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Sociodemographic inequalities in cigarette smoking, alcohol drinking and simultaneous use of cigarettes and alcohol among Polish farmers: findings from questionnaire survey conducted among patients of the voivodeship farmer's rehabilitation centre in Poland

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Abstract

Introduction: Tobacco smoking and alcohol drinking are major causes of premature mortality, especially in men. Both health behaviours are strongly determined by sociodemographic factors.

Aims: To evaluate the role of sociodemographic determinants of cigarette smoking, alcohol drinking and simultaneous use of these psychoactive substances among Polish farmers.

Material and methods: A questionnaire survey on health conditions, disease treatment and health behaviours was conducted among 612 farmers who participated in 21-day rehabilitation courses organised between August 2021 and September 2022 by farmer's rehabilitation centre in Poland. The study presents results of cross-sectional (by gender, age and education) statistical univariate (based on Pearson's and Cramer's chi-square tests) analysis of cigarette smoking, alcohol drinking and simultaneous use of cigarettes and alcohol.

Results: No statistically significant association was found between current cigarette smoking and farmer's gender and education. Smoking was significantly associated with farmer's age ($p=0.003$). In women, smoking rates were lowering with age. All analysed sociodemographic variables were strong predictors of current alcohol drinking. Men drunk alcohol two times more often than women. The highest prevalence of male alcohol drinking was among oldest and low educated farmers. Percent of male alcohol drinkers was increasing with education while in women it was decreasing with age. Simultaneous use of cigarettes and alcohol was significantly associated with all analysed sociodemographic factors. Almost one of ten

farmers was dual user of cigarettes and alcohol while one of two dual abstainers. Dual use was more frequent among male, oldest and low educated farmers those with the lowest education whereas dual abstinence was more frequent among female, middle-aged and high educated farmers.

Conclusions: Cigarette smoking, alcohol drinking and dual use of both psychoactive substances are strongly determined by farmer's sociodemographic status. Tobacco and alcohol preventive and cessation programs addressed to farmers should be tailored to these sociodemographic inequalities.

Keywords: Cigarette smoking, alcohol drinking, sociodemographic determinants, Polish farmers.

Introduction

Tobacco use, mainly cigarette smoking, and alcohol drinking belong to the most common unhealthy behaviours and substantially contribute to the health burden worldwide, in Europe and in Poland [1,2].

The 2019 Global Burden of Disease analyses estimate that globally over 1.3 billion of people use tobacco, including 1.14 billion who currently smoke cigarettes [3; see 4]. In Europe, the population of adult tobacco smokers exceeds 200 million [5]. In Poland, the number of current smokers is estimated in adult population on approximately 8.5 million [5; see also 6]. The global burden of smoking-attributable diseases is huge. It mostly includes the mortality from cancer, cardiovascular (CVDs) and lung diseases and the incidence from psychological and behavioural disorders [3]. In 2019, tobacco smoking caused almost 8 million deaths, mostly premature, and 200 million disability-adjusted life-years [3]. Since few decades, smoking is the major single cause of premature morality in men, contributing now to 20% of deaths in male population [7] and in the past 30 years (1990-2019] to more than 200 million deaths worldwide [3]. In Poland, 85,000 people at age 35 and over died from smoking-attributable diseases in 2015 – 46,000 prematurely [7; see also 6].

WHO estimates that in 2019 approximately 2.5 billion of adults (aged 15+) worldwide used alcohol beverages, 400 million (7%)) had alcohol use disorders and 209 million (3.7%) were addicted from alcohol [2,8]. In the European Union, around 289 million of adults currently drunk alcohol in 2019 [2]. In Poland, the percentage of current adult (aged 18+) alcohol drinkers in 2019 was estimated on 18 million (56%) and those who drunk alcohol daily on 2.6 million (8%)[9,10]. Worldwide, around 2.6 million deaths were caused by alcohol

consumption in 2019 [2]. Alcohol has mostly contributed to CVDs, cancer, liver diseases, the health problems in pregnant women and children, injuries and accidents, and psychological and behavioural disorders [2; see also 11-13]. In the European Union, approximately 240,000 deaths were estimated as alcohol-attributable in 2019 [2]. In Poland, increasing alcohol consumption is one of the major causes of public health crisis [14]. WHO estimates the number of alcohol-attributable deaths in Poland in 2021 on 30,000 deaths [2].

