Risk of Different Diseases in Georgian Population with Overweight and Obesity

Sofio Skliarenko[1],Vasil Tkeshelashvili[2], Zaza Avaliani[3]

The University of Georgia, School of Health Sciences and Public Health
[1]PhD student, Public Health; [2]Supervisor, MD, JD, PhD, ScD, Professor; [3]Supervisor, MD, PhD, Professor

Summary

According to evolutionary history people always struggled to procure food and needed physical efforts for this purpose. Situation significantly changed recently as they don't need much efforts to gain the food. Accordingly overweight, obesity and physical inactivity became the common problem of society. Different studies had been conducted that showed the positive relationship of overweight and chronic diseases, also the inefficacy of diets. The current study had been designed to evaluate the correlation of different diseases and BMI value. Also to calculate the risks of diseases development in the case of overweight and obesity. In the statistical analyses had been included myocardial infarction, hypertension, stroke, etc. The material for the study had been obtained from the survey of non-communicable disease risk factors, conducted in Georgia in 2010- 2011. Target group included males and females in the age group 18-64. Had been analysed 6,469 persons (4,453 women and 1,840 men) in a whole. As the method of analyses were used Chi-square test, multiple regression analyses, calculation of odds ratio and relative risk. The current analysis indicates that increased BMI is associated with increased risk of cancer, stroke, myocardial infarction, diabetes, etc. and therefore, can be prevented if managed precisely. This analysis found that overweight and obesity are strongly associated with the existence of following disease in the anamnesis: Myocardial infarction, cancer, stroke. Future research will be able to compare the relative existence of different diseases across BMI categories to identify additional health risks and work out effective preventive measures.

Abbreviations: *BMI– Body Mass Index, RR-Relative Risk, OR-Odds Ratio, MI- myocardial infarction.*

Key words: *Body mass index, overweight, obesity, relative risk, odds ratio, myocardial infarction, stroke, cancer, diabetes mellitus, heredity, Georgia.*

Problems statement:

Overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer (Roux I., Pratt M., 2008).

Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality in the world, representing 60% of all deaths. Out of the 35 million people who died from chronic disease in 2005, half were under 70 and half were women (WHO, 2014).

According to European Health report, it's possible to prevent the conditions that cause death. The main risk-factors are the following: High blood pressure, high level of cholesterol, etc. The basis for those conditions is overweight, accordingly, it's possible to work-out and embed effective preventive measures (WHO, 2003).

Once considered a problem only in high income countries, overweight and obesity are now dramatically on the rise in low- and middle-income countries, particularly in urban settings.

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed on one hand, and calories expended on the other hand.

For people who are considered obese (BMI greater than or equal to 30) or those who are overweight (BMI of 25 to 29.9) and have two or more risk factors, it is recommended to lose weight. Even a small weight loss will help to lower risk of developing diseases associated with obesity (Roux I., Pratt M., 2008). People who are overweight, do not have a high waist measurement, and have fewer than two risk factors may need to prevent further weight gain rather than lose weight.

Even a small weight loss (between 5 and 10 percent of current weight) will help to lower risk of different disease development.

Obesity maybe associated with various co-morbidities: hypertension, type 2 diabetes (Astrup & Finer, 2000), coronary heart disease (CHD) (Hubert H., Feinleib M. et.al.,1983), stroke, gallbladder disease, and sleep apnoea. Any person may develop diabetes, heart disease, and other

weight-related health risks with increasing body mass index (BMI).

In recent years there is increasing tendency of overweight and obesity in Georgia. This causes increased flow of patients to hospitals and outpatient clinics due to such diseases as hypertension, diabetes mellitus, ischemic heart disease etc. According to World Health Organization – 1 milliard people worldwide are overweight , approximately 300 million are obese *(Obesity: preventing and managing the global epidemic*. Geneva: World Health Organization; 2002).

Though obesity and overweight has serious physical consequences , cause different disorders , various health problems, it also has economic impact (Thompson & Wolf, 2001).

