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Original Paper

ASSOCIATION BETWEEN SELF-RATED HEALTH AND CARDIOVASCULAR RISK FACTORS IN LATVIA

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*The aim of the study was to analyse the association between self-rated health (SRH) and cardiovascular disease (CVD) risk factors (RFs) by age and sex in Latvia. A sample of 6000 individuals was formed using random selection from the population (aged 25–74) in Latvia. The survey consisted of an interview, physical examinations, and collection of blood samples. SRH was assessed by a question about the health self-rate. In total, 4070 individuals were interviewed; blood samples were taken from 2218 respondents. The prevalence of good SRH was 48%, fair in 43.3%, and poor in 8.7%. Good SRH was reported by: 33.5% of individuals with raised blood pressure (≥ 140/90 mmHg), 45.5% of individuals with elevated low-density lipoprotein cholesterol level (≥ 3 mmol/l), 33.6% of individuals with raised glucose level (≥ 5.6 mmol/l), 43.0% of daily smokers; and 32.3% of individuals with body mass index ≥ 30 kg/m^2. There were statistically significant differences in SRH categories between population with normal and elevated levels of the risk factors (*p *< 0.001). Individuals with 0 RF had good SRH in 74%; 1 RF – in 65%; 2 RFs – in 50%; 3 RFs – in 40%; 4 RFs – in 30%; and 5 RFs – in 23%;* p *< 0.001. Aging, elevated BP, elevated glucose level, smoking and non-normal body mass index were associated with a lower SRH while male sex and elevated LDL-C were associated with a higher SRH, adjusted for other covariates included in the model. 32.3% to 48.6% of the population with CVD RFs rated their health misleadingly high. To improve the situation, specifically targeted public education on the relationship of RFs to SRH is necessary.*

Keywords: *population, cross-sectional study, arterial blood pressure, low-density lipoprotein cholesterol level, glucose level;, smoking, body mass index.*

INTRODUCTION

High morbidity due to cardiovascular diseases (CVD) characterises the health profile of the Latvian population and has serious consequences such as high mortality, high treatment costs and deterioration of the socioeconomic status of the population (OECD, 2017; 2022; Lenzi *et al.*, 2022; Luengo-Fernandez *et al.*, 2023). The World Health Organization rates Latvia as a very high CVD mortality risk country (Piepoli *et al.*, 2016; Visseren *et al.*, 2021). Although the prevalence of important CVD risk factors (RFs) and the mean number of RFs in the recent ten years (2009–2019) has decreased in the general population of Latvia, the prevalence of RFs in the population is still high (Erglis *et al.*, 2012; Erglis *et al.*, 2022).

The European Society of Cardiology defines the main modifiable CVD RFs: raised low density lipoprotein cholesterol level (LDL-C); elevated arterial blood pressure (BP); daily cigarette smoking; diabetes mellitus (DM), adiposity and high body mass index (BMI) (OECD, 2017; Visseren *et al.*, 2021).

Lower LDL-C is associated with a lower risk of atherosclerotic CVD (Ference *et al.*, 2017). Elevated BP is a major cause of atherosclerotic as well as non-atherosclerotic CVD (Lim *et al.*, 2012). Raised BP facilitates development of various serious diseases: cerebrovascular disease, coronary artery disease, heart failure, chronic kidney disease, and lower extremity arterial disease (Whelton *et al.*, 2020). Cigarette smoking accounts for 50% of all avoidable deaths in smokers, with half of these resulting from atherosclerotic cardiovascular disease. A lifetime smoker has a 50% probability of dying due to smoking and he may lose ten years of life (Doll *et al.*, 2004). Diabetes mellitus (type 1 and type 2), prediabetes and raised fasting blood glucose concentration are independent risk factors for atherosclerotic CVD (Sarwar *et al.*, 2010). Dyslipidaemia and hypertension in patients of diabetes mediates and increases the risk of multiple atherosclerotic and non-atherosclerotic CVD (OECD, 2017). Adiposity and raised BMI has increased in children, adolescents, and adults worldwide (NCD, 2017). All-cause mortality is lower in healthy people with normal BMI (20–25 kg/m^2) (Di Angelantonio *et al.*, 2016).

Self-rated-health (SRH) is known to be a predictor for cardiovascular (CV) events and mortality (Bardage *et al.*, 2001; Van der Linde *et al.*, 2013; Lorem *et al.*, 2020). Research shows that the prevalence of all diseases is associated with poor SRH (Olson *et al.*, 2016), including coronary heart disease (Wu *et al.*, 2013). Thus, poor SRH can be considered as a risk factor for CVD (Rumsfeld *et al.*, 2013; Kang *et al.*, 2023). This easily accessible measure may be used as an indicator of both individual and population health in general. However, patients' health self-assessment is often missing in healthcare data banks (Korhonen *et al.*, 2014). Moreover, it is crucial to determine whether people tend to underrate or overrate their health — that is, whether their judgement corresponds to the objective reality because differences in perception of risk factors most certainly affect patterns of behaviour and, consequently, the lifetime risk of CVD (Holm *et al.*, 2022).

The aim of the study was to determine the association between the presence of RFs, the number of RFs, and the SRH status in the population of Latvia, using data from a nationwide cross-sectional population-based survey.

