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Research Article

Analysis of the Burden of Cardiovascular Diseases, Prostate and Breast Cancer and Alcoholism in Countries with High and Low Daily Alcohol Consumption

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Abstract

Aims: To examine the effect of alcoholic beverage consumption on metabolic syndrome, the burden of cardiovascular disease, prostate cancer, breast cancer and alcoholism in 158 countries in 2004.

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

Results: Analysis showed that the maximum and minimum daily alcoholic beverage consumption (CAB) in the dietary patterns of 158 countries differed 108-fold in 2004, with 342 and 2.6 grams per person, without regard to gender or age ($p \leq 0.001$). 20 countries with maximum CAB compared to 20 countries with minimum CAB had 14 times higher per capita income ($p \leq 0.001$); 3 times higher prostate cancer burden ($p \leq 0.001$); 2 times higher breast cancer burden ($p \leq 0.001$); 8 times higher burden of alcoholism in men, 18 times in women ($p \leq 0.001$); 6 times lower burden of cardiovascular disease in men, 8 times in women ($p \leq 0.001$). Countries with maximum CAB had 2-fold higher predictors of metabolic syndrome, MS (% of men and women per country) ($p \leq 0.001$). The need for further research on the nature of the associations and gender differences in the associations between CAB and NCD, as well as issues of NCD classification, was identified.

Conclusion: The current literature suggests a causal association between CAB and NCD as a global risk factor for NCD. Further research is needed to find the nature of this association and to develop effective methods of prevention.

Keywords: *NCD; MS; Alcoholic Beverages; Hypertension; Ischemic; Cerebrovascular Heart Disease; Prostate and Breast Cancer; Alcoholism*

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; P:

Person; QOL: Quality of Life; QR: Quartile Range; R1: Multiple Correlation Coefficient; R2: Coefficient of Determination; RE: Rating Educations; SNP: SNP Market - Online Store of Electronics and Equipment; SLC6A4: Encodes a Sodium-Dependent Transmembrane Transporter a Neurotransmitter Serotonin Reuptake Protein; TDC: Total Daily Consumption; UN: United Nations; UV: Ultraviolet Level; WHO: World Health Organization

Introduction

In 2016, 71% of the world's 56.9 million deaths were due to NCDs. The lowest risk of dying from NCDs in 2016 was in high-income countries in Asia-Pacific region, Western Europe, Australasia, and Canada. The highest risk of death from NCDs was in low- and middle-income countries, especially in sub-Saharan Africa, and for men in Central Asia and Eastern Europe [1,2].

In most countries, people with low socioeconomic status have a higher risk of dying from NCDs than in more affluent communities. Alcohol consumption and smoking, high blood pressure and a number of other NCD risk factors are often higher in groups with low socioeconomic status than in groups with high socioeconomic status [3,4].

NCDs, including cardiovascular diseases (CVD), are the leading cause of death worldwide. The incidence of NCDs is increasing rapidly due to increasing risk factors: obesity, hypertension, dyslipidemia, low physical activity, consumption of alcohol and tobacco. Risk factors are tracked from childhood to adulthood [5].

Alcohol consumption is a global risk factor for NCD mortality and morbidity. There is much debate over the findings of the complex relationship between alcohol consumption and the leading cause of death from coronary heart disease (CHD). The epidemiologic evidence for the beneficial effects of low alcohol consumption is strong and supported by experimental data (up to 1 drink per day for women and 1 - 2 drinks per day for men). However, data on average alcohol consumption are insufficient to describe the association between alcohol consumption and CHD [6-10].

Alcohol has a hormetic physiological behavior that leads to either an increased or decreased risk of cardiovascular disease depending on the amount consumed, frequency of consumption, nature of consumption, and type of alcoholic beverage consumed. In addition to new evidence linking low and moderate alcohol consumption to reduced cardiovascular disease risk, specific amounts of safe drinking, type of alcoholic beverage, and age, sex, and genetic/ethnic differences in alcohol consumption remain unanswered [11,12].

The benefits of moderate wine consumption for health have been studied over the past decades, first in observational studies and more recently experimentally and in randomized controlled studies. Proposed biological pathways include antioxidant, lipid-regulating, and anti-inflammatory effects. However, there are no definitive recommendations regarding moderate wine consumption [13,14].