Obesity and overweight are not result of only unhealthy diet but also the lack of physical activity. All weight reduction programs may be successful if they consist of combination of diet and physical activity (Lee IM, Djoussé L, et.al. 2010). Increasing awareness of the disorders with the strongest associations with obesity is important to allow early diagnosis and treatment of these conditions, and to identify the patients most likely to benefit from weight loss. This will allow early identification and assessment of risk so that appropriate interventions can be implemented to reduce risk and mortality.

In a whole, it's obvious that overweight and obesity are associated with development of different diseases. Currently the trends of keeping diet are increasing though not enough to reduce obesity prevalence worldwide. Different approaches must be created to change the dietary patterns of individuals, as well as their attitude to physical activity to keep them from developing health problems.

Aim of research

The aim of current study is to to describe the relationship between weight status and prevalence of different diseases in Georgian population , to determine association between those conditions in anamnesis and BMI value, to identify the risk groups according to BMI values; to optimize the high risk groups of population and embed effective screening measures according to the needs of groups.

Target groups and methodology of research

In this scientific paper was analysed the distribution of overweight and obesity in the target groups – Georgian men and women in the age range 18-64 . Also had been determined the relative risks of different diseases in the overweight and obese population, The analyses was conducted according to sex and age groups as well.

The population of our research were men and women from age 18 to 64 who were included in the non-communicable risk-factor survey conducted in Georgia in 2010-2011. The method by which this survey had been conducted is stepwise approach to surveillance, STEPS. Usually this method uses the same standardized questions and protocols to collect, analyse and disseminate the data in WHO member countries. In the questioner chronic disease was based on self-reported occurrence, based on the question - Have you had any of the following in the last 12 months? Chronic diseases included in this analysis were cholesterol level in the blood, glucose level in the blood, stroke in anamnesis, myocardial infarction in anamnesis, cancer in anamnesis.

Self- reported height and weight were used to calculate BMI as a measure of overweight and obesity. BMI was categorised into four groups: underweight 15.0-18.49 kg/m^2, normal weight 18.5-24.99 kg/m^2, overweight 25.0-29.99 kg/m^2, and obese $\geq$30 kg/m^2.

At the first stage chi-square test had been used in our study to determine BMI distribution within groups. . The independent variables included in the analyses were the existence of following diseases in the anamnesis: stroke, cancer, high level of cholesterol, myocardial infarction. Had been compared different groups according to BMI value and was determined statistically significant differences among groups. Chi-square test gave chance to approve null hypothesis- BMI value is higher in the population with existence of the diseases in anamnesis. The test showed whether the difference between groups was statistically significant or no.

On the second stage had been created regression model to determine regression relationship between group of factors and dependent variable. Such analyses had been conducted to evaluate if change of independent factors influence change of BMI value – constant variable. It was also determined if correlation exists between variables.

At the next stage was calculated the odds ratio and relative risk values for different diseases for overweight and obese population. The following diseases were included in the analyses: stroke, myocardial infarction, diabetes mellitus, cancer. The risks of disease development had been analysed also according to sex and age groups compared with normal weight population.

Results of the research

At the first stage had been analyzed BMI distribution in the case of disease existence in anamnesis. The following results were obtained.

Illustration 1.

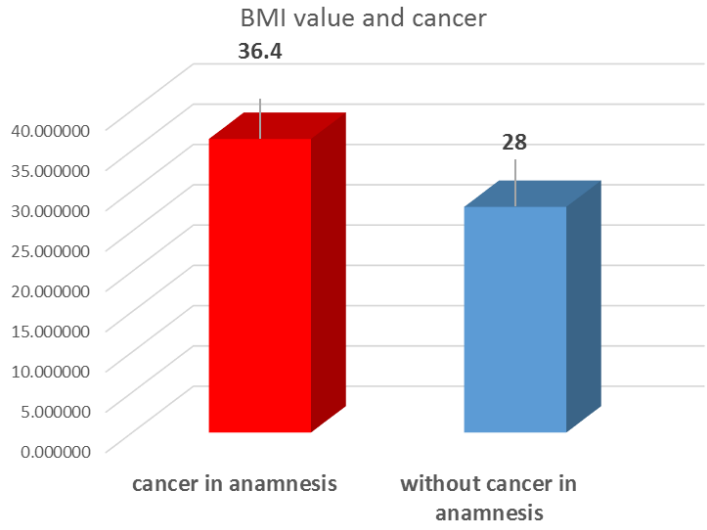


Table 1. BMI value and cancer

			Sum of Squares	df	Mean Square	F	Sig.
BMI_A BMI * cancer	Between Groups	(Combined)	5883.75	1	5883.747	43.68	.000
	Within Groups		862016.06	6400	134.690		
	Total		867899.81	6401			

