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Research Article

Happy People in the World Live 25 Years Longer Than Unhappy People and are Less Likely to Suffer from Cardio Pathologies

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Abstract

Aims: Investigated risk factors for cardiovascular diseases in countries with high and low Happiness Index in 158 countries in 2004.

Methods: Mann-Whitney U-test and Linear Multiple Regression Analysis (LMA); GBD 2004; FAO 1990-2005 databases.

Results: In countries with a high Happiness Index - group 1 (62 ± 8 versus 23 ± 5), income was 4 times higher, quality of life, health care was 3 times higher, and life expectancy by 23 years ($p \leq 0.001$). In the countries of group 1, the overall mortality and overall morbidity were 2 times lower ($p \leq 0.001$). Cardiovascular diseases were 1.5 times higher ($p \leq 0.016$), cerebrovascular events were 2 times higher in group 2 countries ($p \leq 0.001$). In the 1st group of countries, the share of men (%) predictors of metabolic syndrome (MS) was on average 2 times higher than in the 2nd group of countries ($p \leq 0.009$). The daily food consumption in the 1st group of countries was 2 times higher than in the 2nd group ($p \leq 0.001$).

Conclusion: The index of happiness can be considered a subtle and sensitive tool for assessing not only social life, but also human health.

Keywords: Happiness Index 2012; NCD; MS; Alcoholic Beverages; Hypertension; Ischemic; Cerebrovascular Heart Disease; Alcoholism; Nutrition; Risk factors

Abbreviations: AB: Alcoholic Beverage; AP: Animal Products; BMI: Body Mass Index; BP: Blood Pressure; CAB: Alcoholic Beverage Consumption; CD: Communicable Maternal Perinatal Diseases; Cho: Blood Cholesterol; CL: Consumption Level of Selected Foods; CHD: Coronary Heart Disease; CV: Cereals and Vegetables; CVD: Cardiovascular Diseases; COPD: Chronic Obstructive Pulmonary Disease; D: Disease; DALY: The Disability-Adjusted Life Year; DRD2 and DRD3: Genes Encode Type 2 and 3 Dopamine Receptors; EEI: Ecological Efficiency Index; FAO: Food and Agriculture Organization of the United Nations; FS: Fruits and Sweeteners; ICD-10: Codes - Is the 10th Revision of the International Statistical Classification of Diseases; GBD: Global Burden Diseases; GDP: Domestic Gross Product; Glu: Blood Glucose; HPI: Happiness Index; IHD: Index of Human Development; LE: Life Expectancy for Men and Women; LPA: Low Physical Activity; LMA: Linear Multiple Regression Analysis; M: Male; NS: Nutritional Structure; MSP: Metabolic Syndrome Predictors; NCD: Non-Communicable Diseases

Introduction

«Life, Liberty, and the Pursuit of Happiness» is a well-known phrase in the United States Declaration of Independence [1]. This phrase provides three examples of inalienable rights that the Declaration states were granted to all people by their creator, and governments are created to protect them. These words belong to the 3rd President of the United States (1801 - 1809). According to Aristotle, it is "the highest and most beautiful good that gives the greatest pleasure", a perfect and self-sufficient goal of human activity, carried out "in accordance with virtue" [2]. Since the early 2000s, scientific assessment of happiness has become popular. The problem is determined by the special significance of the concept under study, as well as the interest on the part of society, due to the natural desire of every person to be happy [3]. For the first time, the so-called «Index of Happiness on the Planet» was calculated in 2006 among 178 countries of the world [4].

A person's striving for happiness should serve as the gold standard for the development of the state [5-7]. For the first time in Bhutan, it has been proposed to give more importance to the Happiness Index rather than GDP [8]. In modern science, when assessing happiness, there is a desire to combine a quantitative analysis of the characteristics of society with a traditionally inaccurate analysis [9]. The happiness index is calculated according to several parameters (GDP, life expectancy, ecology, life satisfaction and many others [10]. Happiness indices 2006-2009, 2012-2015, and also 2016-2021 differ in the degree of inclusion in the assessment of happiness characteristics of GDP [9-11]. In medicine, there is an attempt to assess the relationship between the Happiness Index and general morbidity and mortality [11-14]. The association of the Happiness Index with the burden of cancer [15], cardiovascular diseases [16,17] and diabetes [18] is assessed.

Happiness is a concept that is gaining increasing importance in both social research and health research. Living standards and satisfaction with life achievements are more important in subjective well-being than health satisfaction [19]. Objective: To analyze risk factors for cardiovascular and comorbid diseases in countries with high and low Happiness Index.

Tasks:

1. Analysis of the quality of life in two groups of countries.
2. Analysis of predictors of metabolic syndrome in two groups of countries.
3. Analysis of the burden of cardiovascular and comorbid diseases in two groups of countries.
4. Analysis of consumption levels of food and nutrients, including alcoholic beverages in two groups of countries.
5. Assessment of the influence of risk factors, as independent variables, on the burden of cardiovascular disease, as dependent variables in a multiple linear regression model.

Material and Method

Study design: Statistical analysis of observations

For the work, a database of NCDs was formed: the burden of cardiovascular and comorbid diseases (ICD-10 codes) for 158 countries. From 158 countries of the base, 2 groups of 15 countries in a group were selected.

Group 1: countries with the highest Happiness Index ().

Group 2: countries with the lowest Happiness Index (Table 1 - List of countries).