The study of SNP genes including alcohol behavior determinants DRD3 (rs167770), DRD2 (rs10891556), and SLC6A4 (rs140701) may contribute to individualizing the risk of alcohol consumption [15].

The crucial role of nutrition in health was known several hundred years ago. In modern society, the nutrition often plays a secondary role. However, 30-50% of the cases of different types of NCDs due to common risk factors can be prevented by following a healthy diet and an active lifestyle [16,17].

In Finland and other European countries with traditionally high alcohol consumption, successful NCD burden reduction programs were implemented by 2018 thanks to multidisciplinary approaches [18].

The World Health Organization (WHO) reported that from 2000 to 2016, GDP growth in developed countries halved the incidence of infectious diseases and reduced global consumption of strong alcohol by 7-10%. However, NCDs continue to grow and NCDs are expected

to increase significantly by 2050, mainly cardiovascular diseases, diabetes mellitus and lung diseases. In this regard, the UN and the WHO in 2014 adopted a declaration to reduce the burden of NCDs by one third by 2030 [19]. Thus, despite the great interest of researchers in the issue of the influence of alcohol on NCD, the associations of this risk factor with certain types of NCD remain unclear.

Purpose of the Study

To investigate the effect of maximum and minimum daily consumption of alcoholic beverages in the dietary pattern on the burden of cardiovascular, prostate and breast cancer, alcoholism and metabolic syndrome (MS) in men and women worldwide in 158 countries of the world.

Materials and Methods

Study design: Statistical analysis of observations.

For the purposes of this study, a database of the total burden of NCDs, cardiovascular disease, prostate cancer, breast cancer, and alcoholism (ICD-10 codes - is the 10th revision of the International Statistical Classification of Diseases) was generated for 20 countries with maximum daily alcohol consumption (CAB) - Group 1, and for 20 countries with minimum CAB - Group 2 (Country List 1).

Disease burden of disease (DALY) data for men and women in 20 countries, standardized by sex and age, were selected from the 2004 GBD database [20].

To characterize the "quality of life" (QOL) in the countries a number of indicators were used: income per capita or gross domestic product (GDP) in 2000 - 2016 (US dollars per person per year) [21]; the geographical position of the countries by latitude and the level of ultraviolet radiation in the capital (UV) (J/m^2 2004) [22]; life expectancy for men and women (LE) [23]; access to good health care, clean water, and clean air [24]; Happiness Index (IH) in 2016 [25]. Body mass index (BMI) ≥ 25 kg/m^2 and ≥ 30 kg/m^2 have been studied as predictors of metabolic syndrome (MSP) - the percentage of men and women in the country who are overweight and obese; the % of population with blood cholesterol (Chol ≥ 5.0 mmol/L and ≥ 6.2 mmol/L); blood glucose level (Glu ≥ 7.0 mmol/L); blood pressure (BP ≥ 140/90 mm Hg); low physical activity (LPA) ≤ 60 min/day walking [26].

The daily level of food consumption (TDC) (g/person/day) (50 types of products) for each country was selected from the FAO database for 1992 - 2005 [27].

The nutritional structure (NS) of the countries is presented in the form of 4 blocks in absolute and percentage terms (TDC): 1 - products of animal origin (AP); 2 - cereals and vegetables (CV); 3 - fruits and sweeteners (FS); 4 - alcoholic beverages (AB) [27].

Statistical analysis of the study results was performed using Mann-Whitney-Wilcoxon U-criterion. U is the numerical value of the Mann-Whitney test.

The central tendency in the sample data distribution was represented by the median with a quartile range and a mean with a standard deviation. The variance of the data in the samples was estimated using a quartile range (QR) between the first and third quartiles, that is, between the 25th and 75th percentiles.

The level of statistical significance, reflecting the degree of confidence in the conclusion about the differences in the indicators of groups 1 and 2 countries: two levels of accuracy were estimated: (1) $p \leq 0.01$, 1% error probability; (2) $p \leq 0.05$, 5% error probability. The Bonferoni correction was also used to assess the significance of the study results, taking into account the two hypotheses $p \leq 0.025$ for multiple comparisons.

NCD burden and MSP dependence on TDC products, including CAB, were analyzed using Multiple Linear Regression Analysis for independent variables (LMA).

Standardized NCD burden of disease indicators: cardiovascular, prostate cancer, breast cancer, and alcoholism from 2004 for 158 countries [20] and MSP predictors [26] were used as the dependent variable, LMA.