The difference between groups was statistically significant. In our study was not determined localization of cancer so those results indicate BMI value in the case of cancer of any localization.

For stroke, the following result was obtained:

Table 2. BMI value and stroke

			Sum of Squares	df	Mean Square	F	Sig.
BMI_A BMI * Stroke	Between Groups	(Combined)	2352.39	1	2352.39	17.39	.000
	Within Groups		865547.41	6400	135.24		
	Total		867899.8	6401			

The difference between groups is statistically significant (P<0.05). In the case of stroke in the anamnesis average BMI value was 33 in this group, while without stroke, it has been determined to be 28.

Illustration 2.

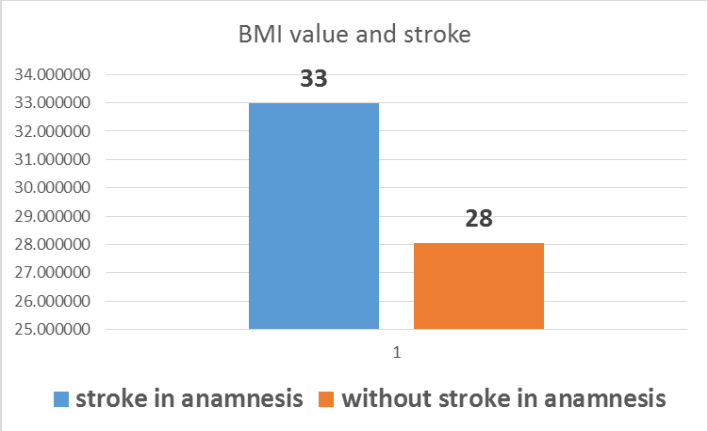


Illustration 3.

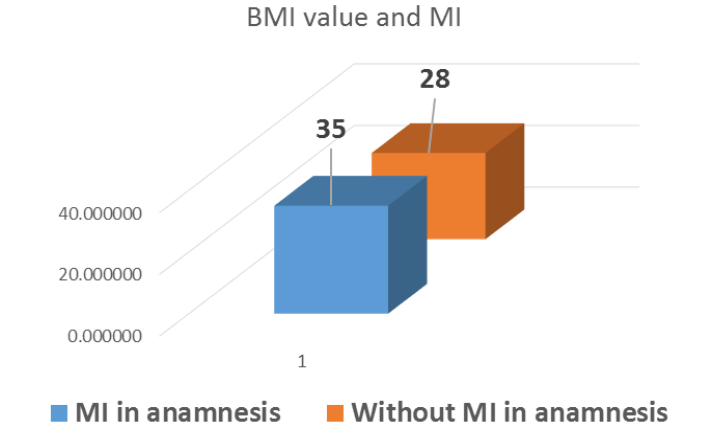
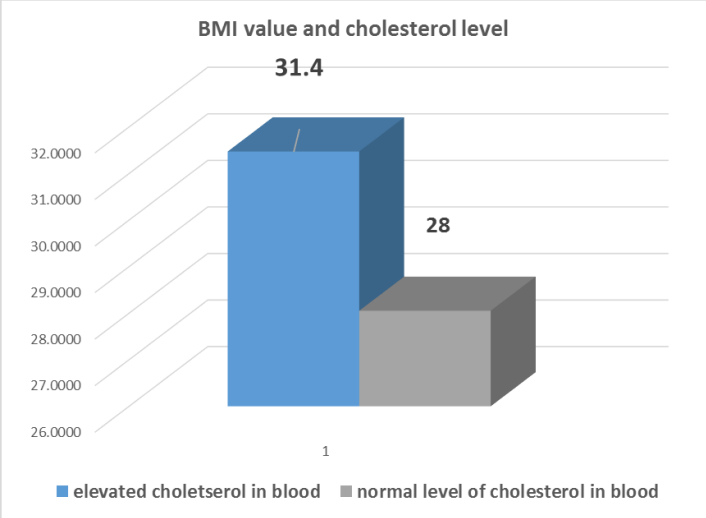


Illustration 4.