Disease burden (DALY) data for men in 158 countries, standardized by sex and age per 100,000 population, were sampled from the 2004 GBD database [20]. To characterize the "quality of life" (QOL) in countries, a number of indicators were used: per capita income (GDP) in 2000–2016 (US dollars per person per year) [21]; geographical position of countries in latitude and level of ultraviolet radiation in the capital of the countries (UV) (J / m2 2004) [22]; life expectancy for men and women (2008 and 2016) [23]; access to quality medicine, clean water and clean air [24]; Index of Happiness and Prosperity (IH) 2012 [25, 26].

Predictors of metabolic syndrome (MS) - the percentage (%) of men in the country with a Body Mass Index (BMI) ≥25 kg / m2 and ≥30 kg / m2; the level of cholesterol in the blood (Chol. ≥ 5.0 mmol / l and ≥ 6.2 mmol / l); Blood glucose (Glu. ≥ 7.0 mmol / l); Blood pressure (BP ≥ 140/90 mm Hg); Low physical activity (LPA ≤ 60 min / day of walking) [27]. The daily food consumption rate (TDC) (g / person / day) (50 foods) for each country was selected from the FAO database for 1992-2005 [28]. The structure of nutrition (NS) of countries is presented in the form of 4 blocks in absolute and percentage terms of TDC: 1 - products of animal origin (AP); 2 - grains and vegetables (CV); 3 - fruit and sweeteners (FS); 4 - alcoholic beverages (strong alcohol, wine and beer) (AB) [28].

Statistical analysis of the study results was carried out using the Mann-Whitney-Wilcoxon U-test. The central trend in the distribution of data in the sample was represented by the Median with Quartile Range and the Mean and Standard Deviation. Sample variance was estimated using the Quartile Range (QR) between the first and third quartiles (25th and 75th percentiles) and the Standard Deviation of the Mean. The level of statistical significance, reflecting the degree of confidence in the conclusion about the differences between indicators of 1 and 2 groups of countries, was assessed for two levels of accuracy: $p \leq 0.01$ - probability of error 1%; $p \leq 0.05$ - error probability 5%. In multiple comparisons, the Bonferroni correction was used to assess the significance of the study results, taking into account two hypotheses ($p \leq 0.025$).

Analysis of the dependence of the burden of NCD on risk factors (quality of life, MS, food) was performed using models of Multiple Linear Regression Analysis for «independent variables» (MLRA). Standardized NCD disease burden indicators from 2004 were used as the MLRA's "dependent variable" [20]. Indicators of risk factors were used as "independent variables". A step-by-step procedure for including «independent variables» was applied to obtain the best regression equations containing the minimum number of predictors statistically significantly associated with the «dependent variable». The quality of the regression model was assessed using multiple correlation coefficient (R1), determination coefficient (R2), F-distribution, t-tests for regression coefficients, and residual analysis. The residuals in the models had a normal distribution. An analysis of the values and signs of the coefficients of the β * and β regression equations made it possible to estimate the contribution of "independent variables" - risk factors - to the values of the burden of NCD types. We forecast how much the "dependent variable" will change when the "independent variable" is changed

by a unit of measurement. All calculations were performed using the STATISTICA program (version 13).

Result

Group 1: 15 countries with the highest Happiness Index: 62 ± 8 (Median 1 ± Quartile1) (Costa Rica, Dominican Republic, Jamaica, etc.) (Table 1).

Group 2: 15 countries with a minimum Happiness Index: 23 ± 5 (Median 2 ± Quartile2) (Botswana, Tanzania, Zimbabwe, etc.) ($p \leq 0.001$) (Table 1).

Table 1: Groups of countries 1 and 2.

1 gr	IPC 2000	UV rad J/m2 2004	HPI 2012	Noncommunicable diseases	Cardiovascular diseases	Ischaemic heart disease	Cerebrovascular disease
Costa Rica	7830	4884	76,1	10 345	1 429	784	238
Dominican Republic	6312	4880	71,8	13 792	3 798	1 810	1 254
Jamaica	6287	4942	70,1	10 662	2 105	1 076	514
Guatemala	4812	5141	68,4	12 840	1 540	640	484
Viet Nam	2100	4293	66,5	11 612	2 596	1 220	823
Colombia	6585	5385	66,1	11 674	1 987	1 063	465
Cuba	8949	4401	65,7	10 332	1 969	1 029	470
El Salvador	5044	5364	61,5	11 712	1 355	763	256
Honduras	2638	4924	61	13 411	2 741	1 250	745
Brazil	9013	4552	61	14 159	3 101	1 205	915
Nicaragua	2739	5078	60,5	12 732	2 291	1 175	544
Egypt	5856	4202	60,3	15 827	5 002	2 690	858
Saudi Arabia	34140	5384	59,7	12 695	4 318	2 576	404
Philippines	3348	4928	59	15 676	3 922	1 631	792
Argentina	11810	3476	59	12 718	2 448	1 037	659
mean	7831	4789	64	12 679	2 707	1 330	628
2 gr	IPC 2000	UV rad J/m2 2004	HPI 2012	Noncommunicable diseases	Cardiovascular diseases	Ischaemic heart disease	Cerebrovascular disease
Niger	597	5811	26,9	16 830	4 209	1 452	1 432
Angola	2781	5287	26,8	20 047	5 217	1 816	1 783
Estonia	9414	1781	26,4	14 444	4 580	2 463	962
Mali	1160	5617	25,8	16 251	3 969	1 374	1 339
Benin	1321	5168	24,6	14 239	3 233	1 131	1 077
Mozambique	445	4646	24,6	13 020	2 951	1 085	992
Togo	1012	5307	23,3	14 206	3 272	1 164	1 086
Sierra Leone	723	5087	23,1	19 021	4 871	1 691	1 655
Central African	649	5498	22,9	14 981	3 586	1 279	1 209
Burkina Faso	829	5567	22,4	15 593	3 727	1 303	1 248
Burundi	598	5111	21,8	16 759	4 102	1 385	1 412
Namibia	4840	5305	21,1	10 964	2 188	734	643
Botswana	8252	4868	20,9	11 878	2 386	884	788
Tanzania	1174	5483	17,8	14 434	3 405	1 212	1 149
Zimbabwe	2038	4918	16,6	14 724	3 422	1 231	1 163
mean	2389	5030	23	15159	3675	1347	1196