Daily blocks of TDC: AP (animal products), CV (cereals and vegetables), FS (fruits and sweeteners) and AB (alcoholic beverages) for 158 countries (2003 - 2005) were used as predictors (independent variables) [27]. A stepwise procedure of inclusion of 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), coefficient of determination (R2), F-distribution, t-criteria for regression coefficients, and residuals analysis. The residuals in all models had a normal distribution. Analysis of the values and signs of the coefficients of β* and β regression equations allowed us to estimate the contribution of UP of different products to the values of the specified types of NCD and MS predictors.

All calculations were performed using the program STATISTICA (version 13).

Results

Quality of life in groups 1 and 2 of countries

Per capita income was 14 and 9 times higher in group 1 compared to group 2 in 2000 and 2016 ($p \leq 0.001$), ($p \leq 0{,}001$).

Group 1 is located 30° north of group 2 ($p \leq 0.001$).

Group 1 is located in the 1st time zone, Group 2 is located in the 4th time zone (64° east longitude) ($p \leq 0.001$).

Group 1 had 2.7 times lower levels of UV (J/m^2) compared with group 2 ($p \leq 0.001$).

Group 1 has 6 times higher Prosperity rating ($p \leq 0.001$); 2 times higher Happiness Index ($p \leq 0.001$); 2 times lower corruption ($p \leq 0.001$); 6 times higher peacefulness ($p \leq 0.001$); 2 times higher Human Development Index ($p \leq 0.001$); 3 times higher Environmental Efficiency ($p \leq 0.001$); 1.4 times better health care ($p \leq 0.001$); 3 times cleaner water ($p \leq 0.001$); 12 times cleaner air ($p \leq 0.001$); 13 times higher life expectancy for men and 14 times for women ($p \leq 0.001$).

NCD morbidity in groups 1 and 2

In group 1, the cumulative burden of NCD was 1.4 times lower in men and 1.5 times lower in women than in group 2 ($p \leq 0.001$).

Group 1 had 6 times lower burden of hypertensive heart disease in men and 10 times lower burden of hypertensive heart disease in women than group 2 ($p \leq 0.001$).

The burden of ischaemic heart disease was 2-fold lower in group 1 in men and 3-fold lower in women than in group 2 ($p \leq 0.001$).

Group 1 had a 2.4-fold lower burden of cerebrovascular disease in men and 2.5-fold lower in women than group 2 ($p \leq 0.001$).

In group 1, men had a 3.3-fold higher burden of prostate cancer; women had a 1.5-fold higher burden of breast cancer than in group 2 ($p \leq 0.001$).

Group 1 had an 8-fold higher burden of alcohol use disorders in men and 18-fold higher burden of alcohol use disorders in women than group 2 ($p \leq 0.001$).

Metabolic syndrome (MS) in groups 1 and 2

Percentage in countries of men and women who are overweight and obese, hyperlipidemic, hyperglycemic, and have high blood pressure

In group 1, the % of overweight men (BMI ≥ 25) was 3 times, the % of women was 2 times higher than in Group 2 ($p \leq 0.001$), ($p \leq 0.03$*), with Bonferroni correction.

In group 1, the % of men with obesity (BMI ≥ 50) was 6.3 times higher, the % of women with obesity was 3.6 times higher than in group 2 ($p \leq 0.001$), ($p \leq 0.022$).

In group 1, the % of men with hyperlipidemia (Col ≥ 6.2) was 3.6 times higher, the % of women with hyperlipidemia (Col ≥ 6.2) was 3.1 times higher than in group 2 ($p \leq 0.001$), ($p \leq 0.001$).

In group 1, the % of men with hyperglycemia was 1.4 times higher, the % of women was 1.1 times higher than in group 2 (Glu ≥ 7.0) ($p \leq 0.001$), ($p = 0.9$).

In group 1, the % of men with high blood pressure (BP ≥ 140/90) was 1.3 times, the % of women was 1.2 times higher than in group 2 ($p \leq 0.001$), ($p \leq 0.001$).

Nutrition patterns in groups 1 and 2

Levels of alcohol consumption: Spirits, wine, and beer (g/person/day) in group 1 and group 2

Group 1 had 23 times higher consumption of alcoholic beverages compared to group 2 ($p \leq 0.001$).

Group 1 had 654 times higher consumption of wine compared to group 2 ($p \leq 0.001$).

