Body mass index, comorbid conditions, and demographic factors among tertiary healthcare workers in Kosovo: Implications for physical activity interventions

Flaka Hoti[1], Merlinda Shehu Kaqi[2], Hasime Terziqi[1*], Myhidin Shehu[3*]

[1] Faculty of Medicine, University of Gjakova "Fehmi Agani", Gjakova 50000, Kosovo.

[2] Alma Mater Europaea Campus Rezonanca, Pristina 10000, Kosovo.

[3] The National Center of Occupational Medicine, Gjakova 50000, Kosovo.

* Correspondence: Myhidin Shehu; dini_shehu@yahoo.com: Hasime Terziqi; hasime.terziqi@uni-gjk.org

ABSTRACT

This study aimed to determine the prevalence of overweightness and obesity among healthcare workers (HCWs) at the University Clinical Center of Kosovo in Pristina, Kosovo, and to examine the relationship between demographic variables, comorbid conditions, and body mass index (BMI). This was a retrospective, descriptive, analytical study. The study population consisted of 3048 HCWs at the University Clinical Center of Kosovo in Pristina, Kosovo. The sample consisted of all HCWs who were willing to provide his/her BMI (n = 1399) and included 717 females (51.25%) and 682 males (48.75%) with an average age of 48.16±10.46 years. Biochemical and hematological tests were carried out. BMI and blood pressure were assessed. The prevalence of overweight and obesity class I was 49.1% and 19.8%, respectively, according to WHO criteria, where overweight is defined as BMI 25.0–29.9 and obesity class I as BMI 30.0–34.9. Males were found to have a higher mean BMI compared to females (p=0.01). Hypertension, dyslipidemia, and hyperglycemia were found to be statistically significant with BMI (p<0.01) while type II diabetes was insignificant (p=0.05). Age was associated with type II diabetes (p<0.05) and hypertension (p=0.05); sex was significantly associated only with hyperglycemia (p<0.05). With an increase in age for both sexes, the rates of obesity and overweight increased, especially from ages 45 to 54 in HCWs. BMI was a significant predictor of hypertension (p<0.01, OR=1.45), dyslipidemia (p<0.01, OR=1.42), and hyperglycemia (p<0.01, OR=1.48). These results indicate the need for increased physical activity in order to reverse obesity-related health problems and obtain better health among HCWs.

KEYWORDS

Overweight; Obesity; Comorbid Conditions; Healthcare Workers; Physical Activity

1. INTRODUCTION

One of the most significant public health issues for individuals and healthcare systems is the rising prevalence of obesity globally, also known as "globesity" (Koliaki et al., 2023). The World Health Organization declared obesity an epidemic in 1997 to acknowledge the extreme consequences of rising prevalence of obesity on a global scale (WHO, 2010).

In 2022, of the 2.5 billion adults aged 18 years and above who were overweight worldwide, over 890 million were obese (overweight and obesity were defined by WHO as follows: a BMI of 25 or higher is considered overweight, and a BMI of 30 or higher as obese). As a result, 43% of individuals over the age of 18 years were overweight (43% of males and 44% of females), much higher than the 25% of adults over the age of 18 years who were overweight in 1990 (WHO, 2024).

Health care workers (HCWs) are much more obese than individuals employed in most occupations. At a 32 percent obesity rate, the healthcare industry overall ranked fifth among 20 industries in the survey (Cimperman, 2019). As a matter of fact, numerous studies verify that. A study by Kynyahami et al. (2021) to identify the prevalence of overweight and obesity among HCWs (n=4489), found that 33.1% of HCWs were overweight, and 21.1% obese. Another research assessed workplace factors contributing to obesity among HCWs in ICUs, out of which 13% HCWs were found to be obese, the determinants being long working hours exceeding 9.5 shifts/month, physical inactivity, increased occupational stress, and prolonged sitting (Ezber et al, 2024).