Quality of life analysis in groups 1 and 2 using the U-Mann-Whitney test

GDP (IPC) of group 1 in 2000 was 4 times higher than group 2 ($p \leq 0.001$). The Gini Index (2021) in group 1 was 1.07 higher ($p \leq 0.002$). The geographical latitude of the countries of the 1st group did not statistically differ from the 2nd group: 18 ± 8 and 12 ± 14 ($p \geq 0.09$). However, the level of ultraviolet radiation (UV rad J / m2 2004) was higher in group 2: 5287 ± 580 versus 4924 ± 740 ($p \leq$

0.042). Group 2 was 4 times closer to Greenwich ($p \leq 0.001$) (Table 2). The ranks of well-being, education, and social capital in group 1 were 1.6 times higher than in group 2 ($p \leq 0.01$). By the rank of corruption, the countries of the 1st and 2nd groups did not differ ($p \geq 0.2$). Group 1 were 1.5-3 times higher than the Index of human development (IHD) and the Ecological efficiency index (EEI) ($p \leq 0.001$).

In group 1, the level of health care, water purity and air purity was 3 times higher ($p \leq 0.005$). In group 1, it was 25 years in women and 21 years in men higher than life expectancy (LE) ($p \leq 0.001$). In addition, in group 1, the gender difference LE was 2.5 times higher ($p \leq 0.001$). Thus, the quality of life of the happy people of the 1st group of countries was significantly higher than the 2nd group.

Analysis of the burden of disease in groups 1 and 2 countries using the Mann-Whitney U test Analysis of the burden of cardio-morbidity in groups 1 and 2 countries

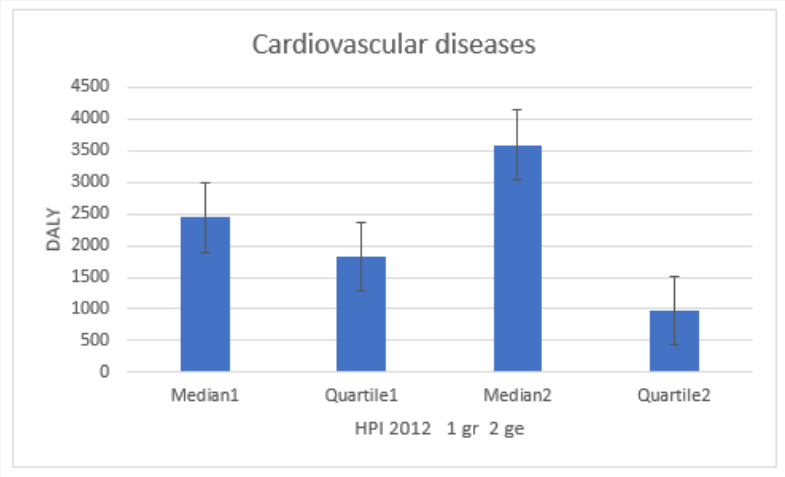

Figure 1: Cardiovascular diseases in the 1st and 2nd group of countries.

Table 2: Comparative analysis of the quality of life, the burden of NCDs and MS 1 and 2 groups of countries differing in the Happiness Index (Mann-Whitney U-test).

HPI 2012							
	p-value	Mean1	Median1	Quartile1	Mean2	Median2	Quartile2
The quality of life							
IPC 2000	0,0009	7831	6287	5601	2389	1160	2132
IPC 2016	0,0016	14587	11132	8808	5375	2006	5282
Gini Index 2021	0,0026	0,782	0,768	0,078	0,720	0,716	0,046
lat°	0,0890	18	18	8	15	12	14
UV rad J/m2 2004	0,0421	4789	4924	740	5030	5287	580
lon°	0,0000	76	83	29	18	19	27
Prosperity Rating	0,0003	71	72	33	112	117	22
Rating Educations	0,0001	76	80	39	117	125	28
Rating of the Social capital	0,0225	69	70	36	98	104	58
Rank of corruption 2016	0,2134	92	94	46	107	119	70
Rating of peacefulness	0,8170	79	74	51	85	74	75
HPI 2012	0,0000	64	62	8	23	23	5
IHD Index of human development	0,0001	0,777	0,766	0,118	0,493	0,414	0,193
EEI Ecological efficiency index	0,0004	52	51	10	37	36	16
Access to the street. medicine1990	0,0011	84	88	18	56	55	32
Access to clean water1990	0,0001	67	69	31	24	15	31
Air pollution for children under 5 years old 2004	0,0055	34	24	41	302	135	419
female life expectancy	0,0000	76	75	4	49	50	10