MATERIALS AND METHODS

Study design. The study population was adults with age 25–74 years in Latvia. The sample of 6000 potential respondents was formed from 1,209,756 persons by simple random sampling from the residency data-base of the Statistical Bureau of Latvia (The Central Statistical Bureau of Latvia, 2018). The study used a stratified systematic random sampling design. The strata were formed by sex (men, women) and age (ten groups with five-year interval). Each of the strata were formed by 300 individuals. More detailed information about the study design can be found in Erglis *et al.* (2022).

Data collection. The fieldwork was organised in two basic parts: an interview and an objective examination. Data on the socio-economic status, self-reported health diagnosis, lifestyle profile, mental health, SRH, etc. according to CINDI Health Monitor Survey principles and HADS questionnaire (Prattala *et al.*, 2001; Hospital Anxiety and Depression Scale, 2023) in face-to-face interviews were obtained. Arterial blood pressure (BP), body weight, height, blood lipid profile (total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (Tg)), and fasting glucose (Glu) were measured. More detailed information about the data collection can be found in Erglis *et al.* (2022).

Risk factors. The following CVD risk factors were analysed:

– elevated BP (≥ 140/90 mmHg); including those whose hypertension was controlled but measurement was higher than 140/90 mmHg);

– elevated LDL-C level (≥ 3.0 mmol/l);

– elevated Glu level (≥ 5.6 mmol/l);

– BMI 25–29.9 kg/m^2; BMI ≥ 30 kg/m^2;

– smoking; defined as daily smokers who have been smoking for at least one year of their lifetime.

The average number of the CVD RFs was calculated: (1) elevated BP; (2) elevated LDL-C level; (3) elevated Glu level; (4) BMI ≥ 25 kg/m^2; and (5) daily smoking.

For analysis of the mean number of RFs, three CV risk groups were used: (1) low CV risk group — individuals with 0 and 1 RF; (2) moderate to high CV risk group — individuals with 2 and 3 RFs; and (3) very high CV risk group — individuals with 4 and 5 RFs.

Self-rated health. SRH was assessed at the beginning of the interview (before objective examinations) by means of the question: “Would you rate your health as 'very good', 'good', 'fair', 'poor' or 'very poor'?” Due to the lack of answers in the “very good” and “very poor” groups for the purpose of our analysis, respondents were grouped into three SRH groups: (1) very good, good; (2) fair; (3) poor, very poor.

Statistical analysis. The sample was weighted by calibration weights to match the distribution of the target population by age, sex, and administrative area (weights were normalised to the sum of the sample size). Then, further analyses were conducted using the weighted sample, except the summary of socio-demographic characteristics. The prevalence estimates of CVD RFs were presented as counts and percentages with 95% confidence intervals (95% CI). A Chi-squared test with Rao & Scott’s second-order correction was used to compare proportions between the specific groups.

The mean (95% CI) of the number of CVD RFs was reported and compared between groups using a two-sample t-test. The association between the mean number of RFs and ten five-year age groups was evaluated by Spearman rank correlation (r).

For all statistical tests an alpha level of 0.05 was used and analyses were performed using R Statistical software (version 4.0.5) (The R Project, 2023). Functions from the survey package (Lumley *et al.*, 2023) were used to account for calibration weights when estimating proportions, mean values, and confidence intervals from a weighted sample.

A multivariable ordinal regression model was fitted to estimate the association between selected covariates and the SRH level (setting poor as the lowest and good as the highest level), accounting for other covariates included in the model. Odds ratios (ORs) were reported, corresponding to the change in odds of having a higher SRH level compared to the reference category of the respective covariate.

ORs for a specific covariate from an ordinal regression can be interpreted as change in odds of having a higher level of the dependent variable. In this study, the dependent variable was SRH with levels from 'poor' to 'good'. Thus OR > 1 is interpreted as increase in odds of having a higher SRH while OR < 1 is interpreted as decrease in odds of having a higher SRH (in both cases with reference to the reference level).

RESULTS

Interviews were collected from 4070 people (67.8% respondence out of 6000 individuals in the target sample). A total of 21 nationalities were represented in the study: 63.7% were Latvian, 25.7% — Russian, and 10.6% — other nationalities.

Physical examination including body weight, blood pressure measurements and blood analysis were obtained from 37.0% of 6000 individuals in the target sample or 54.5% of the interviewed persons. Results about the prevalence of RFs are presented in Tables 1 and 2. The most common RFs were: raised LDL-C (62.0%) with no statistically significant difference between sex groups; overweight (34.3%) with statistically significant difference between sex groups 40.6% in men and 28.8% in women; obesity (29.1%) with no statistically significant difference between sex groups; and raised BP (28%) with statistically significant difference between sex groups in elevated BP — 33.3% in men and 23.5% in women. Elevated BP and elevated Glu level increased progressively with age in both sex groups. Prevalence of elevated LDL-C level increased progressively in men till the age of 45–54 and in women till the age of 55–64, and then decreases in both sex groups. Prevalence of daily smoking was similar among age groups except for the older age groups (Table 2).

