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Environmental Influence on the Physical Activity and Obesity Rates of the Hungarian Adult Females: A Systematic Review

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Abstract

Physical inactivity is insidiously taking over people's lives, when it is accompanied with improper dietary habits, obesity rates can have growing incidence. Those outcomes and health practices are influenced by the environment that adult females live at, since they are required to perform main social roles they carry during adulthood. This systematic review aims to analyse how the environment in Hungary influences their lifestyle patterns, health practices and outcomes.

Following the Social Determinants of Health model, we aimed to analyse how social and built environment affect physical activity levels and lifestyle patterns of the Hungarian female adults and the obesity rates among them. We have collected and analysed literature related to the five determinants from statistical reports and research articles in April 2024, in total 81 research article have been reviewed in addition to national and international reports from statistical databases.

Hungarian adult females tend to have sufficient PA level. However, obesity rates among them are considered high, this is due to PA domains that they tend to practice which are mainly not related to Leisure Time Physical Activity. Additionally, dietary patterns and caloric intakes showed unsatisfying results. Socio-economic status showed negative impact on their lifestyle patterns, while built environment had a positive impact.

Interventions to enhance LTPA are needed, since it has better influence on their health outcomes and practices than other PA domains. The utilization of built environment can help to create outdoor activities with low fees to encourage Hungarian female adults to practice LTPA. Also, there should be focus on nutrition and PA guidelines in public and in working environment.

Keywords: Female Adults, Hungary, Physical Activity, Social Environment

Macar Yetişkin Kadınların Fiziksel Aktivite ve Obezite Oranları Üzerinde Çevresel Etki: Sistematik Derleme

Özet

Fiziksel hareketsizlik sinsice insanların hayatını ele geçirmekte, buna yanlış beslenme alışkanlıkları da eşlik ettiğinde obezite oranları giderek artabilmektedir. Bu sonuçlar ve sağlık uygulamaları, yetişkinlik döneminde taşıdıkları temel sosyal rolleri yerine getirmeleri gerektiğinden, yetişkin kadınların yaşadıkları çevreden etkilenmektedir. Bu sistematik derleme, Macaristan'daki çevrenin yaşam tarzı kalıplarını, sağlık uygulamalarını ve sonuçlarını nasıl etkilediğini analiz etmeyi amaçlamaktadır.

Sağlığın Sosyal Belirleyicileri modelini izleyerek, sosyal ve yapılı çevrenin Macar kadın yetişkinlerin fiziksel aktivite düzeylerini ve yaşam tarzı kalıplarını ve bunlar arasındaki obezite oranlarını nasıl etkilediğini analiz etmeyi amaçladık. Nisan 2024'teki istatistiksel raporlardan ve araştırma makalelerinden beş belirleyici ile ilgili literatürü topladık ve analiz ettik, istatistiksel veri tabanlarından ulusal ve uluslararası raporlara ek olarak toplam 81 araştırma makalesi incelendi.

Macar yetişkin kadınlar yeterli PA düzeyine sahip olma eğilimindedir. Ancak, bu kadınlar arasında obezite oranlarının yüksek olduğu düşünülmektedir ve bu durum, çoğunlukla Serbest Zaman Fiziksel Aktivitesi ile ilgili olmayan PA alanlarını uygulama eğiliminde olmalarından kaynaklanmaktadır. Ek olarak, beslenme şekilleri ve kalori alımları tatmin edici olmayan sonuçlar göstermiştir. Sosyo-ekonomik durum yaşam tarzı kalıpları üzerinde olumsuz bir etki gösterirken, yapılı çevre olumlu bir etkiye sahiptir.

LTPA'nın sağlık sonuçları ve uygulamaları üzerinde diğer PA alanlarına göre daha iyi bir etkiye sahip olması nedeniyle LTPA'yı geliştirecek müdahalelere ihtiyaç duyulmaktadır. Yapılı çevrenin kullanımı, Macar kadın yetişkinleri LTPA uygulamaya teşvik etmek için düşük ücretli açık hava etkinliklerinin oluşturulmasına yardımcı olabilir. Ayrıca, kamuda ve çalışma ortamında beslenme ve PA kılavuzlarına odaklanılmalıdır.

Anahtar kelimeler: Fiziksel Aktivite, Kadın Yetişkinler, Macaristan, Sosyal Çevre

1. INTRODUCTION

As a result of interplay between physical inactivity and dietary habits which is mainly represented by higher calorie intake and less calorie expenditure obesity rates can be a health outcome in all ages and both sexes, regardless of geographical location, ethnicity, or socioeconomic level.[1,2,3] Previous study showed more barriers for healthy eating and performing regular physical activity among females, people with obesity, and those living in rural areas.[4] Another study among European women indicates that adult females are less active and "deprived" from being physically active in comparison with their male counterparts.[5] Additionally, previous findings are related to the duties that are expected to be done from female adults as an employee, partner, and mother: the main social roles that females carry during middle adulthood.[6,7] Certainly, drops in physical activity were mostly correlated with moving into a having relationship, with marriage, and with motherhood.[8] In point of fact, they can be still considered physically active as a result of being responsible on different domains of Physical Activity e.g. (house c hores, job work, transport). However, despite that there is a correlation between physical exercise and health-related fitness, studies have shown that health-related fitness can improve health on its own and in certain situations even after including physical activity.[9,10] Benefits of activity emerge independently from the type of activities engaged in, researchers have revealed that benefits from leisure time physical activity, outdoor, and recreational sporting activities are associated with better health outcomes such as prevention of non-communicable diseases, if compared with daily chores physical activity.[11,12,13] Agreeing with mentioned, researchers stated that physically inactive middle-aged women (engaging in less than 1 hour of exercise per week) experienced a higher cardiovascular and cancer related mortality compared with physically active women.[14]

In any case, there can be found disparities between cultures/nations environment and their beliefs in how they perceive importance of life tasks balance and support female adults to devote time for recreational activities and have proper lifestyle and facing less constraints or barriers. Hence, it is important to study the surrounding environment circumstances which can destine physical activity domain tendency and analyse the health outcomes upon that.[15]

One of the holistic approaches for physical inactivity and obesity prevention management is to analyse and address the Social Determinants of Health (SDOH), which are the conditions that individuals are born in and live under, that affect their health.[16] Thus, there can be set suitable interventions which are compatible with certain societies. SDOH include the environmental, economic, social, and psychosocial factors that surround individuals and influence their habits, preferences, and lifestyle. Specifically, when it comes to analysing adult female physical activity and lifestyle, it is observed that SDOH strongly influence their choices as it is accompanied with their cultural beliefs and thus formalize a group of limitations that face them to have a proper lifestyle.[17] As research on female physical activity and leisure time physical activity (LTPA) is growing, interpretive studies have been produced to reach a deeper knowledge of women's lifestyle and circumstances. In this study, from a systematic review we attempt to analyse: 1) SODH conditions in Hungary, 2) Hungarian female adults physical activity

patterns, dietary and lifestyle habits as moderating factors and 3) Obesity and overweight rates as depending variables.