In all cases difference between groups was statistically significant (P<0.05). The above mentioned results confirmed research hypothesis –in the case of any above disease existence in anamnesis BMI value is higher in Georgian population males and females.

Multiple regression analyses was conducted for biochemistry parameters in the blood. For 6402 persons had been determined cholesterol and glucose level in the blood. Those independent variables were included in the regression model, and BMI as constant variable.

Table 3. Biochemistry parameters in the blood and BMI

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	31.218	2.383		13.098	.000
	Fasting glucose level	.026	.004	**.083**	6.440	.000
	Cholesterol level in blood	2.895	1.168	.032	2.479	.013

The strong positive relation was revealed between those variables. Both of them are affected by body mass index value. The higher level of glucose in the blood, the higher value of BMI exists, the same is true for cholesterol level. The above result indicates that persons with high BMI value need to control their glucose and cholesterol level in the blood to determine certain diseases at early stage.
In the regression model the following diseases were included: stroke, myocardial infarction and cancer as independent variables and BMI as dependent variable.

Table 4. Diseases in anamnesis and BMI value – regression analyses

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	**(Constant)**	**27.77**	**.15**		**187.152**	**0.000**
	Stroke in anamnesis	**3.68**	**1.19**	**.039**	**3.09**	**.002**
	Cancer in anamnesis	**7.99**	**1.27**	**.078**	**6.29**	**.000**
	Myocardial infarction in anamnesis	**6.30**	**.96**	**.083**	**6.59**	**.000**

In all cases strong positive correlation was revealed. The result was statistically significant (P<0.05). That means high BMI value maybe predictor for existing of any of those diseases.

In our research was also studied the relative risks of different diseases in the case of overweight and obesity.

The relative risks were identified for following diseases: stroke, myocardial infarction, diabetes mellitus, cancer.

Table 5. Risk of stroke development in obese population

BMI				stroke yes	stroke no	Total
30 +	age 50 +		Count	39	1133	1172
			% within age	3.3%	96.7%	100.0%
			% within stroke	88.6%	57.1%	57.8%
	age -49		Count	5	850	855
			% within age	0.6%	99.4%	100.0%
			% within stroke	11.4%	42.9%	42.2%
	Total		Count	44	1983	2027
			% within age	2.2%	97.8%	100.0%
			% within stroke	100.0%	100.0%	100.0%
18-24.99	age 50 +		Count	13	649	662
			% within age	2.0%	98.0%	100.0%
			% within stroke	65.0%	30.0%	30.3%
	age -49		Count	7	1515	1522
			% within age	0.5%	99.5%	100.0%
			% within stroke	35.0%	70.0%	69.7%
	Total		Count	20	2164	2184
			% within age	0.9%	99.1%	100.0%
			% within stroke	100.0%	100.0%	100.0%
Total	age 50 +		Count	52	1782	1834
			% within age	2.8%	97.2%	100.0%
			% within stroke	81.3%	43.0%	43.6%
	age -49		Count	12	2365	2377
			% within age	0.5%	99.5%	100.0%
			% within stroke	18.8%	57.0%	56.4%
	Total		Count	64	4147	4211
			% within age	1.5%	98.5%	100.0%
			% within stroke	100.0%	100.0%	100.0%

According to given data, in the case of obesity (BMI >29.9) men and women above 50 have anamnesis of stroke in 88.6% cases, below 50 in 11.4 % cases (X^2=3.8; P<0.05).

With increasing of age risk of stroke development increases 6 times in obese population compared with normal weight people (95% CI 2.3- 15.0).