The use of both substances, cigarettes smoking and alcohol drinking, and its health consequences substantially differ in geographic areas and demographic, social and economic groups [2,15-17]. In the past, the best predictors of tobacco smoking and alcohol drinking were sex, age and sociocultural determinants [18,19]. Currently, the biggest differences in cigarettes smoking and alcohol drinking result from the level of education and economic status [20-22; see also data for Poland in 6 and 9], especially when extreme categories of social status are compared [see 23]. Recently, the fastest increase in the prevalence of cigarette smoking and alcohol drinking has observed in low- and middle-income countries [2,24]. Place of living, especially in women, is another social factor that may strongly determine smoking and alcohol drinking behaviours [25-27]. In Poland, the prevalence of cigarette smoking in women living in rural area was doubled in the past 30 years and might have an important impact on smoking-related health burden in this gender and social group [6].

Therefore, it is an urgent need to monitor and evaluate the prevalence of cigarette smoking and alcohol drinking in farmers and examine the role of demographic and social determinants that may influence on farmer’s smoking and alcohol drinking behaviours, with particular

insight into simultaneous use of these psychoactive and harmful substances. This study makes an attempt to analyze in-depth these behaviours and their sociodemographic predictors.

Material and methods

Study design

The current research was a part of the general study that was dedicated to health condition and health behaviors of farmers and their families. The study has conducted in the KRUS Farmer's Rehabilitation Centre in Jedlec since over ten years among all patients who have participated in 21-day rehabilitation course (in its beginning). The general study is based on the questionnaire asking farmer's on different aspects of their health status, treatment of selected diseases, health behaviours and sociodemographic and economic features. Our research analysis is based on results of the general questionnaire study and refers to all patients who were participating in abovementioned rehabilitation courses between August 2021 and September 2022.

The KRUS Farmer's Rehabilitation Centre in Jedlec is located nearby town of Kalisz in Wielkopolska voivodeship, in western part of Poland. The centre is one of the seven KRUS Farmer's Rehabilitation Centres in Poland. Every year, about 13,000 farmers are treated there, including over 2,000 patients treated in the Jedlec centre. All farmer's rehabilitation centres are financed from the farmer's social insurance system (KRUS) that was legally enforced by the Sejm of the Republic of Poland on 20 December 1990.[1]

[1] Its recently amended version of 14 February 2025 in Journal of Laws 2025, item 197 (Dz.U. 2025, poz. 197).

Study population

Table 1 refers to demographic and social characteristics of study subjects. In total, 612 farmers took part in the study, including 330 women and 282 men. Among all study subjects, 53.9% were women, 62.4% patients at middle age (50-59) and 61.1% with low education (primary or/and basic vocational).

Among men participating in the study, 17.7% was at age 49 or less, 53.2% at age of 50 to 59 and 29.1% at age of 60 and over. Most of male patients have low education (66.7%) while the percentage of those with moderate (28.3%) and, in particular, high education (5%) was much lower. Among women, 23.6% was at age 49 or less, 70.3% at age of 50 to 59 and only 6.1% at the oldest age (60+). 56.4% of female farmers were low educated while 34.8% have moderate and 8.8% high education.

In both gender groups, proportion of patients at middle age and with low education was predominant. However, there were substantial gender differences in demographic and social characteristics of study subjects. When compared with female subjects, men were characterized by much higher percentage of those at the oldest age (29.1% in men vs. 6.1% in women) and lower percentage of those at age of 50 to 59 (53.2% vs. 70.3%, respectively). In comparison with women, higher proportion of men were also noticed among subjects with low education (66.7% vs. 56.4%).

Study questionnaire

The self-reported, voluntary and anonymous questionnaire has included single and multi-choice questions on self-esteemed health status, past or current diseases and their symptoms, past accidents and their impact on health, previous disease treatment, selected health

parameters (for example, blood level of cholesterol, body mass index, blood pressure and hypertension) and major health behaviours, including tobacco use, alcohol drinking, diet habits and physical activity [see full version of the questionnaire in annex to 28]. Questions on physical activity were extensive part of the study questionnaire and based on shorten version of the International Physical Activity Questionnaire (IPAQ)[see 29]. Separate part of the questionnaire was referred to physical, demographic, social and economic characteristics of study subjects. It included questions on weight and height, sex, age, level of education, place of living (in geographical and administrative terms), type of work most often performed, type and size of household. Day, month and year of the questionnaire completion was also recorded.

Measurements

Cigarette smoking

The study questionnaire included several questions on cigarette smoking, the use of other tobacco products and electronic cigarettes: 1/ on current cigarette smoking, 2/ on quit attempt in the past 12 months, 3/ on average number of cigarettes smoked a day in the past month, 4/ on current use of nasal snuff, 5/ on average frequency of daily use of nasal snuff in the past month, 6/ on current use of e-cigarettes. Our analysis is based on the question on current cigarette smoking (“Do you smoke cigarettes? 1. Yes, 2. No”). Behavioral characteristics of cigarette smoking and, if possible, the use of nasal snuff and e-cigarettes will be a subject of additional analysis and separate scientific paper.