Group 1 compared to group 2 had 137 times higher consumption of beer ($p \leq 0.001$).

Group 1 had 132 times higher total AB consumption ($p \leq 0.001$) compared to group 2.

There was a 50-fold higher % AB amount in TDCs in group 1 compared to group 2 ($p \leq 0.001$).

Daily food consumption levels - TDC (grams/person/day)

In group 1, TDC was 2.4 times higher than in group 2 ($p \leq 0.001$).

Group 1 had 3.3 times higher consumption of products of animal origin (AP) than group 2 ($p \leq 0.001$).

Group 1 had 1.3 times higher consumption of cereals and vegetables (CV) than group 2 ($p \leq 0.010$).

Group 1 had 3.9 times higher consumption of fruit and sweeteners (FS) than group 2 ($p \leq 0.001$).

Group 1 had 132 times higher consumption of alcoholic beverages (AB) than group 2 ($p \leq 0.001$).

Percentage composition of TDC units in group 1 and group 2

In group 1, the % of products of animal origin (AP) was 1.4 times higher than in group 2 ($p \leq 0.027$*), Bonferroni correction.

In group 1, the % of cereals and vegetables (CV) was 1.7 times lower than in group 2 ($p \leq 0.001$).

In group 1, the % of fruits and sweeteners (FS) was 1.5 times higher than in group 2 ($p \leq 0.001$).

In group 1, the % of alcoholic beverages (AB) was 50 times higher than in group 2 ($p \leq 0.001$).

Nutrients

Total macronutrients in groups 1 and 2

In group 1, the level of total energy (kcal/person/day) was 1.4 times higher than in group 2 ($p \leq 0.001$).

In group 1, the % of total carbohydrates in total energy was 1.3 times lower than in group 2 ($p \leq 0.001$).

In group 1, the % of total proteins in total energy was 1.1 times higher than in group 2 ($p \leq 0.004$).

In group 1, the % of total fats in total energy was 1.6 times higher than in group 2 ($p \leq 0.001$).

Macronutrients of animal products (AP) in groups 1 and 2

In group 1, the % of energy of products of animal origin (AP) in the total energy was 3.1 times higher than in group 2 ($p \leq 0.001$).

In group 1, the % of the energy of animal proteins in the energy of total proteins was 2.3 times higher than in group 2 ($p \leq 0.001$).

In group 1, the % of energy of animal fats in energy of total fats was 2.1 times higher than in group 2 ($p \leq 0.001$).

In group 1, diversification of total energy was 2 times higher than in group 2 ($p \leq 0.001$).

Analysis of the dependence of NCD burden and MS predictors on daily levels of TDC block consumption in groups 1 and 2 using linear multiple regression analysis (MRA)

An MRA was conducted on the effects of the independent variables: AP - animal products, CV - cereals and vegetables, FS - fruits and sweeteners, and AB - alcoholic beverages on the dependent variables: NCD, Hypertensive heart disease, Ischaemic heart disease, Cerebrovascular disease, Prostate cancer, Breast cancer, Alcohol use disorders and MS predictors: BMI > 25, BMI > 30, Glu > 7.0, total energy, animal products energy (Table 3).

It was found that the highest correlation (R1) and determination (R2) coefficients were with the influence of: AP on Animal products Energy - (0.9244; 0.854); AP on Total Energy kk/p/d - (0.906; 0.822); AP on m BMI > 25 - (0.813; 0.661); AP on m BMI>30 - (0.777; 0.603); CV on NCD - (0.754; 0.569). This indicates that more than 60% of the variability of these dependent variables may be determined by animal products - AP ($p \leq 0.001$).

Using the MPA, we found that a 10-gram increase in the independent variable AB (alcoholic beverages) was accompanied by a 0.5% decrease in NCD burden and a 4% decrease in Hypertensive heart disease burden, and increase in m Alcohol use disorders a 3,0% ($p \leq 0.001$) (Table 3).

A 10-gram increase in the independent variable FS (fruit, sweeteners) caused a 1.3% decrease in the burden of NCD as well as a 3.7% ($p \leq 0.001$) decrease in the burden of Ischaemic heart disease and Cerebrovascular disease (Table 3).

A 10-gram increase in the independent variable CV (cereals and vegetables) was accompanied by a 0.1% decrease in NCD burden and a 1.5% decrease in Prostate cancer burden ($p \leq 0.001$) but a 1.0% increase in Ischaemic heart disease burden ($p \leq 0.001$) (Table 3).