2. Materials and Methods

2.1. Research Strategy and Objectives

This paper provides a systematic analysis from scientific perspectives demonstrating the environmental factors that influence the physical activity patterns and obesity rates of Hungarian female adults and subdividing them into categories following the social determinants of health model (Figure 1.), such as social and community context, neighbourhood and built environment, healthcare access and quality, education access and quality, and economic stability. PA patterns among people with special conditions or diseases are not to be examined since we are focusing on surrounding environment analysis and not on any physiological/psychological barriers.

The analysis was investigated from publications: 1) Major statistical databases: Hungarian Central Statistical Database, Worldometer, Eurostat, European Union Health Profiles, World Health Organization (WHO), Organisation of Economic Cooperation and Development (OECD) library 2) Public health agencies: WHO, Center of Disease Control (CDC) (3) major databases including Pubmed, Science Direct, Google scholar, and Mendeley online article research tool. In this review, we searched the literature using the keywords "physical activity", "female adults", "social environment", "female", "Hungarians", "health", "environmental factors", "obesity".

Figure 1. Social Determinants of Health[18]

2.2. Data Selection

Articles, abstracts, full articles, surveys, factsheets, and documents were analyzed by applying inclusion criteria: female adults, Hungarian adults, and European adults for

comparison purpose. Both objective and subjective data were screened to check if they are somewhat compatible. Data were reviewed among both genders, and then focused on female related results. Along with the included objective data and documents from statistical databases, short-listed and considered articles went through title, abstract and then full article screening, then analysed to extract the main themes and summarize the findings of the study. The publication sources of data analysis are shown in Figure 2.

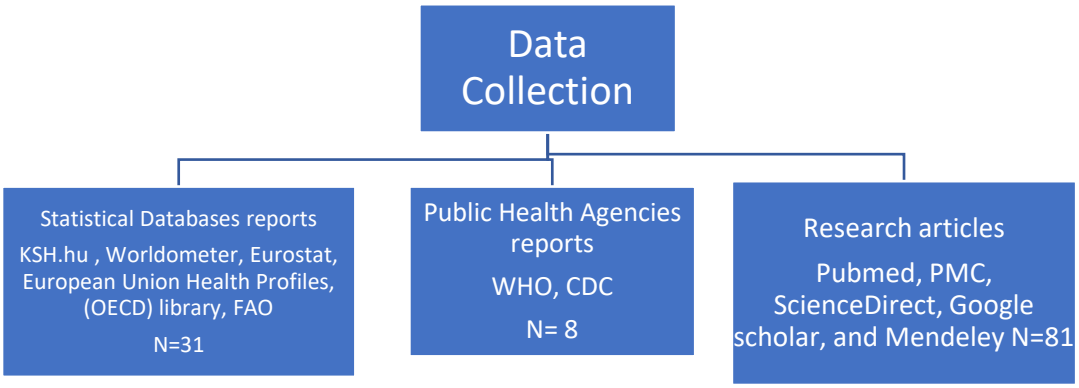

Figure 2. Publication sources of data analysis (N=120)

3. Results and Discussion

3.1. Social Determinants of Health

Social and Community Context

We consider the social determinants crucial for our study target population, since some societies or cultures tend to follow gender ideologies which encompass thoughts and beliefs that characterize masculinity and femininity, and what allowed to be practiced in their living place and what is forbidden. Those beliefs depend on their religion, principles, morals, sects, urbanization, ethnicity, and social bonds; and hence, it may determine the level of social support from their family/partners.[19]

According to "Kozponti Statisztikai Hivatal", Hungary is a central European country with a 93,030 square kilometers land area with 9,6 million inhabitants by 2023, (females 52%).[20] The country's history is infused with influences from different civilizations and empires, each of these invaders left their stamp on the nation's customs, traditions, and beliefs.[21] The main ethnic groups are 92% Hungarians, 2% Roma (gypsies), 0.6% Germans, 0.1% Romanians, 0.2% Slovaks, 0.2% Croatians, and 0.6 others.[22] However, previous statistics have revealed that Roma people with Indo-Aryan origin who traditionally lived a nomadic lifestyle, are estimated to be around 8.8% due to the lack of definition of the concept of Roma and the lack of statistics.[23] According to Central European Management Intelligence, the share of the Roma population will double by 2050, accounting for around 14-15% of the country's population.[24] In Hungary, rural population reached 27.5% by 2022, reflecting poverty which is the most noticed problem in the rural areas whereas urban Hungary is dominated by Budapest (70%).[25,26,27]

Hungary is a historically Christian country. By 2022, main religions in Hungary were: 73% Christianity, 0.1% Jewish, 0.1 % Buddhist, and 0.1% Muslims. Whilst 23.1% of the population did not show religion affiliation.[28] Interestingly, several researchers confirmed that there is a positive correlation between religiousness/spirituality and health behaviours (mentally and physically).[29,30]

Social position and geo-cultural background in Hungary are significant drivers of social cohesiveness and interethnic trust. The migration rate has a surprisingly modest impact on trust and cohesion. Interestingly, a big proportion of Roma inhabitants appear to reduce perceptions of social cohesion, but the presence of national minorities may improve community cohesion.[31] However, according to the U.S Office Diseases Prevention and Health Control with their mission under "happy people" project to promote nation's efforts to improve the health and well-being of all people, many people encounter obstacles and hazards over which they have little control, such as hazardous neighbourhoods, discrimination, or difficulty affording basic necessities, which can have long-term detrimental consequences for one's health and safety. Thus, it is important to reach positive relationships at home, work, and in the community that can help decrease the negative effects.[32] The aforementioned aspects can be accomplished by integration of marginalized groups, for instance through participation in the labour market or duties of some other activities that are useful for the society.[33] As an important result, social cohesion and social support can determine physical activity levels and recreational activities negatively.