Alcohol drinking

The study questionnaire included several questions on alcohol drinking: 1/ on current alcohol drinking, 2/ on type of alcohol consumed, 3/ on size of bottles most frequently used when drinking alcohol, 4/ on volume of beer, wine or vodka drunk, 5/ on intensity of alcohol drinking (any type of alcohol) in the past month, 6/ on alcohol consumption during weekend (Saturday and Sunday) only. Below analysis refers to the question on current alcohol drinking ("Do you drink alcohol? 1. Yes, 2. No"). Detailed analysis of alcohol drinking is planned to be made in separate scientific paper.

Behavioral patterns of simultaneous use of cigarettes and alcohol

Our analysis is also focused on different behavioral patterns of simultaneous use of smoking and alcohol drinking behaviours. Simultaneous use of cigarettes and alcohol does not mean cigarette smoking and alcohol drinking at the same time, however, it may also often happen. It only refers to behaviors of those persons who currently smoke cigarettes and drink alcohol. Using abovementioned questions on current cigarette smoking and alcohol drinking, four behavioral patterns of simultaneous use of cigarettes and alcohol by farmers have been created and analyzed by selected sociodemographic determinants: 1/ farmers who simultaneously smoke cigarettes and drink alcohol (dual users), 2/ farmers who smoke cigarettes but do not drink alcohol, 3/ farmers who do not smoke cigarettes but drink alcohol, and 4/ farmers who neither smoke cigarettes nor drink alcohol (dual abstainers).

Sociodemographic variables.

As it was mentioned in section on study questionnaire (see above), the questionnaire included a sort of questions on various demographic, social and economic features of respondents. Among them only three (sex, age and education) were chosen to be cross-sectionally analysed

as potential determinants of current cigarette smoking, current alcohol drinking and behavioral patterns of simultaneous use of cigarettes and alcohol. Unfortunately, the question on personal or household income, that is considered in many studies as strong predictor of tobacco use and alcohol drinking [20,21,23], was not included into the study questionnaire, therefore we could not evaluate whether economic situation of subjects had an impact on their cigarette smoking and alcohol drinking. Due to small number of respondents in particular age and education categories, primary categories of age and education have been merged – for age into <49 years, 50-59 years and 60+ years, for education into low, moderate and high level of education. Low level of education was defined as completed primary or/and basic vocational education, moderate level as general or/and vocational secondary education and high educational level as post-secondary or/and university or higher education, for example doctorate.

Statistical analysis

The paper was based on analysis of cross-sectional questionnaire data. Results of the analysis are presented in tables and include data on the prevalence of dependent variables in selected sociodemographic categories, relevant numbers of study subjects who fulfil analytical criteria, and values of performed statistical tests. All data were analysed with the use of the IBM SPSS Statistics Package version 29.0.1.0. Univariate statistical analysis was based on results of Pearson's and Cramer's chi-square tests. Pearson's chi-squared test was used to evaluate the relationship between two nominal variables: dependent (cigarette smoking or alcohol drinking or simultaneous cigarette smoking and alcohol drinking) and independent (sex, age and level of education). The association was considered to be statistically significant if p-value was <0.05. Significant p-values were bolded in tables. The Cramer's V test measures the strength

of association between two nominal variables. It was assumed that V<0.3 means weak association, V<0.5 moderate association and V>0.5 strong association.

Results

Prevalence of cigarette smoking by sociodemographic determinants

Table 2 describes data on prevalence of cigarette smoking among study subjects by selected sociodemographic determinants. Among all studied farmers, 20.9% currently smoked cigarettes, 23.4% in men and 18.8% in women.

Age was found as significant demographic predictor for the prevalence of current cigarette smoking among male and female farmers participating in the study (p=0.003). However, the strength of association between age and cigarette smoking seems to be moderate (Cramer's V test = 0.304). In women, older study subjects were characterized by lower percentages of current cigarette smoking. The prevalence of current cigarette smoking was 16.4% in women at age of 49 or less, 9.9% in 50-59 years old women and only 2.9% among the oldest women (aged 60+). In men, the same age pattern of cigarette smoking was not found; the prevalence of current cigarette smoking was the highest among the oldest male farmers (17.6%) and the lowest in male farmers at age of 50 to 59 (8.4%).