In addition, a study of the lifestyle of PHC professionals found that risk factors for diabetes and obesity were elevated due to stress-related eating habits and dietary irregularities, even among health promotion programs available to HCWs (Kuttybaev et al., 2024). In the same vein, several other studies have reported a high percentage of healthcare workers in the overweight and obesity categories (Kyle et al., 2017; Sari et al., 2023; Zubery et al., 2021; Firouzbakht et al., 2019).

Overweight and obesity affect an individual's functioning in daily life and their quality of life, in addition to leading to mental and emotional disorders, such as those associated with work incapacity, sickness absence, and presenteeism (Pihlajamaki et al., 2019) (Vallis, 2016). Increased hunger and

higher risks of being overweight or obese can also be the outcomes of stress management issues, potentially leading to negative emotional issues such as anxiety and depression (Dakanalis et al., 2023).

Overweight and obesity in adults in Kosovo is a priority. A study of 200 adults in 2021 revealed that 21.5% of adults were obese and 46.5% were overweight. It is notable that women were more likely than men to be obese (31.9%) and overweight (54.6%), respectively (Morina & Brestovci, 2021). Overweight (including obesity) was very common in both sexes in Kosovo. The increasing pattern of the average obesity and overweight prevalence in the WHO European Region is consistent (WHO Regional Office for Europe, 2023). Overweight and obesity negatively affect the majority of bodily systems, including the cardiovascular (Das, 2024; Shariq & McKenzie, 2020; Aronow, 2017) and endocrine systems (Yamada et al., 2023; Zheng et al., 2024; Sheth et al, 2016).

The risk of coronary heart disease is expected to increase by 12% and stroke by 24% with every 10 kg increase in body weight, which is linked to 3.0 mm Hg higher systolic and 2.3 mm higher diastolic blood pressure (Din-Dzietham et al., 2007). On the other side, in obese people, dyslipidemia is the leading cause of atherosclerosis and consequent atherosclerotic cardiovascular disease (Wickramasinghe et al., 2018). Moreover, obesity, particularly when accompanied with increased abdominal and intra-abdominal fat distribution, is a key risk factor for prediabetes and type 2 diabetes because it induces both insulin resistance and β-cell dysfunction (Kleain et al., 2022).

The International Diabetes Federation (IDF) forecasts by 2045, around 1 in 8 individuals, representing more than 783 million, to have diabetes, representing a 46% increase in current projections. More than 90% of them, in fact, will have type 2 diabetes, largely due to socioeconomic, demographic, environmental, and genetic factors. (IDF, 2024).

In this regard, physical activity reveals its importance in the prevention and control of being overweight and obese (Pojednic et al., 2022; Wiklund, 2016; Hill & Wyatt, 2005), diabetes (Kirwan et al., 2017; Kanaley et al., 2022), dyslipidemia (Mosteoru et al., 2023; Pressler & Borjesson, 2020), numerous other chronic disorders (Anderson & Durstine, 2019; Esteban, 2009; Wang et al., 2013), almost to the extension of longevity in general (Reimers et al., 2012; Schwendinger et al., 2025; Hoti, 2021). The literature, however, identifies a low rate of regular physical activity in health professionals (Abu Saad et al., 2020; Nndozie et al., 2023; Song et al., 2020).

Obesity and overweight rank among serious health problems worldwide, having adverse effects on health care systems and on quality of life for individuals. In spite of extensive studies in developed nations on population parameters, comorbidities, and correlations with body mass index (BMI), there

is considerable lack of studies on Kosovo (Morina & Brestovci, 2021; Bytyci-Katanolli et al., 2022) and, by extension, on health professionals.

The importance of this study lies in the fact that it tends to clarify the factors influencing the increased prevalence of overweight and obesity in this specific professional community. Knowing the relationship between body mass index (BMI), comorbid diseases, and demographic traits might help develop effective strategies to promote a healthy lifestyle among healthcare workers in Kosovo.