3.2. Economic Stability

Economic status and economic stability highly influence how an individual can afford healthy food and access healthy behaviours.[33,34] Previous research revealed that unemployed individuals and those unable to work, experience increased challenges when it comes to healthcare access. Similarly, providing access to affordable healthcare and other resources is critical for preventing health declines.[35,36]

Employed individuals tend to be physically active (work-related PA), female employees who are engaged in a low or high amount of work-related walking had significantly lower psychological distress symptoms than those who are engaged in no work-related walking.[37] However, work related physical activity shouldn't be promoted above leisure-time physical activity since recreational physical activities are associated with better health outcomes in general (physically and mentally).[13]

In addition, previous results have shown that financial stress is associated with obesity, it is proved that financial insecurity was correlated with overweight or obesity, through both physiological processes and habits, such as the overconsumption of highly palatable foods that are high in fat or sugar. and tend to be cheaper than healthy foods.[38,39,40] Specifically, Kim and Von Dem have shown that there is a clear negative correlation between socioeconomic levels in high-income nations and obesity among adult women.[40] Interestingly, income inequality and poverty are well-known causes of health disparities within populations. It has a direct impact on health since the goods and services that individuals purchase can either benefit or harm their health and habits

and the services be reached differently/unequally.[41] Higher earnings are associated with better health, both in Hungary and across the EU. In 2019, 73% of Hungarians in the top income quintile reported being in good health, while 47% were in the lower perceived health.[42]

Hungary is a high-income mixed economy, its main currency is Forint which equals .0027 USD, with 181.8 billion USD GDP (2021).[43] The country is within the 22nd lowest income inequality by Gini index in the world (30%-35%), which indicates that Hungarian population mostly have equal incomes, but with low average wage gross salary, annually 28.475 USD compared with OECD total average of 53.416 USD.[44]

The employment rates of Hungarian adult just lightly differ from European average data but higher than in the OECD countries (63.17%).[45,46]

Table 1. Employment rates among Hungarian and European adults aged 15-64 years old[46]

	Hungary	EU
Males	78.5%	80.4%
Females	70.8%	70.2%
Total	74.6%	75.3%

EU: European Union countries average

The employment rate reached 84.6 % among females between 15-49 in 2023. According to a recent study investigated with "working mothers", 64% of them have no time to do sports because of work and housework duties.[12]

Another important aspect to understand the financial background of physical active lifestyle is how much the population spend on sport, including leisure and recreation sport, school and student sport, competitive and youth sport, sports scholarships/allowance/achievement, sports administration and anti-doping, and operation and development of sports building and training camps, the total expenditure have increased from 38.883 to 441,147 million HUF (2010-2020) (Figure. 3).[47]

Figure 3. Sports budgetary expenditure[47]

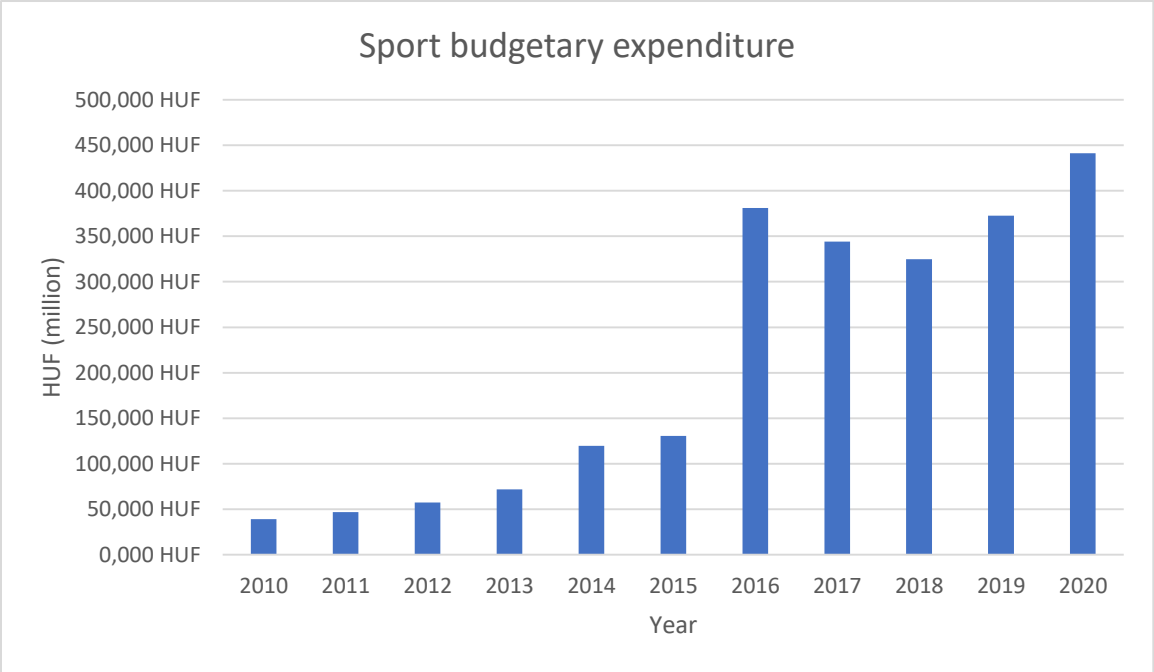

Figure 3. Sports budgetary expenditure[47]

Healthcare Access and Quality

Depending on economic status, access to healthcare is impacted by austerity policies resulting from the economic crisis, including cuts to healthcare insurance coverage and increased taxes.[48] The correlation between active lifestyle and healthcare budget is clearly obvious, patients with chronic diseases which are mainly related to improper lifestyle (exercise habits, dietary habits, regular blood pressure measurement, drinking habits) develop specific needs/cures which the healthcare systems need to adapt to; hence more expenditure is needed. Vice versa, when quality healthcare systems are not available to the population it will impact public health status and thus, more health problems and health inequalities are observed.[49]