A 10-gram increase in the independent variable AP (animal products) led to a 2% increase in the dependent variables Animal Energy; Total Energy kk/p/d by 0.2%; MS predictors BMI > 25 and BMI > 30 by 0.7%; and Breast cancer burden by 0.4% ($p \leq 0.001$) (Table 3).

Variable	U	Z	p-value	Median1	Quartile1	Median2	Quartile2
The quality of life							
IPC 2000	79,00	3,26	0,0011	26569	12644	1895	5921
IPC 2016	73,00	3,27	0,0011	44718	18730	4730	9376
lat°	3,00	5,32	0,0000	50	7	20	16
UV rad J/m 204	-	- 5,40	0,0000	1798	533	4714	1404
lon°	70,00	- 3,50	0,0005	15	18	64	53
Prosperity Rating	7,00	- 5,21	0,0000	16	17	101	59
HPI 2016	22,00	4,60	0,0000	6,889	1,271	4,524	1,276
RK 2016	9,00	- 4,98	0,0000	17	28	131	51
Rpful	5,00	- 4,85	0,0000	17	18	110	43
IHD	16,50	4,95	0,0000	0,954	0,054	0,598	0,225
EPI	11,00	5,02	0,0000	77	6	33	24
ASM 1990	19,00	4,69	0,0000	100	1	69	30
ACW 1990	17,50	4,63	0,0000	100	1	27	56
Air 2004	-	- 5,25	0,0000	0,000	1	118	271
Male life expectancy	38,00	4,37	0,0000	76	3	63	16
Female life expectancy	2,00	5,34	0,0000	81	2	67	18
DALY burden							
n NCD	61,00	- 3,75	0,0002	9841	1732	13593	2979
f NCD	7,00	- 5,21	0,0000	8743	1228	13418	3003
m Hypertensive heart disease	30,00	- 4,58	0,0000	41	42	256	340
f Hypertensive heart disease	7,00	- 5,21	0,0000	28	29	293	222
m Ischaemic heart disease	74,00	- 3,39	0,0007	907	556	1892	764
f Ischaemic heart disease	43,00	- 4,23	0,0000	346	255	1094	780
m Cerebrovascular disease	69,00	- 3,53	0,0004	381	318	918	439
f Cerebrovascular disease	54,00	- 3,94	0,0001	330	171	820	270
m Prostate cancer	64,00	3,67	0,0002	127	28	39	52
f Breast cancer	76,00	3,34	0,0008	298	83	203	102
m Alcohol use disorders	9,00	5,15	0,0000	832	316	110	179
f Alcohol use disorders	4,00	5,29	0,0000	183	68	10	22
Metabolic syndrome MS							
m BMI ≥ 25 m/h^2	62,00	3,72	0,0002	64	7	21	40

f BMI ≥ 25 m/h^2	115,00	2,09	0,0363 *	55	8	27	44
m BMI ≥ 30 m/h^2	63,50	3,68	0,0002	25	5	4	15
f BMI ≥ 30 m/h^2	115,00	2,29	0,0223	25	6	7	26
m Chol ≥ 6.2 mmol/liter	8,00	5,18	0,0000	18	7	5	4
f Chol ≥ 6.2 mmol/liter	-	5,40	0,0000	22	6	7	4
m Glu ≥ 7.0 mmol/liter	103,50	2,60	0,0094	11	2	8	3
f Glu ≥ 7.0 mmol/liter	199,00	- 0,01	0,9892	8	3	9	3
m BP ≥ 140/90 mm Hg	30,00	4,58	0,0000	47	6	36	6
f BP ≥ 140/90 mm Hg	49,00	4,07	0,0000	41	10	34	6

Table 1: *Comparative analysis of quality of life and burden NCD find MSP of 1 and 2 of countries differing in CAB levels (Manna Whitney U-criterion).*

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, female; DALY burden; Metabolic syndrome MC MS; Body mass index - BMI - m/h^2; Blood cholesterol - mmol/liter; Blood glucose mmol/liter; Arterial blood pressure - mm Hg; Bonferroni correction p ≤0.025.*