Study results clearly show that the prevalence of current cigarette smoking was negatively associated with education. The higher was level of education, the lower was percentage of farmers currently smoking cigarettes. This pattern concerned all study subjects, both men and women. Among all farmers, those with low education smoked cigarettes in 24.6%, those with moderate education in 17.4% and high educated in 4.7% only. Although differences in

prevalence of current cigarette smoking in all educational groups were substantial, the abovementioned association was not found to be statistically significant (p=0.825, Cramer's V test = 0.055). It probably resulted from very low number of study subjects with high education (n=2).

Prevalence of alcohol drinking by sociodemographic determinants

Table 3 includes data on the prevalence of current alcohol drinking among study subjects by selected sociodemographic determinants. Among all farmers participating in the study, 34.8% currently drunk alcohol. The prevalence of alcohol drinking was over 2-fold higher in men (51.1%) than in women (20.9%).

Like for cigarette smoking, the association between farmer's age and current alcohol drinking was found to be statistically significant (p=0.001) and moderately strong (Cramer's V test = 0.321). However, the age patterns of alcohol drinking differed in gender groups. Among female farmers, the percentage of current alcohol drinkers has substantially decreased in old persons (aged 60+). At this age group, only 2.9% currently drunk alcohol whereas the prevalence of current alcohol drinking in women at age of 50 to 59 (12.8%) and aged 49 or less (13.3%) was over 4 times or even almost 5 times higher, respectively.

Also level of education was significant predictor of current alcohol drinking (p=0.041) in farmers, however, the strength of this association was weak (Cramer's V test = 0.173). Among male farmers, the association seemed to be negative – the prevalence of alcohol drinking tended to increase with lowering the level of education. Among male farmers with high education, 18.6% currently drunk alcohol, in those with moderate education this percent increased to 21.5% and among low educated farmers it reached the highest value – 25.1%.

Among female farmers, the percentage of alcohol drinkers was the highest in those who were moderately educated (16.4%) and approximately 2-fold lower both among those with low (8.8%) and high education (9.3%).

Prevalence of simultaneous use of cigarettes and alcohol by sociodemographic determinants

Table 4 shows the association between simultaneous cigarette smoking and alcohol drinking among studied farmers and their sociodemographic characteristics. Among all farmers, the largest group were dual abstainers (53.3%) – those who neither did not currently smoke cigarettes nor did not drink alcohol. However, it means that almost 47% of farmers were current cigarette smokers, alcohol drinkers or smoked cigarettes and drunk alcohol simultaneously. The percentage of farmers who currently drunk alcohol but did not currently smoke cigarettes was 2-fold lower (25.5%) than the percentage of dual abstainers. Almost 5-fold lower was percentage of farmers who currently smoked cigarettes but did not drink alcohol (11.6%). The lowest proportion of farmers were dual current users of cigarettes and alcohol (9.3%).

The statistically significant ($p=0.001$) and moderately strong association (Cramer's V test = 0.317) was found between simultaneous cigarette and alcohol use and gender group. Male and female farmers differed very much in their cigarette smoking and alcohol drinking behaviours. The biggest difference was found among male and female farmers who were dual users of cigarettes and alcohol. The percentage of dual users of cigarettes and alcohol was 3-fold higher in men than in women. The high gender difference was also found among farmers who did not currently smoke cigarettes but simultaneously drunk alcohol (36.5% in men vs. 16.1% in women). Women were characterized by higher percentage of dual abstainers

(65.2%) than men (40.1%). The same pattern concerned farmers who currently smoked cigarettes but did not drink alcohol (13.9% of women vs. 8.9% of men).

Age was also strong predictor for simultaneous cigarette smoking and alcohol drinking. The association was statistically significant (p=0.001), however, weaker than for gender (Cramer's V test = 0.154). Like in gender groups, patterns of simultaneous cigarette smoking and alcohol drinking in farmers varied in specific age groups. The percentage of dual users was higher (13.7%) among oldest farmers (aged 60+) than in farmers at age of 49 or less (8.6%) or aged 50 to 59 (8.4%). The percentage of farmers who did not smoke cigarettes but drunk alcohol seemed to increase with age. This proportion was the lowest among farmers aged 49 or less (21.1%), slightly higher among those at age of 50 to 59 (24.1%) and the highest among the oldest farmers (36.3%). In contrast to abovementioned age groups, the percentage of farmers who smoked cigarettes but did not drink alcohol tended to decrease with age and was 20.3% at the youngest analysed age group (49 years or less), 9.9% in middle aged farmers (50-59 years old) and 6.9% among the oldest ones (aged 60+). The percentage of dual abstainers was the highest (57.3%) among farmers aged 50 to 59 and lower in farmers aged 49 or less (49.2%) or in the oldest farmers (43.1%).