One of the aspects of healthcare demands is the population life expectancy, increased life expectancy results in an increased demand for healthcare services.[50] During the last two decades, life expectancy average in Hungary raised from 71.33 in 2000 to 76.60 in 2023, and women have six years longer than men, with a reason that men are more likely to be exposed to risk factors, such as smoking (Table 2.), resulting in a larger gender disparity compared to the EU overall.[51] In addition, obesity-related noncommunicable diseases (NCDs) lead to high premature mortality rates in Hungary, with an average life expectancy around 5 years lower than the EU norm.[42]

One of the main measures to analyse healthcare quality and access is to examine the healthcare insurance availability and budget provided for it, since many researchers concluded that health insurance improved the likelihood of proper care and was positively correlated with better health outcomes, chronic disease prevention and management.[52,53]

In Hungary, healthcare financing of curative-preventive care from 2012 to 2022 have increased from 84.9 thousand HUF/ capita to 227.5 thousand HUF/capita.[54] Despite of the mentioned figures, Hungary was ranked the 19th country with health care expenditure in 2021 among Europe area, considered from the lowest, compared with France, Germany and Italy (Figure 4.). However, universal access to high-quality healthcare at a reasonable cost for both people and society as a whole is commonly considered as a fundamental principle in the EU generally.[55]

The number of active physicians in Hungary reached 40.671 by 2022, as compared with 2012 (36.250 active physician).[56] Overall, Among the European Union countries, Greece, Portugal, and Austria recorded the highest numbers of physicians (who are licensed to practice) per 100 000 inhabitants. Whereas the lowest ratios were registered in France, Belgium, and Hungary.[57]

Table 2. Life expectancy average (2000-2023), both genders.

Gender/Year	HU, 2000	HU,2023	EU, 2023
Females	75.59	79.60	82.9
Males	67.11	73.40	77.2
Total	71.33	76.60	81.3

Figure 4. Healthcare expenditure by total financing schemes (annual, million Euro)[55]

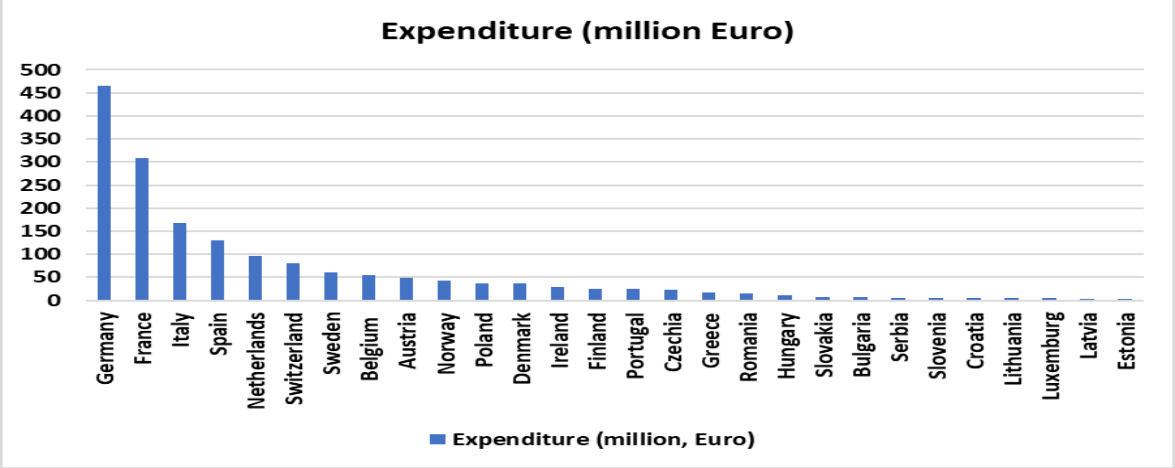

Figure 4. Healthcare expenditure by total financing schemes (annual, million Euro)[55]

Education Access and Quality

Education level earned has its positive correlation with health outcomes and life satisfaction, representing SES with economic status.[58] Adults among the Organisation of Economic Development (OECD) countries with higher educational degrees have better health and lifespans if compared to their less-educated counterparts.[59] Accordingly, healthcare is crucial, but efforts other than health care that are related to education, jobs, and social growth - which influence proper lifestyle habits-, may represent the best approach to stop increasing healthcare expenses by bypassing the seeking for curative

healthcare.[60] Accordingly, high education levels are related to higher healthy life expectancy among American adults.[61]

In addition, physical disability declines more for women than for men as their level of education rises.[62] Montez and Yajacova (2013) have revealed a developing gradient for all-cause mortality indicated rising mortality among low-educated women and decreasing mortality among college-educated women.[63]

Researchers confirmed the association between higher educational attainment and greater food choices (consumption of fruits, vegetables, and fish, lower caloric intake, and diversity in foods) whereas lower education levels among adults was connected to diets high in carbohydrates and low in fibers, higher consumption of sweets, red meats, energy-rich drinks, and fried food.[64,65,66,67] Also, the odds of drinking alcohol were higher among less-educated adults.[68] Therefore, researchers confirmed that dietary habits may contribute to socioeconomic disparities in overweight/obesity in Europe.[66] Moreover, it has been found that years of educational attainment are positively associated with engaging in physical activity. Adding one year of education increases weekly intensive activity by 0.26 hours, daily steps by 560, and aerobic steps by 390. Specifically, it is positively associated with leisure-time physical activity.[69] Also, health literacy which is the individuals' ability to locate, comprehend, and use information and services to help them and others make health-related decisions and take action was positively influenced by higher education attainment.[70,71,72]

In Hungary, the number of years in formal education and literacy is positively associated with the chances of being employed and wages and have a positive impact on non-economic outcomes, such as trust in others, voluntary participation, and self-reported health.[73] In 2021, literacy rates among Hungarians above 15 years old (who can both read and write) was 98.6%, (98.9% females, 98.5% males).[74,75]

However, Hungary is still one of the 12 OECD nations where tertiary education is less frequent than upper secondary or post-secondary non-tertiary education as the highest level.[76] Table 3. shows tertiary attainment percentage in 2023 among Hungarian population in total and among males and females, compared with OECD average of member countries, Poland, Czech Republic and Italy all nations were below OECD average, with an observed higher percentage among females in all compared nations.[77]

Table 3. Percentage of attained tertiary education 25-64 years old in 4 OECD nations compared with OECD average.