Table 6. Risk of MI in the case of obesity

			Myocardial infarction yes	Myocardial infarction no
BMI obesity	**30 +**	**Count**	**78**	**1949**
		% within BMI obesity	**3.8%**	**96.2%**
		% within Myocardial infarction	**76.5%**	**47.4%**
	18-24.99	**Count**	**24**	**2160**
		% within BMI obesity	**1.1%**	**98.9%**
		% within Myocardial infarction	**23.5%**	**52.6%**
Total		**Count**	**102**	**4109**
		% within BMI obesity	**2.4%**	**97.6%**
		% within Myocardial infarction	**100.0%**	**100.0%**

According to results in obese population (BMI >29.9) 76.5% of MI cases were observed while in normal weight population (BMI 18-24.99), 23.5 % of MI cases were observed (X^2=33.6; P<0.05). In obese population risk of MI development is 3.6 times higher compared with normal weight population (95% CI 2.3- 5.7).

Table 7. Risk of MI development in overweight and obese population according to age

BMI_overweight_obesity				Myocardial infarction		Total
				yes	no	
25 +	age	50 +	Count	107	2066	2173
			% within age	4.9%	95.1%	100.0%
			% within Myocardial infarction	82.3%	52.6%	53.5%
		-49	Count	23	1863	1886
			% within age	1.2%	98.8%	100.0%
			% within Myocardial infarction	17.7%	47.4%	46.5%
		Total	Count	130	3929	4059
			% within age	3.2%	96.8%	100.0%
			% within Myocardial infarction	100.0%	100.0%	100.0%
18-24.99	age	50 +	Count	19	643	662
			% within age	2.9%	97.1%	100.0%
			% within Myocardial infarction	79.2%	29.8%	30.3%
		-49	Count	5	1517	1522
			% within age	0.3%	99.7%	100.0%
			% within Myocardial infarction	20.8%	70.2%	69.7%
		Total	Count	24	2160	2184
			% within age	1.1%	98.9%	100.0%
			% within Myocardial infarction	100.0%	100.0%	100.0%
Total	age	50 +	Count	126	2709	2835
			% within age	4.4%	95.6%	100.0%
			% within Myocardial infarction	81.8%	44.5%	45.4%
		-49	Count	28	3380	3408
			% within age	0.8%	99.2%	100.0%
			% within Myocardial infarction	18.2%	55.5%	54.6%
		Total	Count	154	6089	6243
			% within age	2.5%	97.5%	100.0%
			% within Myocardial infarction	100.0%	100.0%	100.0%

According to given data, in the case of obesity (BMI >29.9), population above 50 years old have MI in anamnesis in 82.3% and below 50 in 17.7% cases (X^2=44.7; P<0.05) .
With the age, risk of MI development increases 4 times in obese population compared with normal weight population (95% CI 2.7- 6.6).

Table 8. Risk of diabetes mellitus in the case of overweight

			Diabetes mellitus		Total
			yes	no	
BMI overweight	25-29.99	Count	164	451	615
		% within BMI overweight	26.7%	73.3%	100.0%
		% within Diabetes mellitus	71.0%	53.1%	56.9%
	18-24.99	Count	67	399	466
		% within BMI overweight	14.4%	85.6%	100.0%
		% within Diabetes mellitus	29.0%	46.9%	43.1%
Total		Count	231	850	1081

According to this data in the case of overweight 71% of persons had diabetes mellitus in anamnesis while in normal weight population this number was 29% (X^2=23.8; P<0.05). overweight increases risk of diabetes mellitus development by 2.1 times (95% CI 1.6- 3.0).

Table 9. Risk of diabetes mellitus in the case of obesity

			Diabetes mellitus		Total
			yes	no	
BMI_obesity	30 +	Count	228	604	832
		% within BMI obesity	27.4%	72.6%	100.0%
		% within diabetes	77.3%	60.2%	64.1%
	18-24.99	Count	67	399	466
		% within BMI obesity	14.4%	85.6%	100.0%
		% within diabetes	22.7%	39.8%	35.9%
Total		Count	295	1003	1298
		% within BMI obesity	22.7%	77.3%	100.0%
		% within diabetes	100.0%	100.0%	100.0%