The association between simultaneous current cigarette smoking and alcohol drinking and level of education was also statistically significant (p=0.027) but weaker (Cramer's V test = 0.136) than calculated for gender and age. It was probably caused by lack of or very low number of high educated study subjects, especially among dual users of cigarettes and alcohol (n=0) and those farmers who smoked cigarettes but did not drink alcohol (n=7). Therefore, it was difficult to interpret data on dual use of cigarettes and alcohol by farmers in specific educational groups, however, the percentage of dual use of these substances among studied farmers seemed to be low (at level of 9-10%) as compared with other behavioral patterns. On

the other side, the study provided important data on the percentage of dual abstainers among farmers. This proportion was the highest among all educational groups and tended to increase with increasing level of education (51.6% for low educated farmers, 53.3% for those with moderate education and 67.4% among farmers with high education. In contrast, the percentage of farmers who smoked cigarettes but did not drink alcohol seemed to decrease with increasing level of education (20.3%, 9.9% and 6.9%, respectively), however it should be pointed out that the calculation for high educated farmers was based on small number of study subjects. Proportion of farmers who did not smoke cigarettes but drunk alcohol was similar in all analysed educational groups (varied from 23.8% to 28.2%).

Discussion

Strengths and limitations of the study

The current study is a part of broader, ongoing research project on the health status and health behaviours of farmers that is also planned to be continued in future. So, there is both a need and an opportunity to build up, observe and analyse the cohort of farmers in longitudinal study on their health behaviours, including cigarette smoking and alcohol drinking, also in the context of the association with health perception and health condition. Results of the study also concern the phenomenon (smoking and alcohol drinking) which is not very often correlatively analysed in studies on farmer's health although both health behaviours are scientifically proved major causes of health burden in general and farmer's population [25-27]. It especially refers to lack of studies or research analyses on the simultaneous use of cigarettes and alcohol (poly-substance abuse) among Polish farmers [see 6 and 9]. Moreover, it is also worth to add that the study questionnaire is based on validated version of the international questionnaire (IPAQ) that is frequently used in health studies [29].

However, there is also a sort of methodological limitations that have to be taken into consideration when interpreting the study results. First, results of the study were exclusively based on self-reported questionnaire. It means that results rather describe farmer's health declarations than actually observed health behaviours. It could increase the risk of possible discrepancies between respondents' answers and the actual state of behavioural patterns. Self-reported formula of the questionnaire could also decrease the quality of questionnaire administration and increase the number of blank answers, especially when asked questions could be considered as "too sensitive" or "socially stigmatizing" by respondent. In particular, it might concern specific group of respondents such as women, in particular pregnant, or sick persons and might happen in specific circumstances of the questionnaire completion such as health care setting. Therefore, secondly, it is worth to clarify that all study subjects were recruited from those farmers who expressed the will to be treated and rehabilitated and were participating in rehabilitation courses. Such respondents are usually more aware of health risks, including smoking and alcohol drinking, and tend to be less often smokers and alcohol drinkers than all farmers. Moreover, the study questionnaire was completed in the health institution, first day of pro-health event (rehabilitation course), what could increase number of false questionnaire answers. Third, data used in statistical analysis were based on relatively small number of famers (N=612), mostly living only in one region of Poland (Wielkopolska voivodeship), and were not weighted to population of all Polish famers, so these data could not be treated as representative for health behaviours of all farmers in Poland. Fourth, the distribution of study subjects by age and education substantially differs from age and education structure of farmers population in Poland [see 30]. In our study, farmers at the age of 50 to 59 were overrepresented while young farmers (at age of 18 to 30) and those with high education underrepresented [see 28; also Table 1]. Results of the nation-wide surveys conducted in Poland show that adult Poles aged 50-59 belong to the most frequent smokers

and alcohol drinkers [10,31] and those at young age and with high education, also living in rural area, to the least frequent smokers and alcohol drinkers [10,27,31]. In fact, small number of study subjects with high education makes difficult to reliably interpret the prevalence of current smoking and alcohol drinking by high educated farmers.

Current cigarette smoking

The prevalence of current cigarette smoking among farmers found in our study is substantially lower in both gender groups (23.4% in men and 18.8% in women) than smoking prevalence observed in recent nation-wide questionnaire survey data on attitudes toward smoking in Poland. In 2019, what results from data of the national survey conducted on representative sample of adults (15 years old and over) by the Chief Sanitary Inspectorate, 31% of male farmers and 35% of female farmers smoked tobacco daily [31]. These data can be even underestimated as they concern daily smoking while data from our study measure current smoking that includes both daily and occasional smoking (1-2% in Polish adults)[31]. Nevertheless, even lower, although underestimated, proportion of cigarette smokers in farmers participating in our study seems to be high when compared with farmer's smoking in other countries [26]. It is now close to the level of current smoking characterising all adults in Poland (24% in men and 18% in women)[31]. Since the prevalence of current smoking among Polish female farmers and women living in rural area was increased almost two times between 1974 (it was about 10% at that time) and 2019 [6,31], living in rural area or being a farmer does not protect woman anymore from smoking in her environment. The level of current smoking in men and women found in our study is also enough high for contributing to many smoking-attributable diseases in farmers, especially when the prevalence tends to substantially increase by long time. Sharp increase in smoking prevalence among women living in rural area was probably one of the reasons why lung cancer mortality has increased