The majority of respondents in the study population (85%) reported previous medical conditions, including cardiovas-

Table 1. Prevalence of the most important CVD RFs and comparison between men and women (%)

Risk factor	Total		Men		Women		Men vs. women
	%	[95% CI]	%	[95% CI]	%	[95% CI]	*p*-value[1]
BP, ≥ 140 and/or 90 mmHg	28.0	[26.1, 30.0]	33.3	[30.2, 36.4]	23.5	[21.1, 26.0]	< 0.001
LDL-C, ≥ 3 mmol/l	62.0	[59.8, 64.2]	63.1	[59.7, 66.3]	61.1	[58.2, 63.9]	0.379
Glu, ≥ 5.6 mmol/l	26.6	[24.8, 28.6]	32.2	[29.2, 35.4]	21.8	[19.5, 24.2]	< 0.001
Overweight, BMI 25–29.9	34.3	[32.2, 36.4]	40.6	[37.3, 44.0]	28.8	[26.3, 31.5]	< 0.001
Obesity, BMI ≥ 30	29.1	[27.1, 31.1]	28.2	[25.3, 31.3]	29.8	[27.3, 32.5]	0.427
Daily smokers	22.8	[21.0, 24.7]	31.5	[28.5, 34.8]	15.2	[13.2, 17.4]	< 0.001

[1] for the null hypothesis of equal SRH distribution genders.

Estimated proportions and *p*-values obtained using the weighted sample. CVD, cardiovascular diseases; RFs, risk factors; BP, arterial blood pressure; LDL-C, low-density lipoprotein cholesterol; Glu, fasting glucose; BMI, body mass index.

Table 2. Prevalence of the most important CVD RFs by sex and age

Age groups	25–34		35–44		45–54		55–64		65–74	
Sex	M	W	M	W	M	W	M	W	M	W
BP, ≥ 140 and/or 90 mmHg	8.8	5.1	25.4	7.0***	36.5	22.6**	49.1	37.5*	60.2	44.0**
LDL-C, ≥ 3 mmol/l	49.0	33.7**	65.1	58.5	72.8	70.6	71.5	72.6	54.9	67.8**
Glu, ≥ 5.6 mmol/l	13.4	5.8*	26.3	9.8***	36.4	18.8***	44.9	33.0*	48.9	40.5
Overweight, BMI 25–29.9	39.9	16.2***	40.7	28.0	39.6	32.8	42.2	30.1**	40.7	37.0
Obesity, BMI ≥ 30	17.5	14.2	24.4	16.3*	33.2	31.3	37.6	41.7	30.2	44.3**
Daily smokers	30.3	21.8	34.8	17.9***	35.5	17.0***	32.4	11.9***	20.3	7.4***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ for the null hypothesis of equal prevalence of the respective RF between sexes. Estimated proportions and *p*-values obtained using the weighted sample. CVD, cardiovascular diseases; RFs, risk factors; BP, arterial blood pressure; LDL-C, low-density lipoprotein cholesterol; Glu, fasting glucose; BMI, body mass index; M, men; W, women.

cular RFs. The most common were the following medical conditions: lower back pain or chronic back problems in 31.8%; elevated BP in 28.5%; cervical spine pain or other chronic cervical spine problems in 21.1% (16.5% of men; 25.2% of women); elevated blood cholesterol level in 16.8% of respondents (12.8% of men; 20.3% of women); injury or defect caused by an accident in 15.7% of respondents (20.6% of men; 11.4% of women); arrhythmia in 8.7%; severe headache, such as migraine in 8.5% (5.4% of men; 11.2% of women); rheumatoid arthritis (joint inflammation) in 8.1% of respondents; thyroid gland diseases in 8.0% of respondents (1.6% of men; 13.6% of women); obesity in 7.7% (5.9% of men; 9.3% of women); and malignant tumour/disease in 4.2% (Ērglis *et al.*, 2020).

Self-rated health. The study was designed to asses SRH in terms of 'very good', 'good', 'fair', 'poor', 'very poor' health measures. Consequently, 6% of the population rated health as very good, 42% as good, 43.4% as fair, 7.7% as poor, 0.9% as very poor.

For the purpose of our analysis respondents were grouped into three SRH groups: (1) 'good' — combining 'very good' and 'good'; (2) 'fair' and (3) 'poor' — combining 'poor' and 'very poor'. Consequently, 48% of the respondents rated their health as good, 43.3% as fair, and 8.7% as poor. It was observed that men were inclined to rate their health higher than women: 51% of men and 45.9% of women rated it as good, 39.5% of men and 46% of women rated it as fair, and 9.5% of men and 8.1% of women rated it as poor (p = 0.010), as shown in Table 3.

Comparing age groups: 25 to 34 years old respondents have the highest SRH — 76.5% who rated their health as good. It can be concluded that SRH declines with age — in each subsequent age group the number of respondents with good SRH decreased and the number of respondents with average or poor SRH correspondingly increased ($p < 0.001$) as reported in Table 4.

Self-rated health by number of RF in population of Latvia. The study included 10% of respondents with 0 RF, 24% with 1 RF, 26% with 2 RFs, 26% with 3 RFs, 12% with 4 RFs, 2% with 5 RFs from the following five: (1) BP ≥ 140/90 mmHg; (2) LDL-C ≥ 3.0 mmol/l; (3) Glu ≥ 5.6 mmol/l; (4) BMI ≥ 25 kg/m^2; and (5) smoking daily. 34% of all respondents had a low CV risk due to one RF or no RFs; 52% of all respondents had a moderate to high CV risk (2–3 RFs); and 14% of respondents had a very high CV risk (4–5 RFs) (Fig. 1).

Respondents with no RF in 73% had good SRH, fair in 24% and poor in 3.3%. Significant changes can be observed in respondents with 1 RF, who had good SRH in 60%, fair SRH in 34%, and poor SRH in 5.6% ($p < 0.001$). As the number of RF increases, the prevalence of poor SRH increases from 3.3% in individuals with 0 RF to 24% in individuals with 5 RF ($p < 0.001$).