male life expectancy	0,0000	70	69	4	47	48	10
gender 2008	0,0007	5	5	4	2	2	5
M Death	0,0000	947	986	185	2263	2226	720
All Causes	0,0000	20563	21320	6441	50610	50356	18597
	p-value	Mean1	Median1	Quartile1	Mean2	Median2	Quartile2
Infectious and parasitic diseases	0,0000	1989	1746	2008	20688	19531	3714
Noncommunicable diseases	0,0028	12679	12718	2180	15159	14724	2553
Alcohol use disorders	0,0025	831	891	534	300	236	193
Post-traumatic stress disorder	0,0000	30	30	0	29	29	1
Panic disorder	0,0310	68	67	4	69	69	0
Insomnia (primary)	0,0000	57	69	34	68	69	0
Migraine	0,0000	76	77	0	30	29	4
	p-value	Mean1	Median1	Quartile1	Mean2	Median2	Quartile2
Cardiovascular diseases	0,0161	2707	2448	1829	3675	3586	976
Rheumatic heart disease	0,0620	31	17	22	31	30	13
Hypertensive heart disease	0,7716	295	165	250	178	164	67
Ischaemic heart disease	0,3195	1330	1175	601	1347	1279	322
Cerebrovascular disease	0,0001	628	544	359	1196	1163	420
Inflammatory heart diseases (k)	0,0001	85	68	50	242	212	77
Chronic obstructive pulmonary disease	0,0079	365	283	262	552	547	151
Cirrhosis of the liver	0,1585	394	272	389	210	188	73
Nephritis and nephrosis	0,1711	292	155	391	326	323	150
Self-inflicted injuries	0,2455	243	255	179	323	259	198
MS							
Male BMI>25 (kg / m2)	0,0003	48	49	16	19	16	6
Male BMI>30(kg / m2)	0,0004	15	14	9	4	3	1
Male ch > 5.0 (mmol / L)	0,0019	33	33	12	23	20	13
Male ch > 6.2(mmol / L)	0,0021	7	6	3	4	3	3
Male glu > 7.0 (mmol / L)	0,0213	9	9	4	7	7	1
Male BP >140/90(mm Hg)	0,0042	29	29	6	36	33	7
Male insact <60 minutes / day walking	0,0305	40	44	36	18	17	10

Legend
The quality of life
Per capita income - IPC
latitude, longitude - lat, lon
Ultraviolet - UV
Happiness index - HPI
Corruption rating - RK
Peacefulness rating - Rpful
Human Development Index - HDI
Environmental Performance Index - EPI
Medicine level
Pure water
Fresh air
Life expectancy
m, f - male, femalt

DALY burden
Metabolic syndrome MC
Body mass index - BMI - m/h2
Blood cholesterol - mmol / liter
Blood glucose mmol / liter
Arterial blood pressure - mm Hg
Bonferroni correction p ≤0.025*

In the 1st group of countries with a high Happiness Index, the overall male mortality in 2004 was 2.3 times lower than the mortality of the 2nd group with a low Happiness Index ($p \leq 0.001$) (Table 2). In the 1st group of countries with a high Happiness Index, the overall male morbidity in 2004 was 2.2 times lower than the general morbidity of the 2nd group of countries with a low Happiness Index ($p \leq 0.001$). In the 1st group of countries, the total male Infectious and parasitic diseases in 2004 was 11.2 times lower than the 2nd group with a low Happiness Index ($p \leq 0.001$). In group 1 of countries in 2004 it was 1.2 times lower than group 2 of countries Noncommunicable diseases (NCD) ($p \leq 0.001$) (Table 2). The total burden of cardiovascular diseases in the 1st group of countries was 1.5 times lower than in the 2nd group: 2448 ± 1829 versus 3586 ± 976 ($p \leq 0.016$) (Table 2) (Figure 1).

The burden of Rheumatic heart disease, Hypertensive heart disease, and Ischaemic heart disease was not statistically different between group 1 and group 2 ($p \geq 0.7$). The burden of Cerebrovascular disease was 1.8 times lower in group 1 of countries than in group 2: 544 ± 359 versus 1163 ± 420 ($p \leq 0.001$). The burden of Inflammatory heart diseases was also 2.8 times lower in group 1 of countries compared to group 2 of countries: 68 ± 50 versus 212 ± 77 ($p \leq 0.001$) (Table 2).

Analysis of predictors of metabolic syndrome in groups 1 and 2

Body mass index, Cholesterol and Blood glucose, Blood pressure, Low physical activity were assessed by the proportion (%) of MS predictors in the populations of countries of groups 1 and 2. In group 1 of countries, the proportion of men (% in populations) of six predictors of MS was, on average, 3 times higher than in group 2 of countries ($p \leq 0.009$) (Table 1). At the same time, the predictor of MS "BP> 140/90 (mm Hg)" was 1.2 times lower in group 1 of countries ($p \leq 0.004$) ($p \leq 0.004$) (Table 2).

Analysis of the burden of some comorbid diseases in groups 1 and 2 of countries

There were no statistical differences in the burden of Diabetes mellitus ($p = 0.06$) between countries 1 and 2 (Table 2). Group 1 countries had 1.3 times the burden of group 2 of Unipolar depressive disorders ($p \leq 0.001$). In the 1st group of countries, the burden of Bipolar disorder was 1.2 times lower than in the 2nd group ($p \leq 0.001$). Group 1 had 2.8 times the burden of Alcohol use disorders ($p \leq 0.003$) in Group 2. Group 1 countries had 1.3 times lower burden of Parkinson disease ($p \leq 0.020$). In group 1 countries, the burden of Alzheimer and other dementias was 1.3 times higher than group 2 ($p \leq 0.001$). In group 1 countries, the burden of Post-traumatic stress disorder was 1.03 times higher than group 2 ($p \leq 0.001$). In group 1 countries, the burden of Panic disorder was 1.01 times lower than group 2 ($p \leq 0.031$). The burden of Migraine was 2.5 times higher in group 1 countries ($p \leq 0.001$) (Figure 2).