	U	Z	p-value	Median 1	Quartile 1	Median 2	Quartile2
Dietary Pattern DP							
“Alcoholic Beverages” - AB gram/person/day							
Beverages, Alcoholic	-	5,40	0,0000	16,4	12,50	0,7	1,00
Wine	-	5,40	0,0000	65,4	60,00	0,1	0,00
Beer	-	5,40	0,0000	259,8	61,00	1,9	1,50
AB amount	-	5,40	0,0000	341,6	85,50	2,6	2,00
AB % TDC	-	5,40	0,0000	15,1	3,31	0,3	0,28
Daily consumption levels TDC		gram/person/day					
TDC: amount gram/person/day	2,00	5,34	0,0000	2245	235	946	713
“Animal Products” - AP	12,00	5,07	0,0000	810	182	245	337
“Grains, Vegetables” - CV	05,00	2,56	0,0106	821	115	614	398
“Fruits, Sweeteners” - FS	18,00	4,91	0,0000	268	80	68	139
“Alcoholic Beverages” - AB	-	5,40	0,0000	341,6	85,50	2,6	2,00
TDC:%							
AP % TDC	18,00	2,20	0,0275	36	6	25	16
CV % TDC	26,00	- 4,69	0,0000	37	4	62	16
FS % TDC	92,00	2,91	0,0036	12	2	8	7
AB % TDC	-	5,40	0,0000	15,1	3,31	0,3	0,28
Common macronutrients							

Total Energy kcal/person/day	19,50	4,87	0,0000	3395	430	2435	760
Carboh % TE	8,00	- 5,18	0,0000	52	6	69	8
Proteins %TE	93,50	2,87	0,0041	12	2	11	1
Fats %TE	6,50	5,22	0,0000	36	6	22	8
Animal macronutrients							
Animal Energy % TE	2,50	5,33	0,0000	31	6	10	10
Animal Proteins % TP	3,50	5,30	0,0000	61	6	26	22
Animal Fat % TFat	16,00	4,96	0,0000	58	7	27	18
Diversification							
DE%05	0,50	5,38	0,0000	70	8	39	19

Table 2: *Comparative analysis of dietary patterns, including nutrients in groups of 1 and 2 of countries differing in CAB levels (Manna Whitney U-criterion).*

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.

DV	INV	R1	R2	b*	b	T	F	p	DV1	DV2	Effect %
m NCD	FS	0,615	0,378	-0,615	-17,02	-9,74	F(1,156) = 94,8	0,0000	13071	12901	98,7
f NCD	CV	0,754	0,569	-0,206	-1,631	-3,38	F(3,154) = 67,8	0,0009	11840	11823	99,9
	FS			-0,388	-9,440	-4,64		0,0000	11840	11745	99,2
	AB			-0,306	-6,506	-4,02		0,0001	11840	11775	99,5
m Hypertensive heart disease	AB	0,379	0,144	-0,379	-0,738	-5,11	F(1,156) = 26,1	0,0000	218	210	96,3
f Hypertensive heart disease	AB	0,503	0,253	-0,503	-0,883	-7,27	F(1,156) = 52,7	0,0000	225	216	96,0
m Ischaemic heart disease	CV	0,527	0,278	0,563	1,627	7,22	F(2,155) = 29,8	0,0000	1501	1517	101,0
	FS			-0,462	-4,107	-5,92		0,0000	1501	1460	97,3
f Ischaemic heart disease	CV	0,566	0,320	0,512	0,826	6,76	F(2,155) = 36,5	0,0000	820	828	100,9
	FS			-0,596	-2,956	-7,86		0,0000	820	790	96,3
m Cerebrovascular disease	FS	0,553	0,306	-0,553	-2,465	-8,30	F(1,156) = 68,8	0,0000	888	864	97,3
f Cerebrovascular disease	FS	0,694	0,482	-0,694	-3,022	-12,04	F(1,156) = 145,0	0,0000	808	778	96,3
m Prostate cancer	CV	0,495	0,245	-0,495	-0,155	-7,12	F(1,156) = 50,6	0,0000	132	130	98,5
f Breast cancer	AP	0,288	0,083	0,288	0,106	3,75	F(1,156) = 14,0	0,0002	252	253	100,4
m Alcohol use disorders	AB	0,441	0,194	0,441	1,789	6,14	F(1,156) = 37,6	0,0000	570	588	103,0