Persons with low CV risk had good SRH in 64.1%, while people with moderate to high CV — in 41.6% and persons with very high CV risk —— in 29.4% (Table 5). Statistically significant differences between sex groups were found in the moderate to high CV risk group and in the very high CV risk group. 47.1% of men and 37.6% of women had a good SRH in the moderate to high CV risk group ($p < 0.001$). 34.6% of men and 21.4% of women had a good SRH in the very high CV risk group ($p < 0.001$). There were no statistically significant differences between sex groups in people with poor SRH (Table 5).

Analysing the relationship of SRH with the risk of CV diseases depending on sex and age (Figs. 2 and 3), we can found that:

1) the prevalence of good SRH decreased with age in all CV risk groups for both men and women, as well as with increasing CV risk.

Table 3. Summary of reported SRH (%) overall and by sex

SRH	Total	Men	Women	p-value[1]
Good	48	51	45.9	0.010
Fair	43.3	39.5	46	
Poor	8.7	9.5	8.1	

[1] for the null hypothesis of equal SRH distribution between genders.

Estimated proportions and p-values obtained using the weighted sample. SRH, self-rated health.

Table 4. Summary of SRH (%) overall and by age

SRH	Total	25–34	35–44	45–54	55–64	65–74	p-value[1]
Good	48	76.5	66.5	48.5	30.8	22.3	< 0.001
Fair	43.3	22	31.4	44.4	54.6	60.7	
Poor	8.7	1.5	2.1	7.0	14.6	16.9	

[1] for the null hypothesis of equal SRH distribution between age groups

Estimated proportions and p-values obtained using the weighted sample. SRH, self-rated health.

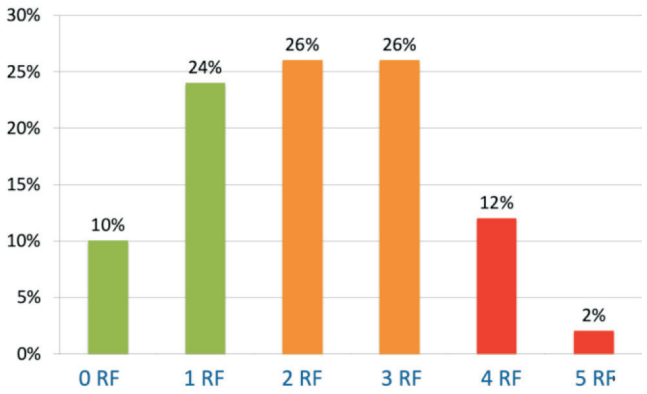

Fig. 1. Number of RFs in population of Latvia (%). RF, cardiovascular risk factors from the following five: (1) systolic BP ≥ 140 mmHg, and/or diastolic BP ≥ 90 mmHg; (2) LDL-C ≥ 3.0 mmol/l; (3) Glu ≥ 5.6 mmol/l; (4) BMI ≥ 25 kg/m^2; and (5) smoking daily in population of Latvia. Green – low cardiovascular risk. Orange – moderate to high cardiovascular risk. Red – very high cardiovascular risk.

Table 5. Summary of SRH (%) by low, moderate to high, very high CV risk categories, overall and by sex

SRH	Number of RFs			*p*-value[1]
	low CV risk 0–1 RF	moderate to high CV risk 2–3 RFs	very high CV risk 4–5 RFs	
	Total			
Good	64.1	41.6	29.4	< 0.001
Fair	30.9	48.6	56.4	
Poor	5.0	9.8	14.2	
	Men			
Good	68.6	47.1	34.6	< 0.001
Fair	25.9	42.4	51.8	
Poor	5.5	10.5	13.6	
	Women			
Good	61.9	37.6	21.4	< 0.001
Fair	33.4	53.1	63.4	
Poor	4.7	9.3	15.1	

[1] for the null hypothesis of equal SRH distribution between CV risk categories.

Risk factors were calculated from the following: (1) systolic blood pressure ≥ 140 mmHg, and/or diastolic blood pressure ≥ 90 mmHg; (2) low density lipoprotein cholesterol level ≥ 3.0 mmol/l; (3) fasting glucose level ≥ 5.6 mmol/l; (4) body mass index 25 kg/m^2; (5) smoking daily. Estimated proportions and *p*-values obtained using the weighted sample. SRH, self-rated health; CV, cardiovascular; RF, risk factor; RFs, risk factors.

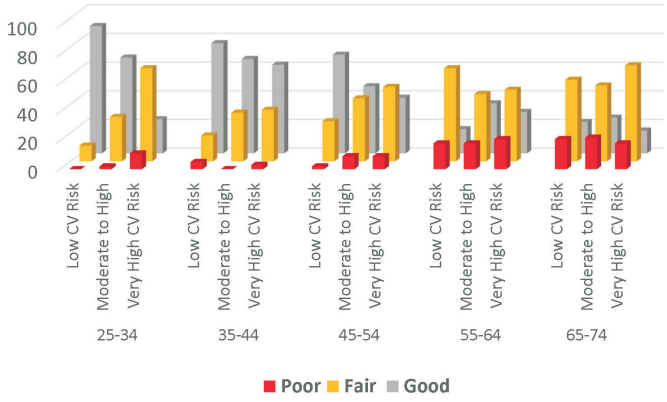

Fig. 2. Self-rated health by cardiovascular risk groups and age in men (%). CV, cardiovascular. Low CV Risk, 0 to 1 CV risk factor; Moderate to High CV Risk, 2 to 3 risk factors; Very High CV Risk, 4 to 5 CV risk factors. Risk factors were calculated from the following: (1) systolic blood pressure ≥ 140 mmHg, and/or diastolic blood pressure ≥ 90 mmHg; (2) low density lipoprotein cholesterol level ≥ 3.0 mmol/l; (3) fasting glucose level ≥ 5.6 mmol/l; (4) body mass index ≥ 25 kg/m^2; and (5) smoking daily.