in all women for many years and became the leading cancer in female population since 2007 [6]. However, it requires additional research analysis based on long-term aggregated data on smoking prevalence, its behavioural patterns and standardized lung cancer mortality rates.

Although the prevalence of current smoking by age and education found in farmers participating in our study differs from the level observed in Polish nation-wide surveys, the age and educational patterns of current smoking in farmer's study seem to be consistent with the same patterns found in national studies, especially in women [compare with 27 and 31]. Similar smoking patterns are also found in foreign studies conducted in rural areas [26]. In general, the prevalence of current smoking has the highest level in young adult women, also farmers, and tends to decrease with increasing age while in men this pattern is not observed. In surveys based on enough big, random and representative samples, the smoking prevalence usually remains high in low educated people and decrease with increasing level of education [see data from GATS Poland in 27]. However, as it is underlined above, we have to carefully interpret educational patterns of smoking in our study because a "small numbers bias" in high educated farmers.

Current alcohol drinking.

The prevalence of current alcohol drinking found among farmers in our study (34.8% for all study subjects, 51.1% in men and 20.9% in women seems to be substantially underestimated. First of all, it results from methodological limitations of the study (see above the section on stud strengths and limitations). Results of the nation-wide questionnaire survey on alcohol drinking conducted in 2022 by the State Agency for Prevention of Alcohol-Related Problems on representative sample of 2,000 adult Poles indicates on much higher prevalence of alcohol drinking both in general population (76.1% in men, 84% in women) and among people living

in rural area (81.5%) than in farmers participating in our study [10,32]. First of all, it may result from abovementioned methodological limitations of farmer's study, mainly from recruitment of respondents who were more aware of health risk of alcohol drinking and the circumstances in which the study questionnaire was completed (health care setting) what might have an impact on lower alcohol drinking rates among studied farmers (see above the section on study strengths and limitations). Moreover, the high rates of alcohol drinking observed in the 2020 survey might result from changes in mental health (e.g. stress, anxiety, sleep disturbances, social isolation) and weakening the alcohol prevention and treatment programs and services during the COVID-19 epidemic [33,34]. Although there are substantial differences in the prevalence of alcohol drinking found in our study and in results of the nation-wide Polish surveys on alcohol use, the age pattern of alcohol drinking seems to be consistent in both studies – the older age of adults, the higher alcohol drinking rates. However, the same similarities were not found in analysed studies for educational patterns of alcohol drinking.

Simultaneous use of cigarettes and alcohol.

The presented analysis of simultaneous use of cigarettes and alcohol by farmers is unique in Polish studies, in particular when made in specific age and educational groups. Results of our study show that almost 47% of farmers smoke cigarettes, drink alcohol or are dual users of the both psychoactive substances. Due to reasons described above, this percentage might be even underestimated. Underestimated seems to be also the percentage of those farmers who simultaneously smoke cigarettes and drink alcohol (9.3%, including 14.5% of men and 4.8% of women). However, it means that big number of Polish farmers, mostly men, is exposed to toxic and carcinogenic compounds contained both in tobacco smoke and alcohol. It may contribute to more massive and more severe health consequences than those observed in

farmers who are exposed to only one of these risky substances [35]. Moreover, poly-substance abuse may increase addiction symptoms and impede treatment of tobacco and alcohol dependence. It also requires more intensive and specific cessation interventions, programs and services [36].

Conclusions

The prevalence of cigarette smoking and alcohol drinking remains still high among Polish farmers. One of ten farmers simultaneously smoke cigarettes and drink alcohol. Only the half of farmers are current cigarette and alcohol drinking abstainers. It may contribute to serious psychological and somatic health problems among farmers that have to be in-depth investigated. All abovementioned dependent variables are strongly determined by farmer's sociodemographic status. Strong association was found with gender, age and the level of education. Differences in gender and age groups seem to be bigger for current alcohol drinking, differences in educational groups tend to be bigger for current cigarette smoking. These social inequalities should be seriously taken into consideration when building up the target-tailored tobacco and alcohol preventive and cessation programs for farmers in order to effectively change their health status and health behaviours.