	Hungary	Poland	Czech Republic	Italy	OECD average
Attained tertiary education, 25-64 years old (%)	29.4%	33.9%	26.7%	20.3%	40.4%
Attained tertiary education, 25-64 years old (%) – Males	24.8%	27.4%	23.7%	17.1%	36.5%
Attained tertiary education, 25-64 years old (%) – Females	33.9%	40.4%	29.8%	23.5%	44.3%

Several behavioural risk factors are more prevalent among those with lower education or income levels. In 2014, 30% of Hungarian individuals who had not completed secondary education smoked daily, compared to 13% of those with tertiary education which is more than double the EU average. Likewise, 25% of Hungarians without secondary school self-reported being obese in 2019, compared to 17% of those with higher educational degrees.[42]

Inequalities in life expectancy by the level of education earned remain observed, and are significant in Hungary (Bíró et al., 2021). At the age of 30, Hungarian males with the lowest degree of education will live nearly 11 years less than those with tertiary education. whereas for women, the difference in life expectancy is much lower, with 3.1 years less.[42]

However, health literacy and physical activity promotion among adults was the primary which was established since 2013 by health-promoting offices. HPOs operate in subregions of Hungary, offering cost-free services.

Also, as physical education in schools plays an important role to generate healthy adults, there are 5 mandatory PE lessons in primary and secondary schools in Hungary. Additionally, physical education teachers receive required training on physical activity and health, including health impacts, determinants, and effective treatments, during their undergraduate and postgraduate degrees. Hence, Physical education sessions in schools are evaluated as part of the whole pedagogical process.[78] From these measures, a successful implemented practice should be applied among the university and workplace environments for adults.

Neighbourdhood Built Environment

Neighbourhood and built environment include key issues such as housing quality, transportation accessibility, neighbourhood walkability, access to service and stores, place aesthetics, and neighbourhood crime and violence.[79] Mentioned issues can influence individuals' physical activity patterns. Therefore, the main goal is to promote

neighbourhood safety and flexibility for citizens to achieve better health outcomes, especially for adult females.

It was agreed that there is a positive correlation between neighbourhood-built environment and health outcomes and physical activity patterns. Moderate to vigorous physical activity (MVPA) was higher in high-SES and walkable neighbourhoods and had the lowest average sedentary minutes.[80] On the other hand, individuals in low-income neighbourhoods spent more time watching television and had higher levels of obesity and body fat.[81] In addition, a study that analysed 5 urban regions in Europe, including Budapest, has found lower sedentary behaviours among those who had better conditions of accessible destinations such as supermarkets, recreational facilities, or restaurants in their neighbourhood, and among adults who perceived measured aesthetic features, such as trees, water areas or public parks. In addition, same study has found that perceived aesthetics and neighbourhood safety were positively associated to transport-related PA only among women.[82] McCormack and colleagues have confirmed the aforementioned associations through both perceived and objective measures for built environment factors and PA levels the walkability index of the Physical Activity Neighbourhood Environmental Survey (PANES) was positively associated with cardio respiratory fitness (CRF), muscular strength (MS), flexibility, and overall perceived fitness.[83] The mentioned correlation interprets that supportiveness neighbourhood for parks and recreation facilities is positively related with CRF, MS, and flexibility.[84] Besides, people who have reported feeling safe from crime had 27% greater odds of being physically active regardless of the domain of physical activity.[85] Whereas sufficient MVPA was related to more perception of safety from traffic to walk.[85] Specifically, among women, the correlation between fear of walk in the neighbourhood and crime has been studied; female gender was associated with an increase in fear of walking when they felt the presence of crime or violence.[86] Additionally, green open spaces in urban areas had an important role in promoting physical activity especially among the women and the old population.[87] A higher number of neighbourhood features (approxity to stores, access to recreation facilities) was positively associated with physical activity patterns among American adult females, whereas perceived crime was inversely associated with meeting PA recommendations.[85] Overall, it was agreed by several studies that lower perceived safety appears to decrease physical activity in groups (women, older adults, ethnic minorities and those with lower educational attainments) that are already known to be more concerned about crime.[88,89,90]

In Hungary there are 10 national policies for the promotion of physical activity for health with 6 sectors involved including sport, health, education, environment, urban planning, and transport.[78] The Centre for Development of Active and Ecotourism has initiated a country-wide program to create public running and cycling pathways, as well as skate parks, to promote physical activity and nature-based recreation. These facilities are available to all ages and social groups, potentially benefiting socially disadvantaged individuals.[91] To date, over 800 parks have been established by the Hungarian Government.[78] In addition, to promote active transport there has been applied a tax on motor vehicles and high parking fees in city centres that are implemented nationwide.[92]

Besides, Hungary is known for well-connected and integrated public transport network including buses along all cities, trolley buses, trams, and night buses in bigger cities.[93]

Table 4. shows the presence of environmental features and policies which are utilized currently in Hungary that create better built environment for female adults PA and lifestyle patterns.[94,73,95]

Table 4. Environmental features and policies in Hungary[96]

Environmental Feature	Yes/No
National Guidance or Programme to promote active travel to work (walking, cycling)	Yes
National guidance or program to promote physical activity at the workplace	No
Infrastructure for leisure-time physical activity (free recreational parks, green spaces, cycling and walking lanes)	Yes
Free counselling on physical activity and exercise prescription	Yes
Monitoring and surveillance of physical activity through aforementioned sectors	Yes
Existence of a national recommendation on physical activity	Yes
National awareness-raising campaign on physical activity using social media and public events	Yes
National policy on walking and cycling	Yes
Safe pedestrian and cycling crossing	Yes
Operational, multisectoral policy, strategy or action plan for non-communicable diseases	No
Operational policy, strategy, or action plan to reduce unhealthy diet related to non-communicable diseases	No
Sugar-sweetened beverage tax	Yes
Food-based dietary guidelines	Yes

Moreover, it is crucial for cities to invest in green infrastructure to promote the well-being of their residents and enhance the quality of urban life, there is a clear evidence main Hungarian cities (Budapest, Pecs, Szeged, Debrecen) prioritize environmental preservation and recreational spaces similarly.[96]