2) the prevalence of fair SRH increased with age in all CV risk groups for both men and women, as well as with increasing CV risk.

3) the prevalence of poor SRH increased with age in all CV risk groups for both men and women, as well as with increasing CV risk.

Self-rated health and blood pressure. The prevalence of elevated BP (≥ 140/90 mmHg) was in 28.0% of the investigated persons, with a statistically significant difference between sex groups: 33.3% in men and 23.5% in women (p < 0.001) (Tables 1 and 2).

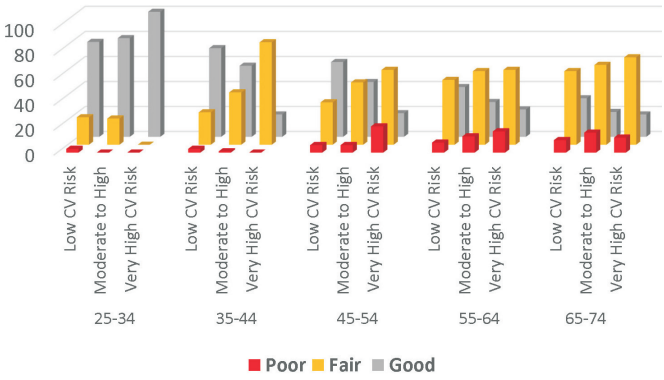

Fig. 3. Self-rated health by cardiovascular risk groups and age in women (%). CV, cardiovascular. Low CV Risk, 0 to 1 CV risk factor; Moderate to High CV Risk, 2 to 3 risk factors; Very High CV Risk, 4 to 5 CV risk factors. Risk factors were calculated from the following: (1) systolic blood pressure ≥ 140 mmHg, and/or diastolic blood pressure ≥ 90 mmHg; (2) low density lipoprotein cholesterol level ≥ 3.0 mmol/l; (3) fasting glucose level ≥ 5.6 mmol/l; (4) body mass index ≥ 25 kg/m^2; and (5) smoking daily.

Among persons with elevated BP, good SRH was observed in 33.5%, fair in 53.0%, and poor in 13.5%, while among persons with normal BP, good SRH was observed in 54.0%, fair in 39.3%, and poor in 6.7% (p < 0.001). A significant difference between groups of elevated and normal BP was observed in men and women (p < 0.001). Men with elevated BP rated their health as good in 39.3%, while women with elevated BP rated their health as good in 28.0%. Only 14.6% of men and 12.3% of women with elevated BP rated their health as poor (Table 6).

Self-rated health and low-density lipoprotein cholesterol level. The prevalence of elevated LDL-C level (≥ 3.0 mmol/l) was 63.1% in men and 61.1% in women, without statistical significance (Tables 1 and 2).

Among individuals with elevated LDL-C level, good SRH was observed in 45.5%, fair in 45.7%, and poor in 8.8% while, among people with a normal LDL-C level, good SRH was observed in 52.2%, fair in 39.4%, and poor in 8.7% (p = 0.010). Men with elevated LDL-C level rated their health as good in 48.9%, while women with elevated LDL-C level rated their health as good in 43.1%. Only 9.4% of men and 8.4% of women with elevated LDL-C level rated their health as poor (Table 6).

Self-rated health and glucose level. The prevalence of elevated Glu level (≥ 5.6 mmol/l) was 26.6% of the population: 32.2% in men and 21.8% in women with a statistically significant difference (p < 0.001) significance (Tables 1 and 2).

Among individuals with elevated Glu level, good SRH was observed in 33.6%, fair in 53.5%, and poor in 12.9% while among individuals with normal Glu level, good SRH was observed in 53.4%, fair in 39.5%, and poor in 7.1% (p <

Table 6. Summary of SRH (%) by select RFs, overall and by sex

SRH	BP < 140/90 mmHg	BP ≥ 140/90 mmHg	*p*-value[1]
Total			
Good	54.0	33.5	< 0.001
Fair	39.3	53.0	
Poor	6.7	13.5	
Men			
Good	57.3	39.3	< 0.001
Fair	35.7	46.1	
Poor	7.0	14.6	
Women			
Good	52.0	28.0	< 0.001
Fair	41.5	59.7	
Poor	6.5	12.3	

SRH	LDL-C < 3 mmol/l	LDL-C ≥ 3 mmol/l	*p*-value[1]
Total			
Good	52.2	45.5	0.010
Fair	39.4	45.7	
Poor	8.7	8.8	
Men			
Good	54.5	48.9	0.2
Fair	35.8	41.7	
Poor	9.8	9.4	
Women			
Good	50.7	43.1	0.040
Fair	41.9	48.5	
Poor	7.5	8.4	