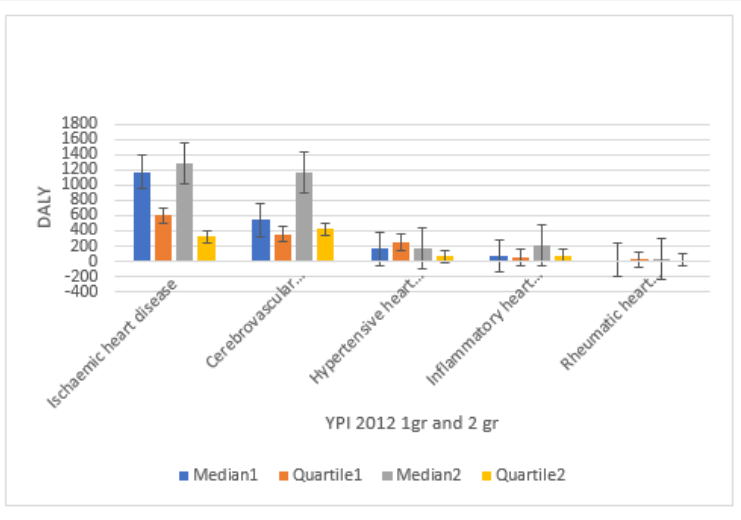

Figure 2: Burden of CVD in Group 1 and Group 2 countries.

There were no statistical differences in group 1 of countries from group 2 for the burden of Cirrhosis of the liver (p = 0.59). There were no statistical differences in group 1 of countries from group 2 for the burden of Nephritis and nephrosis (p = 0.17). There were no statistical differences in group 1 of countries from group 2 of the burden of Self-inflicted injuries (p = 0.26) (Table 2).

Analysis of the Impact of Risk Factors on the Burden of Cardiovascular Disease Using Multiple Linear Regression Analysis

The burden of cardiovascular disease was investigated as a dependent variable. A group of 12 types of comorbid diseases was used as independent variables; MS predictors; daily consumption of alcoholic beverages (AB) (strong alcohol, wine and beer, AB amount,% AB); group of Daily levels of food consumption (Red meat, Fats, Animals, Fish amount, Grains and legumes, Oil amount, FD amount, AB amount); The quality of life (Index of human development, Ecological efficiency index, Access to the street. Medicine, Access to clean water, Access to clean Aair); Energy, Proteins, Fats (kcal / person / day) 1990-92; 2003-05. The research results are presented in (Table 3).

Effect of independent variables on the dependent variable for the burden of cardiovascular disease

Panic disorder, Self-inflicted injuries, and Cirrhosis of the liver (R1 0.760; R2 0.578) had a statistically significant effect on CVD DALYs from 12 comorbid diseases. A unit increase in the independent variable Panic disorders (by 1 DALY) was accompanied by an increase of 422 DALYs in CVD (p ≤ 0.001). The effect of Self-inflicted injuries was 2 DALYs (p ≤ 0.001). Influence of Cirrhosis of the liver -1 DALYs (p ≤ 0.001). Thus, comorbid diseases caused an increase in CVD DALYs. R2 = 0, 578 shows that more than 50% of the variability in DALY CVD can be caused by some comorbid disorders (Table 3). The statistically significant effect of the remaining independent variables was more modest. They provided about 20% of the DALY CVD variability (Table 3) (Figure 3).

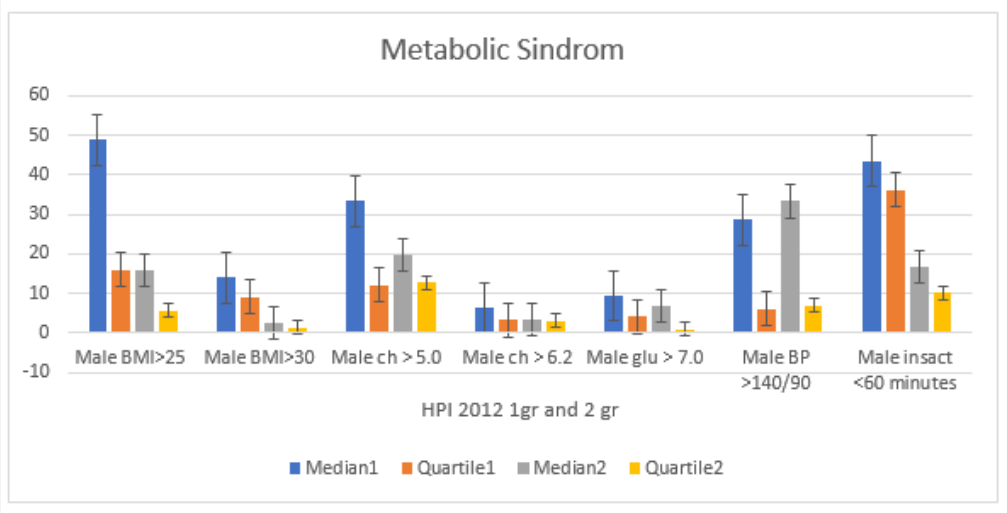

Figure 3: Predictors of metabolic syndrome in countries 1 and 2.

Table 3: Examine the effects of risk factors (explanatory variables) on cardiovascular morbidity (dependent variable) using predictive multiple linear regression analysis.