f Alcohol use disorders	AP	0,655	0,429	0,337	0,121	3,85	F(2,155) = 58,2	0,0002	94	95	101,0
	AB			0,369	0,303	4,21		0,0000	94	97	103,0
m BMI>25	AP	0,813	0,661	0,384	0,031	5,18	F(2,155) = 151,0	0,0000	42,5	42,8	100,7
	FS			0,478	0,101	6,45		0,0000	42,5	43,5	102,0
f BMI>25	FS	0,604	0,364	0,604	0,110	9,43	F(1,155) = 88,8	0,0000	46	47	102,0
m BMI>30	AP	0,777	0,603	0,367	0,014	4,57	F(2,155) = 117,8	0,0000	13,8	13,9	100,7
	FS			0,457	0,045	5,70		0,0000	13,8	14,2	102,8
f BMI>30	FS	0,547	0,299	0,547	0,067	8,15	F(1,156) = 66,4	0,0000	20,5	21,2	103,4
m glu > 7.0	AP	0,554	0,307	0,554	0,005	8,32	F(1,156) = 69,2	0,0000	9,3	9,4	101,0
Total Energy kk/p/d	AP	0,906	0,822	0,271	0,543	4,89	F(3,154) = 236,3	0,0000	2717	2722	100,2
	CV			0,320	0,547	7,99		0,0000	2717	2722	100,2
	FS			0,466	2,453	8,51		0,0000	2717	2741	100,9
Animal Energy %	AP	0,924	0,854	0,924	0,0339	30,18	F(1,156) = 910,6	0,0000	16,9	17,3	102,0

Table 3: *Investigate the effect of TDCm power supplies (AP, CV, FS, AB) (explanatory variables) on burden NCD, and MS predictors (dependent variables) using multiple linear regression analysis.*

Legend

NCD: Non-Communicable Diseases; TDC: Total Daily Food Intake (g/p/d); AP: Animal Products (g/p/d); D: Disability-Adjusted Life Year (DALY); CV: Grains, Vegetables (g/p/d); FS: Fruits, Sweeteners (g/p/d); AB: Alcoholic Drinks (g/p/d); DV1: Dependent Variable 1; DV2: Dependent Variable 2; Bonferroni amendment - p ≤ 0,025; R1: Correlation Coefficient; R2: Coefficient of Determination; b: Standardized Ratio; b: Regression Coefficient; DALY: Disability-Adjusted Life Years.*

Discussion

So, group 1 has several times more MS and alcohol consumption than group 2. In the 1st group of countries the population is mostly Christians. Group 2 is mostly Muslim. In some countries of group 1 the prohibition was periodically enacted (Iceland, Norway, Sweden, Finland, USA). In the second group of countries, prohibition on alcohol is permanent. Prohibition is accompanied by a decrease in overall mortality, as well as mortality from alcoholism, cardiovascular disease, liver cirrhosis and other diseases, suicide and trauma [28,29].

However, in our studies, the burden of cardiovascular disease was 6 to 11 times higher for men and women in Group 2 with low MS and alcohol consumption. Per capita income was 14 times lower in group 2 than in group 1. Literature data indicate that cardiovascular disease incidence is the highest in middle- and low-income countries, which is consistent with our results [1-4]. It can be assumed that the risk factors for cardiovascular diseases are low quality of life and its accompanying health, environmental and general development indicators of the countries, as well as nutritional deficiencies.

NCD risk factors were significantly higher in the 1st group of countries: obesity, hyperglycemia, alcohol consumption, which were accompanied by high burden of prostate and breast cancer and alcoholism, it was consistent with the literature data [5,30-35]. In the 21st century, researchers on the effects of alcohol on NCDs can be divided into two groups. Some researchers believe that alcohol is a carcinogen and insist on the absolute harm of alcohol [36-40]. Other researchers believe that alcoholic beverages in low doses improve health and protect against cardiovascular disease and diabetes [6-10]. Excessive doses of alcohol reduce resistance to cardiovascular disease and diabetes [11,12]. But optimal doses of alcohol have not yet been clearly established [13,14]. So far, prognostic methods for diseases, including genetic methods, are not perfect. What should do a person, who does not have any disease yet - to drink or not to drink?

Group 1 had 8 times higher burden of alcoholism in men and 18 times higher burden of alcoholism in women than group 2, which is quite consistent with the high consumption of alcoholic beverages in group 1 and data from the literature. Alcohol use is part of the lifestyle of both young and old people there. The genetic basis of alcohol dependence, concerning ethanol metabolism, is well known [41]. Severe alcohol withdrawal syndrome is associated with significant morbidity and mortality [42].