SRH	Glu < 5,6 mmol/l	Glu ≥ 5,6 mmol/l	*p*-value[1]
Total			
Good	53.4	33.6	< 0.001
Fair	39.5	53.5	
Poor	7.1	12.9	
Men			
Good	58.0	36.9	< 0.001
Fair	34.1	50.2	
Poor	7.9	12.9	
Women			
Good	50.6	30.3	< 0.001
Fair	42.8	56.8	
Poor	6.6	13.0	

SRH	Non-smoking	Daily smoking	*p*-value[1]
Total			
Good	49.3	43.0	0.010
Fair	42.8	45.4	
Poor	7.9	11.6	
Men			
Good	54.0	44.4	0.018
Fair	37.6	43.5	
Poor	8.4	12.1	
Women			
Good	46.8	40.9	0.2
Fair	45.7	48.2	
Poor	7.6	10.8	

SRH	BMI < 18.5	BMI 18.5–24.9	BM–29.9	BMI ≥ 30	*p*-value[1]
Total					
Good	68.3	60.1	48.6	32.3	< 0.001
Fair	22.7	33.7	43.8	55.1	
Poor	9.0	6.2	7.6	12.6	
Men					
Good	70.2	58.3	53.8	38.4	< 0.001
Fair	12.9	33.3	36.2	51.6	
Poor	16.9	8.4	10.1	10.0	
Women					
Good	67.7	61.1	43.7	28.6	< 0.001
Fair	25.7	34.0	51.0	57.	
Poor	6.6	4.9	5.3	14.2%	

[1] for the null hypothesis of equal SRH distribution genders

Estimated proportions and p-values obtained using the weighted sample. SRH, self-rated health; RFs, risk factors; BP, arterial blood pressure; LDL-C, low-density lipoprotein cholesterol; Glu, fasting glucose; BMI, body mass index.

0.001). A significant difference between groups of elevated and normal Glu level was observed both in men and women ($p < 0.001$). Men with elevated Glu level rated their health as good in 36.9% while women with elevated Glu level rated their health as good in 30.3%. Only 12.9% of men and 13.0% of women with elevated Glu level rated their health as poor (Table 6).

Self-rated health and smoking. The prevalence of daily smoking was 22.8% of the investigated persons: 31.5% in men and 15.2% in women with a statistically significant difference ($p < 0.001$) significance (Tables 1 and 2).

Daily smokers reported good SRH in 43%, fair SRH in 45.4% and poor SRH in 11.6% while non-smokers had good SRH in 49.3%, fair SRH in 42.8% and poor SRH in 7.9% ($p = 0.010$).

Smoking men rated their health as good in 44.4% while smoking women rated their health as good in 40.9%. Only 12.1% of smoking men and 10.8% of smoking women rated their health as poor (Table 6).

Self-rated health and body mass index. The prevalence of overweight (BMI 25 – 29.9 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) was 34.3% and 29.1%, respectively. 40.6% in men and 28.8% in women were overweight with a significant difference ($p < 0.001$) significance (Tables 1 and 2).

Among overweight persons (BMI 25–29.9), good SRH was observed in 48.6%, fair in 43.8%, and poor in 7.6% ($p < 0.001$); among persons with obesity (BMI ≥ 30), good SRH was observed in 32.3%, fair in 55.1%, and poor in

12.6%; while among persons with a normal weight (BMI 18.5–24.9) good SRH was found in 60.1%, a fair SRH in 33.7%, and a poor SRH in 6.2% ($p < 0.001$) (Table 6).

Statistically significant association between overweight and normal BMI was found both in men and women ($p < 0.001$). Overweight men with rated their health as good in 53.8%, while overweight women rated their health as good in 43.7%. Only 10.1% of overweight men and 5.3% of overweight women with rated their health as poor (Table 6).

A significant association between obesity and normal BMI was observed both in men and women ($p < 0.001$). Men with obesity rated their health as good in 38.4%, while women with obesity rated their health as good in 28.6%. Only 10.0% of men and 14.2% of women with obesity rated their health as poor (Table 6).

Associations between self-rated health and risk factors. ORs from the fitted ordinal regression model are presented in Table 7. Male sex, education level and elevated LDL-C were associated with increased odds of having a higher SRH, while age, elevated BP, elevated Glu level, smoking and non-normal BMI (i.e., not in 18.5 to 24.9 range) were associated with decreased odds of having a higher SRH, adjusted for other covariates included in the model.

Table 7. Ordinal regression analysis results for the association between SRH and selected demographic and CVD risk factors

Characteristic	Categories	OR[1]	CI 95%[2]
Sex	Women	-	-
	Men	1.33	1.19, 1.49
Age	25–34	-	-
	35–44	0.69	0.56, 0.86
	45–54	0.41	0.34, 0.51
	55–64	0.23	0.18, 0.28
	65–74	0.14	0.12, 0.18
BP	< 140/90 mmHg	-	-
	≥ 140/90 mmHg	0.95	0.84, 1.07
LDL-C	< 3 mmol/l	-	-
	≥ 3 mmol/l	1.16	1.03, 1.31
Glu	< 5.6 mmol/l	-	-
	≥ 5,6 mmol/l	0.90	0.80, 1.01
Smoking	Non-smoking	-	-
	Daily smoking	0.80	0.71, 0.92
BMI	18.5–24.9	-	-
	< 18.5	0.69	0.42, 1.15
	25.0–29.9	0.89	0.78, 1.02
	≥ 30	0.62	0.54, 0.72
Education	Elementary school or less education	-	-
	Secondary school or professional education	1.31	1.09, 1.58
	Higher education	2.09	1.71, 2.56

[1] OR, odds ratio; [2] CI, confidence interval. Regression analysis was conducted the weighted sample. SRH level was treated as an ordinal variable with poor as lowest and good as highest level for the regression analysis. OR > 1 is interpreted as increase in odds of having a higher SRH level, while OR < 1 is interpreted as decrease in odds of having a higher SRH level. SRH, self-rated health; CVD, cardiovascular; RFs, risk factors; BP, arterial blood pressure; LDL-C, low-density lipoprotein cholesterol; Glu, fasting glucose; BMI, body mass index.