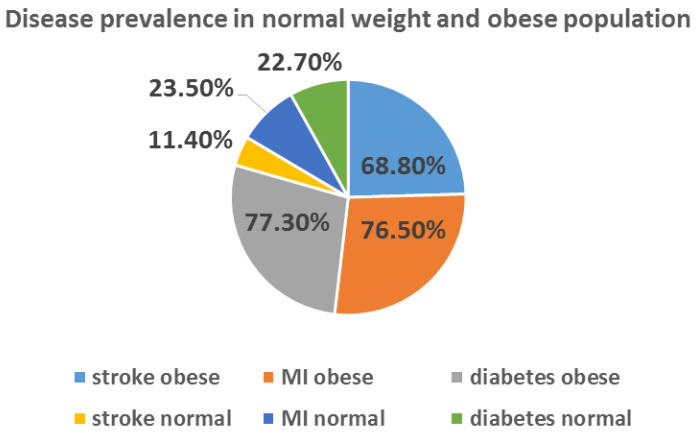
According to gained results, 77.3% of obese population experience diabetes mellitus in anamnesis while 22.7% of normal weight population indicates presence of diabetes mellitus (X^2=28.9; P<0.05). In obese population risk of diabetes development is 2.4 times higher compared with normal weight population (95% CI 1.7- 3.0).

According to the given data, in overweight and obese individuals above 50 years old indicate diabetes mellitus in anamnesis in 74.6% cases while below 50 have diabetes in 25.4% cases (X^2=7.3; P<0.05). With the age risk of diabetes development in overweight and obese individuals increase 1.6 times (95%CI 1.1- 2.2) .

Table 10. Risk of diabetes mellitus in overweight and obese population with increasing age

BMI_overweight_obesity			Diabetes Mellitus		Total
			yes	no	
25 +	50 +	Count	170	391	561
		% within age	30.3%	69.7%	100.0%
		% within diabetes	74.6%	64.7%	67.4%
	-49	Count	58	213	271
		% within age	21.4%	78.6%	100.0%
		% within diabetes	25.4%	35.3%	32.6%
	Total	Count	228	604	832
		% within age	27.4%	72.6%	100.0%
		% within diabetes	100.0%	100.0%	100.0%
18-24.99	50 +	Count	50	163	213
		% within age	23.5%	76.5%	100.0%
		% within diabetes	74.6%	40.9%	45.7%
	-49	Count	17	236	253
		% within age	6.7%	93.3%	100.0%
		% within diabetes	25.4%	59.1%	54.3%
	Total	Count	67	399	466
		% within age	14.4%	85.6%	100.0%
		% within diabetes	100.0%	100.0%	100.0%
Total	50 +	Count	220	554	774
		% within age	28.4%	71.6%	100.0%
		% within diabetes	74.6%	55.2%	59.6%
	-49	Count	75	449	524
		% within age	14.3%	85.7%	100.0%
		% within diabetes	25.4%	44.8%	40.4%
	Total	Count	295	1003	1298
		% within age	22.7%	77.3%	100.0%

Illustration 5.

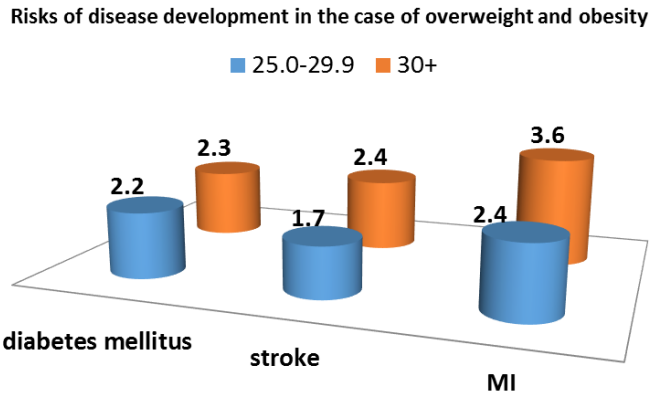


According to given data, In the case of overweight and obesity in population over 50 years old cancer is indicated in 69% cases while below 50 25.4% indicates disease in anamnesis (X^2=5.6; P<0.05). With the age risk of cancer development in overweight and obese population increases twice compared with normal weight population (95%CI 1.1- 3.4).