The principal goal of this study is to evaluate overweight and obesity prevalence in health professionals in Kosovo, and to analyze their comorbidities, demographic data, and their body mass index. The following hypotheses to be offered are: 1) University Clinical Center of Kosovo health professionals have a considerable overweight and obesity prevalence; 2) Body mass index is recognized to have an influential role in health professionals' incidence of hypertension, type 2 diabetes, dyslipidemia, and hyperglycemia.

2. METHODS

2.1. Participants

The type of study is retrospective, descriptive, and analytical, with the study population consisting of healthcare professionals (n=3048) in the University Clinical Center of Kosovo in Pristina, Kosovo. The sample included all healthcare professionals with known BMI (n=1399), 717 females (51.25%) and 682 males (48.75%), mean age 48.16±10.46 years. Their participation in the study was entirely voluntary. Approval for the study was granted by the ethics committee of the University Clinical Center of Kosovo. Participants were informed about the aim of the study; the nature of confidentiality and anonymity was assured; and all incomprehensible queries were sorted out.

2.2. Procedure and medical assessments

Data was collected between June 2023 and November 2023. Thirty health professionals were given the challenge of conducting regular medical checks in accordance with accredited institutions. The areas of evaluation included basic biochemical and hematological examinations for the measurement of glucose, cholesterol, and triglycerides levels. BMI measurement and assessment of blood pressure were also carried out on the first-day examination by an internal medicine specialist-cardiologist. Each health worker visited the appropriate expert clinics in their designated departments on the second day, when they were examined by the specialist who fit their profile.

Each visit's medical report was left in the appropriate specialist departments, and the unit's authorized person received the files (medical reports) at the conclusion of each working day and filled them out for every employee. The relevant physician suggested any further tests and examinations during these appointments.

2.3. Statistical Analyses

Demographic characteristics of study participants, i.e. sex, age, and BMI categories, were systematically summarized using descriptive statistics. Distributions of the BMI categories were shown for health care workers using frequency tables and percentages. Chi-square tests were applied to compare frequencies of BMI categories among men and women.

Type II diabetes, hypertension, dyslipidemia, and hyperglycemia prevalence were analyzed against BMI, age, and sex categories using frequency distributions and chi-square tests. The BMI classification was further evaluated concerning sex and age group using cross-tabulations, while differences in distributions of BMI across the different age groups and sex were assessed by chi-square tests.

To evaluate the association between BMI, gender, age, and the presence of health conditions, logistic regression analysis was conducted. All statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences, version 21), and a significance level of $p < 0.05$ was considered statistically significant. The type of study is retrospective, descriptive, and analytical, with the study population consisting of healthcare professionals (n=3048) in the University Clinical Center of Kosovo in Pristina, Kosovo. The sample included all healthcare professionals with known BMI (n=1399), 717 females (51.25%) and 682 males (48.75%), mean age 48.16±10.46 years. Their participation in the study was entirely voluntary. Approval for the study was granted by the ethics committee of the University Clinical Center of Kosovo. Participants were informed about the aim of the study; the nature of confidentiality and anonymity was assured; and all incomprehensible queries were sorted out.

3. RESULTS

For the classification of BMI categories, we followed the WHO criteria, which define them as follows: Below 18.5=Underweight; 18.5–24.9=Normal weight; 25.0–29.9=Overweight; 30.0–34.9=Obesity class I; 35.0–39.9=Obesity class II; Above 40=Obesity class III (WHO, 2010). Following is the description given by the graph about BMI categories among study participants (1399 HCWs). Maximum number of participants come under overweight category (49.1%), while normal