4. Mediating Factors

4.1. Physical Activity

It is well known that physical activity helps preventing obesity which is the main risk factor of noncommunicable diseases such as cardiovascular disease, cancer, and diabetes.[97] The effects of physical activity on specific health conditions depends on the precise amount of activity, the level of effort or intensity, and the type of PA that contributes to health.[98] Hence, it is necessary to focus on which domain of PA is more efficient to physical fitness (PF) and chronic disease prevention. leisure time physical

activity (LTPA), occupational activity, active travel, and domestic activity are the main domains of PA (Figure 5).[99] An Individual's surrounding environment can determine which domain he/she tends to practice.[100,101] There are PA guidelines that were recommended by WHO that considered PA as "anything that gets the body moving". These guidelines state that for adults aged between 18-64 it is recommended to do at least 150–300 minutes of moderate-intensity aerobic PA or 75-150 minutes of vigorous-intensity aerobic PA weekly in addition to muscle-strengthening that involve all major muscle groups on 2 or more days a week.[97]

Generally, walking is the most common form of PA among the 4 domains and that is easily and objectively measured (CDC).[102] It can be initially prescribed as a first step prescription to meet physical activity recommendations and prevent/cure chronic diseases.[103] However, better health outcomes are strongly associated with other PA domains and not only walking; several literatures included stronger positive correlation between LTPA and health outcomes and life satisfaction than other domains; as these are inversely associated with obesity rates.[104,105] A study has found that a higher total amount of physical activity was not related to better health status or obesity. Precisely, women with higher occupational physical activity (OPA) were significantly less likely to have good health, while women with higher recreational PA were having better self-perceived health.[106] More researchers agreed that OPA has more negative correlations with health outcome unlike LTPA.[107,108,109]

Other studies gave ecological evidence which indicates that obesity rates are increasing in environments where active travel (walking and cycling) is dropping.[110,111] Interestingly, time spent in domestic physical activity at moderate or vigorous intensity was found to be negatively associated with weakness.[112] However, another study showed no correlation between heavy housework and reduced levels of being overweight.[113]

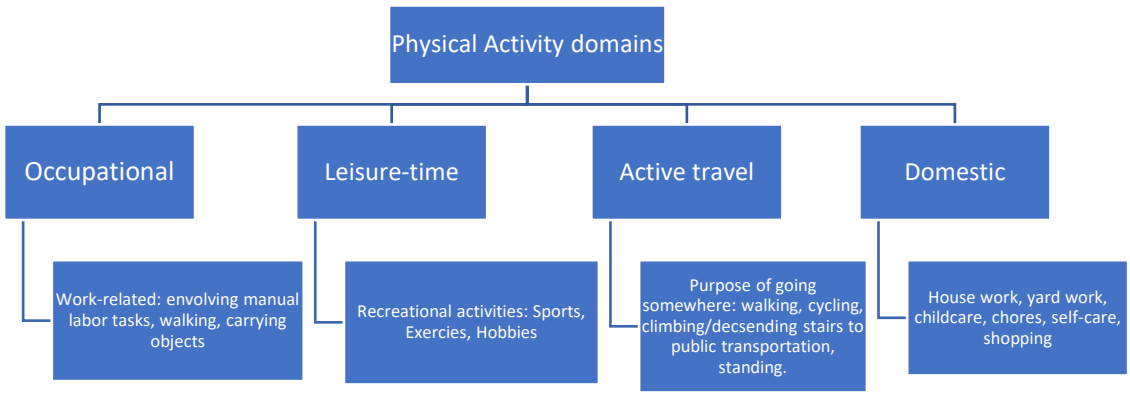

Figure 5. Physical activity domains[99]

Estimated prevalence of sufficient vigorous physical activity levels among Hungarian adults aged 18-64 years old are 32.9 % among females and 36.9% among males whereas prevalence of insufficient physical activity was 43% and 33% for female and male adults respectively. Figure 6. demonstrates the settings where citizens engage in sport or other physical activity compared to Europeans (average of 27 countries), according to The European Commission special Eurobarometer no. 525 for sports and PA.[114,115] It indicates that Hungarians PA domains tendency are: OPA, active travel, and domestic activities if compared with 27 European countries average.

The same report indicated the frequency of people (male, female) who never or seldom attend exercise or play sports and physical activity outside sports (Table. 5).

Table 5. Frequency of never attending sports/exercise and PA outside sports.

Country	Sports or exercise		PA outdoor sports	
	Males	Females	Males	Females
EU27	57%	65%	47%	54%
Hungary	71%	76%	47%	53%

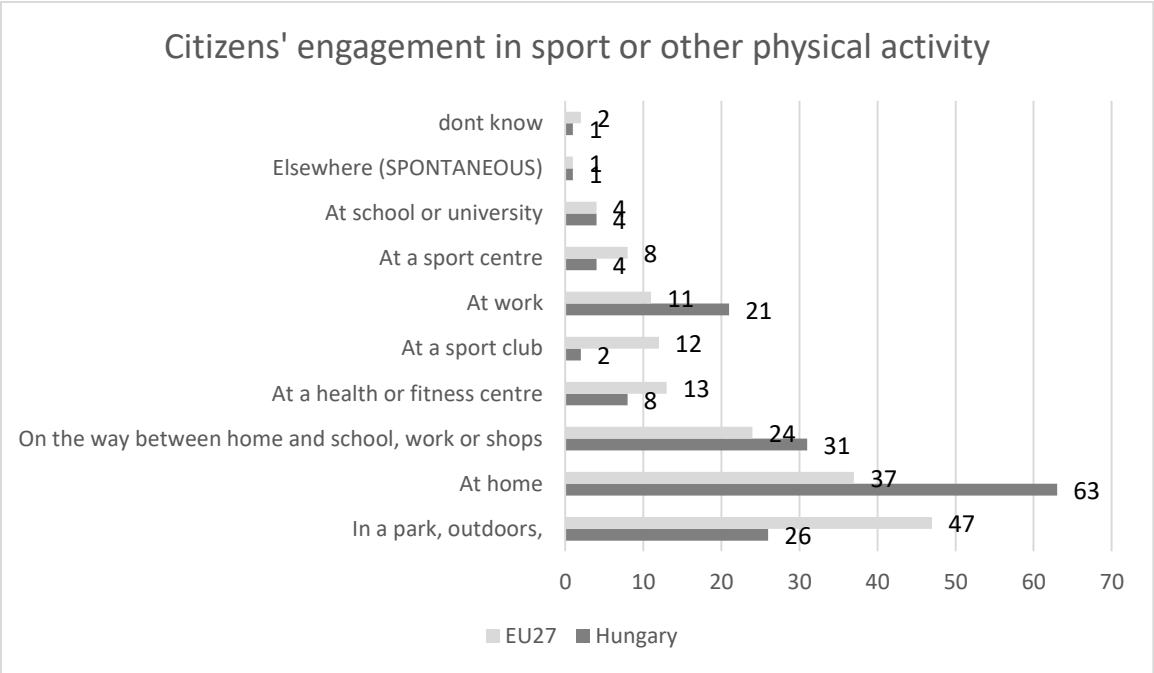

Figure 6. Settings where citizens engage in sport or other physical activity (Eurobarometer, 2017).