DV	IndV	R1	R2	b*	b	F	t(152)	p-value	DV1	DV2	Effect
Dependent variable	Independent variable										
Cardiovascular diseases	The quality of life										
	index of human development	0,481	0,232	-0,976	-7632,66	F(2,1)=19	-5,55	0,000	3 134	3 126	8 DALY
Cardiovascular diseases	DALY NCD	comorbid diseases									
	Panic disorders	0,760	0,578	0,630	421,96	F(3,1)=70	11,72	0,000	3 306	3 728	422 DALY
	Self-inflicted injuries			0,326	2,02		5,65	0,000	3 306	3308	2 DALY
	Cirrhosis of the liver			0,204	1,30		3,54	0,001	3 306	3307	1 DALY

Cardiovascular diseases	MS	7 predictors									
	Male ch > 5.0 (mmol / L)	0,452	0,205	-0,331	-32,93	F(2,1)=20	-4,60	0,000	3 306	3 273	33 DALY
	Male AD >140/90(mm Hg			0,338	78,44		4,70	0,000	3 306	3 385	81 DALY
Cardiovascular diseases	TDC										
	Grains and legumes	0,487	0,237	0,280	3,69	F(2,1)=24	3,92	0,000	3 296	3 299	3 DALY
	FS amount			-0,449	-6,89		-6,29	0,000	3 296	3 289	7 DALY
Cardiovascular diseases	AB										
	Wine 2003-05	0,479	0,230	-0,217	-10,66	F(3,1)=15	-2,49	0,014	3 307	3 296	7 DALY
	Beverages, Alcoholic 2003-05			0,336	50,23		4,04	0,000	3 307	3 357	50 DALY
	% AB			-0,381	-109,93		-3,89	0,000	3 307	3 197	110 DALY
Cardiovascular diseases	Energy (kcal / person / day)1990-92										
	Fats (g/person / day) 1990-02	0,451	0,204	-0,451	-14,82	F(1,1)=33	-5,79	0,000	2 998	2 983	15 DALY
Cardiovascular diseases	Energy (kcal / person / day)1990-05										
	Fats (g/person / day) 2003-05	0,317	0,101	-0,317	-13,59	F(1,1)=17	-4,18	0,000	3 306	3 293	13 DALY

R1 -	correlation coefficient
R2 -	coefficient of determination
b* -	standardized ratio
b –	regression coefficient
Dependent variable – DV Independent variable - IV	

From the group of characteristics the quality of life, the independent variable Index of human development (IHD) (R1 - 0.4814 and R2 - 0.232) ($p \leq 0.003$) had the greatest influence on CVD. An increase in IHD per unit was accompanied by a decrease in 8 DALYs burden CVD (Table 3). Of the 4 predictors of MS CVD was most influenced by the independent variables chol> 5.0 (mmol / L) and BP> 140/90 (mm Hg (R 1 = 0.452, R 2 = 0.205) ($p \leq 0.001$). measurement of hyperlirademia was accompanied by a 33 DALY burden CVD decrease. was accompanied by an 81 DALY increase in the dependent variable burden CVD (Table 3).

From the group of daily food consumption levels (TDC), the greatest influence on the dependent variable burden CVD was exerted by Grains and legumes and FS amount (R1 = 0.487; R2 = 0.237) ($p \leq 0.001$). A unit increase in the independent variable Grains and legumes was accompanied by an increase in the dependent variable burden CVD by 3 DALYs. A unit increase in the independent variable FS amount was accompanied by a decrease in CVD burden by 7 DALYs (Table 3). From the group of daily consumption levels of alcoholic beverages (AB), the independent variables Wine, Beverages, Alcoholic and% AB (R1 = 0.479; R2 = 0.230) ($p \leq 0.002$) had the greatest influence. Increases per unit of independent variables Wine, Beverages, Alcoholic and% AB were accompanied by a decrease in CVD burden by 7 DALYs. an increase in burden CVD by 50 DALYs and a decrease in burden CVD by 110 DALYs, respectively (Table 3).

Of the independent variables: Energy, Proteins, and Fats, the independent variable Fats (g / person / day) (R1 = 0.4512; R2 = 0.204) ($p \leq 0.001$) had the greatest effect on the dependent variable burden CVD. A unit increase in the independent variable Fats caused a 15 DALYs decrease in CVD burden (Table 3).

Analysis of the daily levels of products in the 1st and 2nd group of countries

The total daily food consumption (TDC) in the 1st group of countries was 2 times higher than in the 2nd group of countries ($p \leq 0.001$) (Table 4). Consumption of products of animal origin (AP

amount) in the 1st group of countries was 2.2 times higher than the 2nd group of countries ($p \leq 0.001$). Consumption of grains and vegetables (GV amount) in group 1 was 1.6 times higher than group 2 ($p \leq 0.001$). Consumption of fruits and sweeteners (FS amount) in group 1 was 5 times higher than group 2 ($p \leq 0.001$). Consumption of alcoholic beverages (AB amount) in the 1st and 2nd groups of countries did not differ statistically ($p = 0.08$).

But the average indicator was 3 times higher in group 1

The energy of animal products (AP amount) was 3 times higher in the 1st group of countries ($p \leq 0.001$). The total energy consumption was 1.3 times higher than the 2nd group of countries ($p \leq 0.001$) (Table 4).

