked meals per portion		1 g	0,120	0.030
Salad	15853	47559		237.795
Salad / per portion		3 g		0.015

Table 1. Usage of certain articles in preparation of warm meals

The name of the meal	The unit of measurement	Total intake per year	Average intake per employee/per year
Dried meat	kg	10314	3.82
Dried sausage	kg	9186	3.4
Beef sausage	kg	18137	6.7
Chicken baloney	kg	27068	10.02
Cheese (45-55%mm)	kg	5477	2.02
Cans (fish excluded)	Piece	415569	154
Can of fish	piece	112569	41.7

Table 2. Intake of certain meals per year

According to these data, one employee intake is 4 grams of salt in one portion of cooked meal with salad and if one eats 2 pieces of burek with salad than the intake of salt is 9 grams per meal, etc. If we add the intake of dried meat products and food in cans that represent so called warm meal, the high prevalence of cardiovascular diseases in miners can be partially understood (Table 2).

4. DISCUSSION

Cardiovascular diseases are the main cause of death among population in life age of 60 years and second among population between 15-59. According to data of WHO, 62% of all strokes and 49% of all coronary diseases can be caused by high blood pressure (28). Single clinical study showed that almost half of 492 employees (216 or 43.9%) in the mine pit department were with hypertension. According to NCEP-ATP III definition 211 or 42.88% of tested subjects were with metabolic syndrome.

According to results of another research in same coal mine (30) 65 out of 80 tested subjects with hypertension, were with metabolic syndrome, and in group of healthy miners, 18 of them (22.5%) were with criteria for diagnosing of metabolic syndrome. The research have proven the existence of risk factors grouping which is more evident among tested subjects with high blood pressure: the most of pit miners (18.88%) out of 492 had 5 risk factors, and in group of normotensive tested subjects the most of them were with 3 (21.73%) and 4 (21.37%) risk factors (out of 9 tested). In high blood pressure tested group, the most of tested subjects were with 5 (21.29%), 6 (23.61%) and 7 (18.51%) of grouped risk factors and the number of tested subjects with 8 (12.5%) grouped risk factors is not to be neglected (31).

Direct cause relation between level of salt intake and blood pressure in population level (32,33) is also recognized. Average

daily salt intake in world is 9-12 grams per person on daily basis and WHO recommends decrease of sodium intake on <2 grams of salt per day (5g of salt per day) in adults for decrease of blood pressure and cardiovascular risks, stroke and coronary disease in adults (34). Reduction of salt on national level presents the cheapest way of preventing cardiovascular diseases. It is estimated that the decrease of salt intake in food from usual 6g per day will be related with decrease of systolic/diastolic blood pressure 7/4 mmHg in those with hypertension and for 4/2 mm Hg in those without hypertension (22). Decrease of high blood pressure in level of population can decrease the rate of stroke in 24 % and coronary disease in 18% (18). The intake of salt per employee in coal mine is highly above the recommended value. According to recommendations of Dietary Guidelines for Americans, maximum daily intake of Sodium is 2.3 g (5.75 g of salt) (13) and in salt-reduction DASH diet (recommendations of American Heart Association) daily intake of Sodium is 1.5 g (3.75 g of salt) (12). In only one meal eaten during work time, an employee takes in 4-9 grams of salt. Along with other grocery offer, dried meat products and food in cans that are being eaten apart from work time, daily intake of salt in pit miners is several times larger than recommended. This could be one of reasons of high rate of disease and hypertension of relatively young population among employees. High intake of salt is related to significantly increased risk of stroke and general cardiovascular disease but for inaccuracy in salt intake measurement this part of efficiency will probably be underestimated (20). The guideline for evaluation of immediate Sodium intake in comparing to referent values and development of measures for decrease of Sodium intake is in need to develop through public health interventions including labeling of food and products along with education of consumers but not with necessity of it (34).

Clinical research prove that decrease of Sodium intake decreases blood pressure in adults with hypertension and prehypertension in men and women, in Afro-Americans and non-Afro-Americans, in older and younger people. That step would be sufficient for prevention and progressing from prehypertension to hypertension and for promotion of non pharmacological control of cardiovascular pressure in those cases with hypertension, and less intake of Sodium is related to lower risk from cardiovascular events in those cases with and without hypertension (35). It is proven that DASH diet rich in fruit, vegetables and low fat milk products with less intake of total fat, significantly reduces blood pressure (36). Results show that usage of DASH diet decreases systolic blood pressure for 11.2 mm Hg in tested subjects with 1 degree of isolated systole hypertension, what is sufficient for control of hypertension in this stadium and effect is comparable with effect of antihypertensive medicaments (37). Recommendations of AHA/ACC for adults, which will have benefit from decrease of blood pressure, are in under consumption of more than 2.4g per day and further decrease of Sodium up to 1.5g per day can lead to even more decrease of blood pressure as well as adults consumption should be up to 1.5 grams per day (34). TONE study proved that decrease of salt in 1.8 g per day lead to decrease of need for antihypertensive medications for 30% (38). Studies for prevention of hypertension (TOHP I and II) have reported that rate in cardiovascular events was 25% lower in tested group which was advised to decrease Sodium intake in comparing to controlled tested group in 2007 what was the most convincing evidence related to limitation of sodium intake and cardiovascular risks (39).

5. CONCLUSION

Many studies proved that increased intake of salt leads to the increase of blood pressure and cardiovascular complications. Intake of salt in labor kitchens – restaurants is higher than recommended so the higher incidence of arterial hypertension is proven. Teams of family medicine can introduce and conduct the DASH dietary program in their work in order to decrease the incidence of hypertension and cardiovascular complications.

CONFLICT OF INTEREST: NONE DECLARED.

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