Table 11. Risk of cancer development with age in overweight and obese population

BMI_overweight_obesity			cancer		Total
			yes	no	
25 +	50 +	Count	40	2133	2173
		% within age	1.8%	98.2%	100.0%
		% within cancer	69.0%	53.3%	53.5%
	-49	Count	18	1868	1886
		% within age	1.0%	99.0%	100.0%
		% within cancer	31.0%	46.7%	46.5%
	Total	Count	58	4001	4059
		% within age	1.4%	98.6%	100.0%
		% within cancer	100.0%	100.0%	100.0%
18-24.99	50 +	Count	12	650	662
		% within age	1.8%	98.2%	100.0%
		% within cancer	50.0%	30.1%	30.3%
	-49	Count	12	1510	1522
		% within age	0.8%	99.2%	100.0%
		% within cancer	50.0%	69.9%	69.7%
	Total	Count	24	2160	2184
		% within age	1.1%	98.9%	100.0%
		% within cancer	100.0%	100.0%	100.0%
Total	50 +	Count	52	2783	2835
		% within age	1.8%	98.2%	100.0%
		% within cancer	63.4%	45.2%	45.4%
	-49	Count	30	3378	3408
		% within age	0.9%	99.1%	100.0%
		% within cancer	36.6%	54.8%	54.6%
	Total	Count	82	6161	6243
		% within age	1.3%	98.7%	100.0%
		% within cancer	100.0%	100.0%	100.0%

Illustration 6.



The above chart indicates disease prevalence in obese population compared with normal weight people. According to those results the disease prevalence is much higher in the case of obesity.

Overweight (BMI value 25- 29.9) increases risk of development of stroke for 1.7 times (95% CI 1-3.0).
in the case of obesity the risk is twice more compared with normal weight population (95% CI 1.4-4.0).

The risk of MI development increases 2.4 times in overweight population (95% CI 1.5-3.9), while for obese people OR is 3.6 (95% CI 2.3 -5.7).

The risk of diabetes mellitus increases with overweight for 2.2 times (95% CI 1.5-2.9) and in the case of obesity by 2.3 times (95% CI 1.7-3.0).

In the obese and overweight population above 50 years old risk of stroke increases 6 times, risk of MI increase 4 times, risk of diabetes mellitus increases 1.6 times compared with normal weight people.

According to the results maybe worked out useful recommendations. For the persons with high BMI it's recommended to make prophylactic examinations (screening) for above mentioned diseases.

Conclusions:

1. Increased BMI value is in relation with certain health conditions, such as high arterial pressure (t=3.4), high cholesterol level in blood (t=-2.5), high blood glucose level (t=6.4), stroke in anamnesis (t=-3.1), MI in anamnesis (t=-6.6), cancer in anamnesis (t=-6.3);
2. The risk of diabetes mellitus increases with overweight for 2.1 times and in the case of obesity for 2.2 times .
3. The risk of diabetes mellitus increases in obese population with age (50+), for 1.6 times;
4. Overweight increases risk of development of stroke for 1.7 times, obesity for 2.4 times; With the age (50+),obesity increases risk of stroke for 6 times;
5. The risk of MI development increases 2.4 times in overweight population and 3.6 times in obese population.
6. With the age (50+),obesity and overweight increase risk of MI for 4.2 times;
7. With the increase of age (50+), risk of cancer development increases twice in overweight and obese population.

Recommendations:

The study results outlined the necessity of practical recommendations that can be given based on current analyses:

1. In the case of presence of different diseases in the anamnesis (MI, stroke, high blood pressure), population indicates high BMI index. Accordingly abnormal value of BMI at certain extent is the risk of developing of such diseases. For these purposes it's very important to recommend such patients weight control. This may allow them to avoid development of health risks.
2. It's important step to control blood level of glucose and cholesterol in the above mentioned cases. This may allow to identify and prevent certain diseases, such as diabetes mellitus and CHD at early stages.
3. Persons with high BMI value need to perform screening of diseases, such as diabetes, cancer, stroke, MI periodically.

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