Multiple linear regression analysis (LMA) showed that the blocks of dietary pattern of daily food consumption (TDC): AP (animal products), CV (cereals and vegetables), FS (fruit and sweeteners) and AB (alcoholic beverages) as independent variables have an impact on the dependent variables: NCD burden, including cardiovascular (hypertension, coronary, cerebrovascular heart disease), cancer (prostate and breast cancer), neuropsychiatric (alcoholism), and also on metabolic syndrome predictors (MS). Using LMA prediction, we determined by how much the characteristics of the dependent variables would change if the independent variables that statistically significantly affect the dependent variables were increased by 10 grams (Table 3).

By means of the LMA it has been established that:

- A 10-gram increase in the independent variable AB (alcoholic beverages) was accompanied by a 0.5% decrease in NCD burden, a 4% decrease in Hypertensive heart disease burden and increase in m Alcohol use disorders a 3,0% (Table 3);
- A 10-gram increase in the independent variable FS (fruit, sweeteners) caused a 1.3% decrease in the NCD burden, a 3.7% decrease in the Ischaemic heart disease and Cerebrovascular disease burden ($p \leq 0.001$) (Table 3);
- A 10-gram increase in the independent variable CV (cereals, vegetables) was accompanied by a 0.1% decrease in NCD burden and a 1.5% ($p \leq 0.001$) decrease in Prostate cancer burden but a 1.0% ($p \leq 0.001$) increase in Ischaemic heart disease burden (Table 3);
- A 10-gram increase in the independent variable AP (animal products) led to a 2% increase in the dependent variables Animal Energy; Total Energy kk/p/d by 0.2%; MS predictors BMI>25 and BMI>30 by 0.7%; and Breast cancer burden by 0.4% ($p \leq 0.001$) (Table 3).

Thus, as a result of observational studies using Mann-Whitney U-test and LMA, we obtained results indicating that the structure of NCD burden, including more than 70 types of diseases and injuries is heterogeneous. Low socio-economic status and poor "quality of life" are risk factors for cardiovascular disease.

Harmful use of alcohol is a worldwide problem and the third highest risk factor for the burden of NCDs in the world. It is a causal factor in at least 60 types of diseases and injuries [43].

Recent studies have shown that certain environmental factors, including social factors and lifestyle, can contribute to the development of systemic chronic inflammation (SCI), which, in turn, can lead to several diseases, such as cardiovascular diseases, cancer, diabetes, chronic kidney disease, autoimmune and neurodegenerative disorders.

Mechanisms underlying the TCM phenotype are lack of physical activity, poor nutrition, environmental and industrial toxicants. Strategies for early diagnosis, prevention and treatment of chronic inflammation are being developed [44]. Our results show the divergence of country vectors for NCD gradients. The same risk factors for NCDs, such as AB - alcoholic beverages, increase the burden of alcoholism, but reduce the burden of NCD and Hypertensive heart disease.

Our research is aimed at differentiating the impact of NCD risk factors on the burden of disease for targeted prevention of NCDs [45].

Conclusion

The analysis showed that the maximum and minimum daily consumption of alcoholic beverages (CAB) in the diets of 158 countries differed 108-fold in 2004, with 342 and 2.6 grams per person, without regard to gender or age ($p \leq 0.001$). The 20 countries with maximum CAB compared to the 20 countries with minimum CAB had 14 times higher per capita income ($p \leq 0.001$); 3 times higher prostate cancer burden ($p \leq 0.001$); 2 times higher breast cancer burden ($p \leq 0.001$); 8 times higher burden of alcoholism in men, 18 times in women ($p \leq 0.001$); 6 times lower burden of cardiovascular disease in men, 8 times in women ($p \leq 0.001$). Countries with maximum CAB had 2-fold higher predictors of metabolic syndrome, MS (% of men and women per country) ($p \leq 0.001$). Further research is needed to explore the nature of the association and gender differences in the associations between CAB and NCD, as well as issues of NCD classification.

Conclusion

The current literature suggests a causal relationship between CAB and NCD as a global risk factor for NCD. Further research is needed to find the nature of the association between CAB and individual NCD diseases and to develop effective methods of prevention.

Conflict of Interest

The authors have no conflict of interest.

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