DISCUSSION

Information about the relationship between the SRH and the prevalence of CVD RFs was analysed using data from a population-based cross-sectional study of CVD RFs in the population of Latvia to understand the discrepancy between objective CVD risk status and SRH. The main strength of the survey was the wide population sample representing all country. Therefore, our results represent the general population. The study sample of 4070 was in general representative of the target population; remaining differences were accounted for by re-weighting the sample.

Although more than a half of the respondents rated their health as good, the prevalence of CVD RFs does not allow to confirm such an optimistic assessment. Self-reported health was reported as good in 48% of the respondents despite high prevalence of the moderate to high (52%) and very high (14%) CV risk profile. Also, previously published results showed high prevalence of self-reported risk factors and non-cardiovascular medical conditions (85%), which contradicts the above-mentioned optimistic SHR rating.

SRH is a useful tool to predict health disorders (Rumfeld *et al.*, 2013; Van der Linde *et al.*, 2013; Olson *et al.*, 2016; Lorem *et al.*, 2020; Kang *et al.*, 2023). Our results show that people with moderate to high CV risk (2–3 RFs) rated their health as fair in 48.6 % and as poor only in 9.8%; people with high CV risk (4–5 RFs) rated their health as fair in 56.4 % and as poor only in 14.2%. At the same time, there were many individuals with moderate to high CV risk (2–3 RFs) or high CV risk (4–5 RFs) who rated their health as good — 41.6% and 29.4%, respectively. There was also statistically significant difference between sex groups: men with a high CV risk (4–5 RFs) have a good SRH in 34.6% while women in 21.4% ($p < 0.001$).

A significant portion of population still do not associate the existing CVD RFs with their health status or even do not know they may have risk factors. For example, 33.5% of persons with elevated blood pressure (≥ 140/90 mmHg), 45.5% of persons with elevated LDL-C level (≥ 3 mmol/l), 33.6% of persons with elevated Glu level (≥ 5.6 mmol/l), 48.6% of overweight persons, 32.3% of obese persons and 43% of daily smokers had a good SRH.

These data, of course, raise an additional question about the evaluation of RF effects, namely, which RFs make people feel unhealthy and which RFs have a smaller effect on well-being. For example, high LDL-C level may not affect the perception of health for a long time, while high blood pressure is likely to affect the health assessment much faster. These considerations underline the importance of

evaluating doctor-diagnosed pre-existing risk factors in future studies.

According to the data of numerous studies, smoking is one of the leading RFs for cardiovascular, lung diseases, and cancer (Burns, 2003; Lee, 2013; Parris *et al.*, 2019). 31.5% of men and 15.2% of women are daily smokers in Latvia. However, many smokers rated their health as good, which means that they did not associate smoking with a bad health habit and/or did not feel the impact of smoking on their health.

One more question that should be highlighted following the literature is that SRH is related not only to physical health and physical well-being, but also to mental health — safety, happiness, anxiety, depression — which also affects SRH (Chang-Quan *et al.*, 2010; Rantanen *et al.*, 2019) and should be analysed in the context of aforementioned parameters. British sociologist Mildred Blaxter, defining health, came to the conclusion that the concept of health is relative, because individuals evaluate health subjectively, based on different biographical, historical, contextual environments and experiences (Blaxter, 2010). Other studies also show that SRH is related to a number of different side-conditions, such as traditions, religion and worldview, socioeconomic or geopolitical situation, marital status, pain threshold and other factors (Amzat *et al.*, 2014), which can affect a respondent's answer to the questions for good, poor or fair SRH.

In order to make a full judgment about the relationship of SRH with CVD RFs, the data must be analysed in relation to other factors such as: objective diagnosis, education level, socioeconomic status, health literacy etc. Following the study, it was concluded that the problem of RFs awareness is a national level problem that requires explanation and solutions for improving RFs recognition as well as health literacy about the relationship of RFs with SRH.

The study had potential limitations. Firstly, the study included individuals between 25 and 74 years old. Secondly, we use self-reported data rather than confirmed diagnoses. Lack of objective information from the medical documentation about medical diagnosis of respondents was another limitation of the study. Some self-reported diagnoses of respondents were precise, while some of them were descriptive and incomplete. However, it would be significant to analyse the association between doctor-diagnosed pre-existing risk factors and the risk factors identified at the time of the study and associated blood sampling or physical measurements in the context of SRH — which is a topic for investigation in the next population study.

CONCLUSIONS

A remarkable number of people with several CVD RFs rated their health misleadingly high. Almost 30% of people with very high CV risk (4–5 RFs) and 42% of people with moderate to high CV risk (2–3 RFs) still had a good SRH, which contradicts the objective health indicators. Targeted public education on RFs recognition, importance and relationship to SRH at the national level is necessary.