In agreement with the aforementioned the demonstrated data, it has been proved by Bácsné et al. (2020) that Hungarians lead active lives, but the dominant forms of their physical activity are work and housework, with the fact that 63.39% and 24.7% of the adult Hungarian population are engaged in vigorous and moderate PA respectively.[12] Besides, Eurobarometer survey of 2017 stated that 56% of the population never practice LTPA.[116]

Accordingly, the least prevalence of mortality risk factors among Hungarians was physical inactivity (2%) if compared with dietary risk factors, alcohol use, and pollution.[117]

4.2 Lifestyle risk factors and Eating Habits

Tobacco use, unhealthy eating habits, insufficient physical exercise, and alcohol usage are regarded to be the primary risk factors for noncommunicable diseases.[118,119] Several studies had convincing proves that smoking is correlated with improper dietary habits and insufficient vitamin and mineral intakes that may lead to higher risk for chronic disease in smokers if compared with non-smokers.[120,121] Also, Heydari et al. (2014) found that smokers significantly consumed more fast foods and white meat and less fruit, vegetables, and dairy products.[122] The prevalence of smoking worldwide is far higher among men than women. However, global male smoking rates have been in a stable prevalence or on the decline while women's rates are still rising.[123] Also, females' Socio-Economic Status and education attainment is positively associated with their smoking habits.[124,125] In countries with low or middle incomes, the gap between males and females' smoking is smaller.[126] Interestingly, women who smoke have a relatively greater risk of smoking-related chronic diseases than men, and they tend to face more difficulty to quit smoking.[127] It was found that there is a negative association between body mass index and smoking among women since it increases energy expenditure and metabolic rate.[128,129] However, it was found that adult smoker women had decreased amount of protein intake, dietary fibre and several vitamins while higher amount of cholesterol compared with non-smoker counterparts.[130] Similarly, it was found that alcohol intake was associated with lower fibre, fruit, and milk intake, with higher intakes of fat and vitamin D. Nevertheless, among drinker men it was shown less favourable nutritional intake than their female counterparts.[131]

Another lifestyle risk factor is the problem of alcohol abuse, which is positively associated with weight gain, obesity, and larger waist circumference.[132] Although there wasn't clear association between obesity and alcohol drinking among women, it was found that women with alcohol disorders at age 24 were 4x more likely to be obese at 27.[133]

Daily smoking prevalence reached 24.7% among Hungarian adult population (males 27.7%, females 22.3%) and it was the fourth highest among OECD countries and the first highest among females.[134,135] Nevertheless, Hungary introduced significant measures to curb smoking: smoking had been restricted in enclosed and in certain open public areas, also high level of education among Hungarian women showed lower smoking rates than those who have lower education attainment: 12% vs. 25%, (Cselkó et al., 2018). However, Hungary was among the lowest percentage of adults who reported heavy episodic drinking, 14% in total (males 22%, females 6%).[136,137]

According to Food and Agriculture Organization of The United Nations (FAO), in Hungary the daily kilocalorie (Kcal) intake from all food average per capita reached 3421 Kcal in 2021, notably increasing if compared with the years 2010 and 2015 (3041 Kcal and 3172 Kcal), respectively. Hungary is considered from the highest among countries in daily

caloric intake. Table 7 shows a comparison of calorie intake between Hungary, Eastern Europe, Western Europe countries average during the same period.[138]

Table 7. Average per capita daily kilocalorie (Kcal) intake from all foods

	2010	2015	2021
Eastern Europe	3242	3247	3336
Hungary	3041	3172	3421
Western Europe	3559	3531	3622

In Addition, a study indicated that the structure of dietary energy supply is not adequate because of the predominance of fats (among both genders) and the backwardness of carbohydrates whereas protein intake was within the national recommendation, but lower than Europe countries average.[139,140] Table 8. demonstrates the macronutrients supply (Fat, protein) in Hungary in the periods (2010, 2015, 2021), compared with Eastern and Western Europe countries average.[138] The differences in supply are largest for fat.

Table 8. Per capita fat and protein supply from all foods per day (gramms)

	2010		2015		2021	
	Fat	Protein	Fat	Protein	Fat	Protein
Eastern Europe	108	102	107	103	118	108
Western Europe	150	112	145	111	160	113
Hungary	134	84	142	88	152	93

4.3. Obesity and Overweight Rates

It is well known that overweight obesity results from an imbalance of energy intake (diet) and energy expenditure (physical activity). In 2022, one out of every eight individuals worldwide were obese. Since 1990, the global adult obesity rate has more than doubled.[141] The proportion of obese Hungarian adults is also greater than the EU average.[42] More than half (57.3%) of the population has a weight problem and only 42.7% of the population belongs to the health zone.[142]

According to Hungarian Central Statistical Office, adult males have higher prevalence of overweight and obesity (40.1% and 25.1%) than adult females (29.2%, 22.7). The percentages of obesity is gradually increasing among both genders since 2009, whereas overweight prevalence among females is stable if compared with their male counterparts (Figure 7).[143]