The Discussion of the Result

In accordance with the set goal and objectives, the conducted studies found that in happy countries, in comparison with unhappy ones, the per capita income was 4 times higher and the happiness index was 3 times higher. In happy countries, the quality of life was on average 3 times higher, prosperity and health were 1.6 times higher. Life expectancy was 23 years higher in happy countries. This was consistent with the data of other authors [29]. A high quality of life and income ensured a higher (in 2 slots) level of food consumption in happy countries. In the happy countries, the consumption of red meat, pulses, fruits was 3 times higher and the consumption of hard alcohol was 9 times higher. As a result of the higher consumption of individual foods in the happy countries, they consumed 2 times more energy from animal products and 1.3 times the total energy. High consumption of foods and nutrients in happy countries was accompanied by higher (2 times) indicators of predictors of metabolic syndrome. In happy countries, there were 2.5 and 4 times more men with overweight and obesity, 2 times more men with hyperlipidemia, hyperglycemia and low physical activity.

Table 4: Predictors of metabolic syndrome in countries 1 and 2.

	p-value	Mean1	Median1	Quartile1	Mean2	Median2	Quartile2
Total CL	0,0001	1298	1212	409	662	557	347
Bovine Meat2003-05	0,2628	34	20	20	19	19	23
Pigmeat2003-05	0,0079	19	10	19	9	2	7
Mutton & Goat Meat2003-05 0,1354		6	2	4	6	3	8
Red meat	0,0381	59	44	43	33	29	39
Poultry Meat2003-05	0,0000	56	46	34	12	8	12
Meat, Other2003-05	0,0055	31	33	20	17	15	22
Offals, Edible2003-05	0,2455	7	5	4	5	5	7
Milk, Whole2003-05	0,0191	173	172	144	75	37	139
Milk, Skimmed2003-05	0,0114	20	9	28	13	3	6
Eggs2003-05	0,0001	16	17	9	5	2	3
Cheese2003-05	0,0045	7	5	6	3	0	3
Butter, Ghee2003-05	0,0137	2	1	2	1	0	1
Fats, Animals, Raw2003-05	0,0815	4	4	5	3	2	3
Freshwater Fish2003-05	0,7400	7	5	10	7	5	8
Demersal Fish2003-05	0,1409	4	2	8	3	0	2
Pelagic Fish2003-05	0,2808	9	6	7	8	3	12
Marine Fish, Other2003-05	0,3195	7	2	5	2	1	3
Molluscs, Other2003-05	0,0055	2	1	3	0	0	0
Fish amount	0,2540	30	18	31	20	18	18
Wheat2003-05	0,0032	142	89	120	54	35	73
Rice2003-05	0,0144	128	107	101	51	46	51
Maize2003-05	0,6041	98	68	145	114	119	94
Barley2003-05	0,4068	1	0	1	2	0	0
Beans 2003-05	0,0971	19	15	34	12	2	19
Rye2003-05	0,9212	1	0	1	5	0	1
Nuts2003-05	0,8519	2	1	4	2	1	2

Grains and legumes	0,0002	390	378	96	238	250	86
Potatoes2003-05	0,0107	40	32	46	31	7	19
Tomatoes2003-05	0,0037	63	44	51	16	10	18
Onions2003-05	0,0004	17	14	18	6	2	6
Vegetables, Other2003-05	0,0421	123	106	121	66	57	40
Soyabean Oil2003-05	0,0011	12	10	17	2	0	3
Sunflowerseed Oil2003-05	0,1914	3	1	3	2	0	1
Olive Oil2003-05	0,2211	0	0	1	0	0	0
Oil amount	0,0015	16	11	19	4	1	9
% Oil	0,0251	1	1	1	1	0	1
Oranges2003-05	0,0019	51	43	43	10	9	8
Lemons, Limes2003-05	0,0037	9	6	15	2	1	3
Apples2003-05	0,0009	12	9	17	5	0	3
Honey2003-05	0,9835	0	0	1	1	0	1
Sugar (Raw Equivalent)2003-05	0,0079	87	98	44	37	20	47
Coffee2003-05	0,0035	5	4	5	2	0	2
Tea2003-05	0,1776	4	3	0	2	3	2
Beverages, Alcoholic2003-05	0,0035	9	9	6	4	1	4
Wine2003-05	0,6459	8	2	5	3	1	3
Beer2003-05	0,1354	51	42	66	43	16	51
TCL g / person / day	0,0001	1298	1212	409	662	557	347
AP amount	0,0006	404	400	314	187	126	163
GV amount	0,0001	649	565	238	361	346	114
FD amount	0,0002	168	165	114	56	33	61
AB amount	0,0779	67	52	71	51	18	47
% AP	0,1985	31	32	20	26	24	19
% GV	0,0680	50	49	19	60	61	28
% FD	0,0090	13	13	7	8	6	7
% AB	0,8682	5	4	5	6	4	7
AP Energy%2003-05	0,0011	15	15	8	8	6	7
AP Protein%2003-05	0,0025	39	39	20	24	19	22
AP Fat%2003-05	0,0005	43	42	13	24	24	17
Carboh%E 2003-05	0,3401	67	68	11	70	69	5
Proteins%E 2003-05	0,7875	10	10	1	10	10	1
Fats%E 2003-05	0,1985	23	23	9	20	20	4
Energy (kcal / person / day)2003-05	0,0003	2745	2670	590	2177	2070	380
Proteins (g/person / day) 2003-05	0,0084	71	67	25	56	49	20
Fats (g/person / day) 2003-05	0,0045	69	67	31	49	49	13
2003-05 E%	0,0019	52	51	17	37	37	17
2003-05 P%	0,0310	56	54	19	46	44	17
2003-05 F%	0,0152	89	89	13	81	80	11
mDailyAge	0,7859	20	17	18	20	15	19
fDailyAge	0,2367	7	4	8	5	1	7