References

1. World Health Organization (WHO). WHO Report on the Global Tobacco Epidemic, 2023. Protect people from tobacco smoke. WHO, Geneva 2023.
2. World Health Organization (WHO). Global status report on alcohol and health and treatment of substance use disorders. WHO, Geneva 2024.

3. Global Burden of Disease 2019 Tobacco Collaborators (GBD). Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019. Lancet 2021; 397(10292): 2337–2360. DOI: 10.1016/S0140-6736(21)01169-7.
4. Giovino GA, Mirza SA, Samet JM, Gupta PC, Jarvis MJ, Bhala N, Peto R, Zatoński W, Hsia J, Morton J, Palipudi KM, Asma S; GATS Collaborative Group. Tobacco use in 3 billion individuals from 16 countries: an analysis of nationally representative cross-sectional household surveys. Lancet 2012; 380(9842): 668-79. DOI: 10.1016/S0140-6736(12)61085-X.
5. European Commission (EC). Attitudes of Europeans towards tobacco and related products. Report. Special Eurobarometer 539. EC DG SANTE, Brussels 2023.
6. Przewoźniak K, Zatoński W. Tobacco smoking. In: Public health. The social and ecological dimension. Golinowska St (ed.). Scholar Publishing House, Warsaw 2024: 167-188.
7. Peto, R, Lopez AD, Boreham J, Thun MJ, Heath C. Mortality from Smoking in Developed Countries 1950–2020. 4th ed. Oxford University Press, Oxford 2015.
8. Manthey J, Shield KD, Rylett M, Hasan OSM, Probst C, Rehm J. Global alcohol exposure between 1990 and 2017 and forecasts until 2030: a modelling study. Lancet 2019; 393(10190): 2493-2502. DOI: 10.1016/S0140-6736(18)32744-2.
9. Bętkowska-Korpała B, Klingemann J. Alcohol use. In: Public health. The social and ecological dimension. Golinowska S (ed.). Scholar Publishing House, Warsaw 2024: 189-204.

10. Centrum Badania Opinii Społecznej (CBOS). Konsumpcja alkoholu w Polsce. Komunikat z badań [Alcohol consumption in Poland. Research report]. Fundacja CBOS, Warszawa 2019 [in Polish].
11. Niu C, Dong J, Zhang P, Yang Q, Xue D, Liu B, Xiao D, Zhuang R, Li M, Zhang L. The global burden of cardiovascular disease attributable to high alcohol use from 1990 to 2021: an analysis for the global burden of disease study 2021. Front Public Health 2025; 13. DOI: 10.3389/fpubh.2025.1541641.
12. Rumgay H, Shield K, Charvat H, Ferrari P, Sornpaisarn B, Obot I, Islami F, Lemmens VEPP, Rehm J, Soerjomataram I. Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study. Lancet Oncol 2021; 22(8): 1071-1080. DOI: 10.1016/S1470-2045(21)00279-5.
13. GBD 2017 Cirrhosis Collaborators. The global, regional, and national burden of cirrhosis by cause in 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Gastroenterol Hepatol 2020; 5(3): 245-266. DOI: 10.1016/ S2468-1253(19)30349-8.
14. Zatoński W. The alcohol crisis in Polish public health. J Health Inequalities 2019; 5(2): 122-123. DOI: 10.5114/jhi.2019.91380.
15. Drope J, Schluger NW (eds.). The Tobacco Atlas. 6th ed. American Cancer Society, Atlanta 2018.
16. Zatoński W, Przewoźniak K, Sulkowska U, West R, Wojtyła A. Tobacco smoking in countries of the European Union. Ann Agric Environ Med 2012; 19;2: 181-192
17. Rehm J, Probst C. Decreases of life expectancy despite decreases in non-communicable disease mortality: the role of substance use and socioeconomic status. Eur Addict Res 2018; 24 (2): 53-59. DOI: 10.1159/000488328.