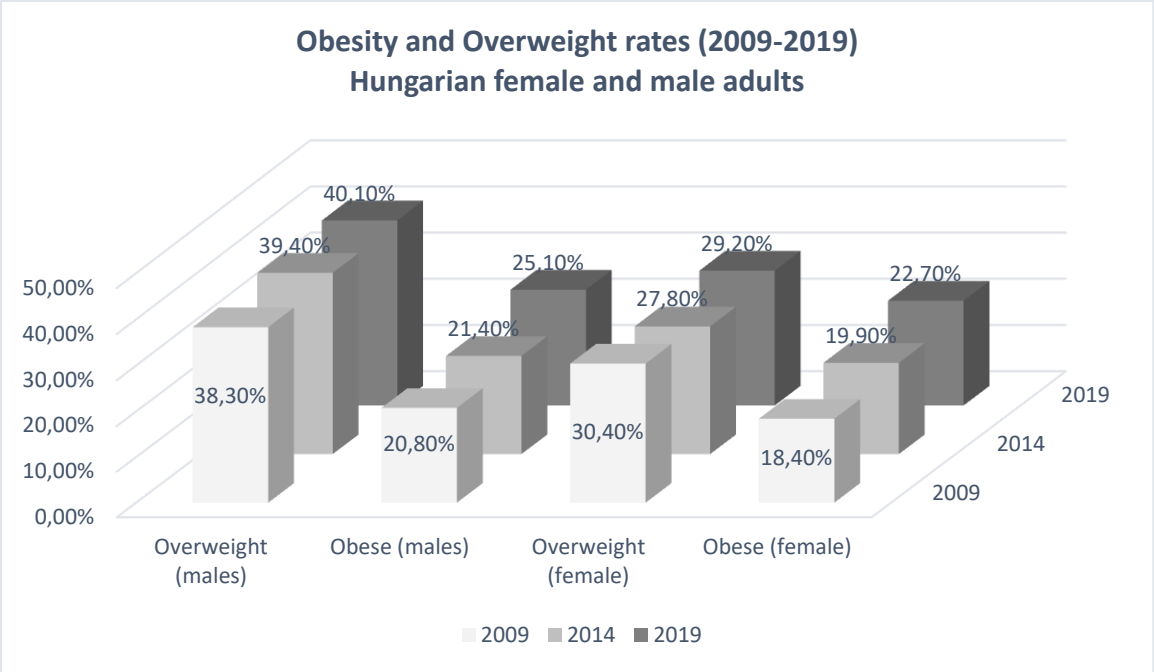

Figure 7. Obesity and overweight prevalence among Hungarian female and male adults in the periods of 2009, 2014, 2019.[143]

Among Europe, Estonia (23.6 %) Latvia (25.7 %), Ireland (26.0 %) and Malta (26.7 %) had the highest percentages of obese women, while for obese men the highest prevalence were found in Croatia (23.7 %), Ireland (25.7 %), Hungary (25.8 %) and Malta (30.6 %)in 2021.[144]

5. Summary

Hungary is having inter-regional gaps socially and economically; it has the 6th largest inter-regional disparities in terms of GDP per capita among small regions in the OECD. However, it is within the lowest income inequality in the world, which indicates that Hungarian population mostly have equal incomes but with overall low wages compared with most of European countries. Besides, employment rates among Hungarian adult females (18-64) years old is considerably high compared with the OECD countries average rate, the high rates of employment might indicate that there is no enough time to practice LTPA and the high PA levels is basically belong to OPA and active travel, Bácsné et al. (2020) agreed with the aforementioned facts that Hungarians lead an active lifestyle but mainly related to physical activities other than sports or exercises.

Socially, there is a high rate of discriminated groups existence (Roma) in Hungary which might impact social trust and cohesion and thus, influence females' perceived safety and crime to practice PA and especially outdoor recreational activities.

The majority of the publications indicated that average life expectancy is around 5 years lower than the EU norm. Nevertheless, the annual per capita healthcare financing of curative-preventive care and coverage has doubled in the past ten years; yet, the lowest among Euro area and among the lowest in the ratio of physicians to inhabitants (France, Belgium, and Hungary) in Europe.

We found that educational level and attainment can influence chances of being employed and therefore influence other non-economic outcomes such as self-reported health. Literacy rate in Hungary is considerably high whereas tertiary education attainment is among the lowest in OECD countries rates among both genders but higher among females. However, health literacy and physical activity promotion among adults was a primary policy in Hungary. Besides, physical education is highly valued in the whole pedagogical process and taught by efficient and trained physical education teachers, from this practice several positive intervention should be conducted among the older adults and not merely among school levels.

Additionally, the natural environment in Hungary makes it suitable and safe for citizens to walk or practice recreational activities since there are establishments for parks until our day and the transportation is accessible and well-conditioned/promoted for inhabitants to avoid using cars and promote active travel.

Accordingly, results and previous research shows concordance in the domains of PA that Hungarian adult females practice and obesity rate. However, according to previous researches those types of PA are not enough to impact better health outcome as LTPA does. Beside PA patterns, smoking and eating habits among Hungarian adult females showed unpleasant results: high caloric and fat intakes but low protein intake, accompanied with high daily smoking rates compared with their western and Eastern European counterparts. However, it was from the lowest countries in heavy drinking. Mentioned results are dealing with previous conclusions that higher smoking patterns impact dietary habits improperly.

As a result, obesity and overweight rates are equally high among both genders, which indicates that both are exposed to improper health lifestyle as mediating factors which are influenced by SDOH.

6. Conclusion

SDOH (economic stability, education quality and access) showed a higher negative impact on PA domains and levels among Hungarian female adults, as well as on smoking and eating habits. Besides, there can be found interrelation between social context (beliefs, ethnicities, social cohesion, and trust) on PA patterns and domains. Neighbourhood built environment showed positive impact on PA levels generally and on active travel specifically, but negative impact on LTPA that might be influenced by economic status (employment status).

Healthcare quality and access didn't show significant influence on lifestyle patterns (PA, eating, and smoking habits).

It can be concluded that the high obesity rates belong to insufficient LTPA compared with other domains despite the PA levels overall and higher energy intakes with high daily smoking habits, this is influenced mainly by economic stability, education attainment which can be defined as SES strongly more than other determinants. However, some existing practices should be invested to create implementations and

intervention to promote LTPA and PA ingeneral such as PE quality, outdoor public facilities and aesthetics.

PA levels alone cannot fully compensate for the negative factors related to the pattern of eating and smoking habits, and thus there should be focus on specific PA domains. LTPA for female employees and housewives promotion, more strict measures on smoking, promoting for healthy food cantines availability in public and in work places are needed.

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