ETHICS

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Institute of Cardiology and Regenerative Medicine, University of Latvia (No 2-260918, 26 September 2018).

Informed consent was obtained from all subjects involved in the study.

AUTHORS' CONTRIBUTIONS

Conceptualization, A.E., I.B. and V.D.; methodology, A.E., I.B. and V.D.; validation, A.E., I.B. and V.D.; formal analysis, I.B., A.E., V.D., S.J., P.A., A.C. and A.L.; investigation, A.E., I.B., V.D., S.J., P.A., A.C. and A.L.; resources, I.B., A.E., V.D., S.J., P.A. A.C. and A.L.; data curation, A.E., I.B., V.D., S.J., P.A., A.C. and A.L.; writing-original draft preparation, I.B., A.E. and V.D.; writing-review and editing, A.E., I.B., S.J., A.L. and V.D.; visualization, A.L., I.B. and S.J.; supervision, A.E. and V.D.; project administration, A.E.; funding acquisition, A.E.

All authors have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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SAISTĪBA STARP VESELĪBAS PAŠVĒRTĒJUMU UN SIRDS UN ASINSVADU RISKA FAKTORIEM LATVIJĀ

Pētījuma mērķis bija analizēt saistību starp veselības pašvērtējumu un sirds un asinsvadu slimību (SAS) riska faktoriem (RF) pēc vecuma un dzimuma Latvijā. Darbā tika izmantoti 2019. gadā veiktā Latvijas iedzīvotāju kardiovaskulāro un neinfekcijas slimību riska faktoru šķērsgriezuma pētījuma dati. Pētījuma objekts bija 25 līdz 74 gadus veci Latvijas iedzīvotāji (6000 personas) desmit dažāda dzimuma un vecuma grupās ar desmit gadu intervālu pa 600 cilvēkiem katrā grupā (300 sievietes un 300 vīrieši), kas iekļauti pētījumā, izmantojot nejaušinātu atlasi no Centrālās Statistikas pārvaldes "Mājokļu reģistra" (1 209 756 personas). Tika veikta: subjektīvā izmeklēšana (anketēšana) un objektīvā izmeklēšana (asinsanalīzes un mērījumi). Anketā (izstrādāta pēc *Countrywide Integrated Non-communicable Diseases Intervention* jeb CINDI metodes) tika iekļauti jautājumi par sociāldemogrāfisko raksturojumu, riska faktoriem, noteiktām slimībām un sindromiem. Objektīvajā izmeklēšanā tika iekļauti izmeklējumi: arteriālā asinsspiediena mērīšana (pēc Pasaules Veselības organizācijas standartmetodes), ķermeņa svara un garuma mērīšana, lipīdu profila un glikozes līmeņa asinīs noteikšana. Rezultāti tika apstrādāti, izmantojot datorprogrammas *Microsoft Excel* un R. Labs veselības pašvērtējums bija 48%, vidējs — 43,3%, slikts — 8,7% respondentu. Personas ar paaugstinātu asinsspiedienu (≥ 140/90 mmHg) vērtēja savu veselību kā labu 33,5%, kā vidēju 53,0%, kā sliktu 13,5% gadījumu. Personas ar paaugstinātu zema blīvuma lipoproteīnu holesterīna līmeni (≥ 3 mmol/l) vērtēja savu veselību kā labu 45,5%, kā vidēju 45,7%, kā sliktu 8,8%. Respondenti ar paaugstinātu glikozes līmeni (≥ 5,6 mmol/l) vērtēja savu veselību kā labu 33,6%, kā vidēju 53,5%, kā sliktu 12,9%. Ikdienas smēķētāji vērtēja savu veselību kā labu 43,0%, kā vidēju — 45,4%, kā sliktu 11,6% gadījumu. Respondentiem ar paaugstinātu ķermeņa masas indeksu (ĶMI) 25–29,9 kg/m^2 labs veselības pašvērtējums bija 48,6%, vidējs — 43,8%, slikts — 7,6% gadījumu, savukārt personām ar ĶMI ≥ 30 kg/m^2 labs veselības pašvērtējums bija 32,3%, vidējs 55,1%, slikts 12,6% gadījumu. Pētījums parāda statistiski nozīmīgu veselības pašvērtējuma atšķirību starp populācijām ar normālu un paaugstinātu RF līmeni ($p < 0,001$). Indivīdiem ar 0 RF labs veselības pašvērtējums bija 74% gadījumu; cilvēkiem ar 1 RF – 65%; 2 RF – 50%; 3 RF – 40%; 4 RF – 30%; 5 RF – 23%; $p < 0,001$. Lielāks vecums, paaugstināts asinsspiediens, paaugstināts glikozes līmenis, smēķēšana un paaugstināts ĶMI bija saistītas ar zemāku veselības pašvērtējumu, savukārt vīriešu dzimums un paaugstināts ZBLH bija saistīti ar augstāku veselības pašvērtējumu. 32,3% līdz 48,6% iedzīvotāju ar SAS RF savu veselību novērtē maldinoši augstu. Situācijas uzlabošanai nepieciešama īpaši mērķtiecīga, plaša (t.i., valsts līmeņa) sabiedrības izglītošana par RF atpazīšanu un to saistību ar veselības pašvērtējumu.