18. Bobo JK, Husten C. Sociocultural influences on smoking and drinking. Alcohol Res Health 2000; 24(4): 225-32.
19. Ng R, Sutradhar R, Yao Z, Wodchis WP, Rosella LC. Smoking, drinking, diet and physical activity-modifiable lifestyle risk factors and their associations with age to first chronic disease. Int J Epidemiol 2020; 49(1): 113-130. DOI: 10.1093/ije/dyz078.
20. Palipudi KM, Gupta PC, Sinha DN, Andes LJ, Asma S, McAfee T, et al. Social Determinants of Health and Tobacco Use In Thirteen Low and Middle Income Countries: Evidence from Global Adult Tobacco Survey. PloS One 2012; 7(3): e33466. DOI: 10.1371/journal.pone.0033466.
21. Wang Q, Shen JJ, Sotero M, Li CA, Hou Z. Income, occupation and education: Are they related to smoking behaviors in China? PLoS One 2018; 13(2):e0192571. DOI: 10.1371/journal.pone.0192571.
22. Ruokolainen O, Härkänen T, Lahti J, Haukkala A, Heliövaara M, Rahkonen O. Association between educational level and smoking cessation in an 11-year follow-up study of a national health survey. Scand J Public Health 2021; 49(8): 951-960. DOI: 10.1177/1403494821993721.
23. World Health Organization (WHO). Tobacco and poverty: a vicious circle. WHO, Geneva 2004.
24. World Health Organization (WHO). WHO global report on trends in prevalence of tobacco use 2000–2030. WHO, Geneva 2024
25. Friesen EL, Bailey J, Hyett S, Sedighi S, de Snoo ML, Williams K, Barry R, Erickson A, Foroutan F, Selby P, Rosella L, Kurdyak P. Hazardous alcohol use and alcohol-related harm in rural and remote communities: a scoping review. Lancet Public Health 2022; 7(2): E177-E187. DOI: 10.1016/ S2468-2667(21)00159-6.

26. Vander Weg MW, Cunningham CL, Howren MB, Cai X. Tobacco use and exposure in rural areas: Findings from the Behavioral Risk Factor Surveillance System. Addictive Behaviors 2011; 36(3): 231-236. DOI: 10.1016/j.addbeh.2010.11.005.
27. Włodarczyk A, Raciborski F, Opoczyńska D, Samoliński B, GATS Collaborators. Daily tobacco smoking patterns in rural and urban areas of Poland – the results of the GATS study. Ann Agric Environ Med 2013; 20(3): 588-594.
28. Piotrowski K. Uwarunkowania stanu zdrowia i zachowań zdrowotnmych rolników z dolegliwościami bólowymi narządu rychu uczestniczących w turnusach rehabilitacyjnych [Determinants of health status and health behaviors among farmers with musculoskeletal pain symptoms participating in rehabilitation courses]. Praca doktorska. publikowana Akademia Wychowania Fizycznego, Poznań 2016 [in Polish].
29. Biernat E, Stupnicki R, Gajewski AK. Międzynarodowy Kwestionariusz Aktywności Fizycznej (IPAQ) – wersja polska [International Physical Activity Questionnaire – Polish version]. Wychowanie Fizyczne i Sport 2007; 51(1): 47-54 [in Polish].
30. Główny Urząd Statystyczny (GUS). Ludność. Stan i struktura oraz ruch naturalny w przekroju terytorialnym w 2024 roku. Stan w dniu 30 czerwca [Population. Size and structure and vital statistics in Poland by territorial division in 2024. As of 30 June]. GUS, Warszawa 2024 [in Polish].
31. Główny Inspektorat Sanitarny (GIS). Raport z ogólnopolskiego badania ankietowego na temat postaw wobec palenia tytoniu [Research report from the nation-wide questionnaire survey on attitudes toward tobacco smoking in Poland]. GIS, Warszawa 2019 [in Polish].
32. Rowicka M, Postek S, Zin-Sędek M. Wzory konsumpcji alkoholu w Polsce. Raport z badań kwestionariuszowych 2020 r. [Patterns of alcohol consumptionin Poland.

Research report from questionnaire study, 2020]. Państwowa Agencja Rozwiązywania Problemów Alkoholowych, Warszawa 2021.

33. Herbeć A. Inequalities in health behaviours during the COVID-19 pandemic – a commentary. J Health Inequalities 2024; 10 (2):157–161. DOI: 10.5114/jhi.2024.145106.
34. Zatonski WA, Zatonski M, Janik-Koncewicz K, Wojtyla A. Alcohol-related deaths in Poland during a period of weakening alcohol control measures. JAMA 2021; 325(11): 1108-1109. DOI: 10.1001/jama.2020.25879.
35. Ellis JD, Rabinowitz JA, Ware OD, Wells J, Dunn K, Huhn A. Patterns of polysubstance use and clinical comorbidity among persons seeking substance use treatment: An observational study. J Subst Use Addict Treat 2023; 146:208932. DOI: 10.1016/j.josat.2022.208932
36. Sridharan S, Kawata JH, Campbell B, Tseng CWM. Contemporaneous relationship between substance abuse treatment and poly-substance use: Evidence from the Persistent Effect of Treatment Studies. J Subst Abuse Treatment 2005; 28(Suppl 2): S83-S90. DOI: 10.1016/j.jsat.2004.09.003.