Legend
Dietary Pattern DP
Daily consumption levels TDC

Overall consumption
“animal products” - AP
“grains, vegetables” - CV
“fruits, sweeteners” - FS
“alcoholic Beverages” - AB
gram / person / day
kcal / person / day
Diversification
Total Energy kcal / person / day
% Carbohydrates
% Proteins
% Fat
% animal Energy
% Animal Proteins
% animal Fat
Bonferroni correction p≤0,025

Obesity has been shown to be an important risk factor for NCDs, including cardiovascular disease and cancer [30,31]. However, in happy countries, there were 1.2 times fewer men with high blood pressure. Happier countries consistently report lower levels of hypertension. This not only potentially confirms differences in the measurement of happiness across countries, but also suggests that blood pressure readings can be valuable as part of a national well-being index [32]. In our studies in happy countries, the burden of cardiovascular disease was 1.5 times lower than in unhappy countries. In happy countries, in comparison with unhappy ones, there was a lower overall mortality and overall morbidity. This was consistent with the results of other researchers [33].

The results of our studies were similar to those published by us earlier [14]. In [14], we used the 2016 Happiness Index. The income of the happy countries was 20 times higher than that of the unhappy countries [14]. The burden of cardiovascular disease in happy countries was 2.6 times lower than in unhappy countries. Predictors of metabolic syndrome and food consumption levels were 4 times higher in the happy countries [14]. The results of our study of multiple linear regression analysis models showed that an increase per unit of measure (1 DALY) in independent variables of comorbid diseases: the burden of panic attacks, suicide, or cirrhosis of the liver, may be accompanied by an increase in the burden of cardiovascular diseases (dependent variable) by 422, 2 and 1 DALYs, respectively (p≤0.001).

An increase per unit of measurement (1 g) in red wine consumption was accompanied by a decrease in the burden of cardiovascular disease by 7 DALYs (p≤0.001). But an increase in hard alcohol consumption by (by 1 g) caused an increase in the burden of cardiovascular diseases by 50 DALYs (p≤0.001). A similar effect was caused by an increase in the consumption of pulses by (by 1 g). The burden of cardiovascular disease in this case increased by 3 DALYs (p≤0.001). At the same time, an increase in fruit consumption (by 1 g) is accompanied by a decrease in the burden of cardiovascular diseases by 15 DALYs (p≤0.001). Thus, as a result of our research, it has been established that the risk factors for the burden of cardiovascular diseases, apparently, are a low Happiness Index, a low quality of life, and a high consumption of strong alcohol and carbohydrates.

Modern research in the prevention of cardiovascular diseases recommend lifestyle changes, the transition to a healthy diet; maintaining a low body mass index; to give up smoking; and regular physical activity of moderate intensity [34]. Our studies in recent years indicate that risk factors for NCDs are not unambiguous for the main NCDs, which make up almost 80% of NCDs [14,35,36]. Currently, there is no consensus in society regarding the harm and benefits of consuming alcoholic beverages [37-39]. According to Aristotle, the more emotions we want to experience, the happier we are. Happiness involves experiencing emotions that feel right, regardless of whether people feel good [40].

It has been shown that positive emotions in early and middle adulthood are associated with improvement in cardiovascular diseases over several decades. Baseline cardiovascular disease was also associated with stronger positive emotions during follow-up [41]. The relationship between 2 different aspects of positive well-being was studied: affective well-being and eudaimonia with the progression of aortic stiffness, an indicator of subclinical cardiovascular disease. Higher eudemonic well-being by 1 SD was associated with lower baseline progression of aortic stiffness in males (β = -0, 100 m / s [95% CI = -0.169 to -0.032]), regardless of social, behavioral and biological factors. In older men, higher levels of eudemonic well-being were associated with lower long-term levels of arterial stiffness.

These results support the notion that the model of the relationship between positive well-being and cardiovascular health outcomes includes eudemonic rather than affective well-being and is gender-dependent. (Eudemonic well-being is a quality of life that manifests itself in the development of personal potential, personal expressiveness and internal determination) [42]. Feelings of happiness, sadness and negative life events were associated with the diameter of the retinal vessels. high levels of psychosocial stress in childhood adversely affect the diameter of the retinal vessels, potentially reflecting the microvessels of the heart and brain [43].

A higher BMI has been found to be associated with lower subjective well-being. this research provides additional motivation to combat the obesity epidemic by pursuing subjective well-being [44]. It was found that in acute coronary syndromes, especially in acute myocardial infarction, patients with non-alcoholic fatty liver disease have a poor prognosis compared to patients without non-alcoholic fatty liver disease [45]. A study of mortality data from 1969 to 2014 concluded that by 2020 the number of deaths associated with heart disease will decrease by 21.3% for men and 13.4% for women. It can be assumed that the forecasts will come true. Heart disease significantly depends on GDP, which is growing steadily in developed countries [46]. It can be concluded that the Happiness Indices open up new possibilities for studying the mechanisms of influence of risk factors on CVD and NCD.

Conclusion

Countries with a high Happiness Index have been found to have lower overall mortality and morbidity and a lower CVD burden compared with a low Happiness Index due to higher quality of life, better health care and food security. The index of happiness can be considered a subtle and sensitive tool for assessing not only social life, but also human health.

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Conflict of Interest

No conflict of interest.

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