weight have a very fewer count (27.6%). A significant number of participants are categorized under obese class 1 (19.8%); whereas, very few fall into obese class 2 (2.5%) or obese class 3 (0.4%). The least represented (0.6%) is the underweight group (Graph 1).
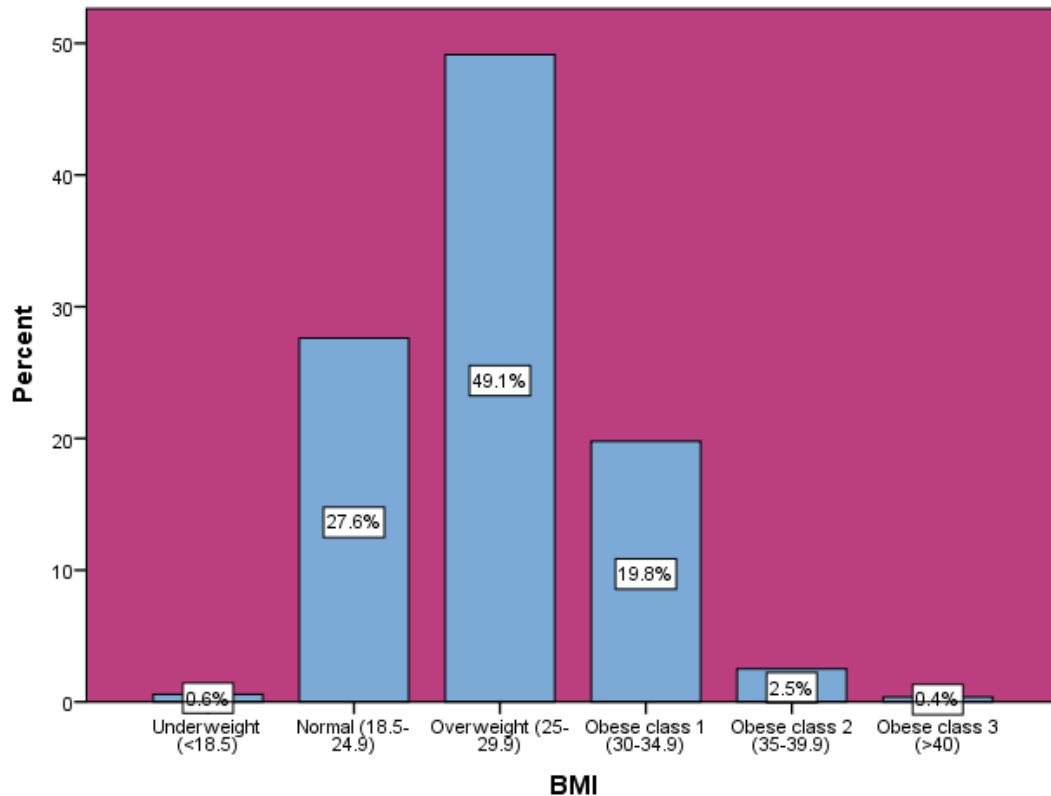
Graph 1. BMI categories distribution among study participants

Table 1 denotes the findings on differences based on gender concerning BMI categories. Results indicate that the average BMI of the total sample was 27.40+/-6.18. Thus, it can be said that on average the sample falls in the overweight category since a BMI of anywhere more than or equal to 25 is classified as overweight and more than or equal to 30 is classified as obese (WHO, 2010). In further analyses, t-test results indicated that there was a statistically significant difference between men and women in terms of BMI average, with men showing a higher average as compared to women (p=0.003).

Table 1. BMI gender differences results

	Total	Men	Women	*p* value
BMI (Mean±SD)	27.40±6.18	27.89±6.69	26.9±5.62	0.003

BMI: Body Mass Index; SD: Standard Deviation

Table 2 shows distribution of type II diabetes, hypertension, dyslipidemia, and hyperglycemia by age group, gender, and BMI categories. Analyses show that the p-values ≤ 0.001 for hypertension, dyslipidemia, and hyperglycemia were statistically significant in their association with BMI, while Type II diabetes p=0.05. Age is associated with Type II diabetes (p = 0.02) and hypertension (p = 0.04), but not with dyslipidemia (p = 0.07) or hyperglycemia (p = 0.45). The results indicate that sex has no significant association with Type II diabetes (p = 0.59), hypertension (p = 0.62), or dyslipidemia (p = 1.00), although there is a statistically significant association with hyperglycemia (p = 0.03) (Table 2).

Table 2. Prevalence of type II diabetes, hypertension, dyslipidemia, and hyperglycemia by BMI, age, and sex categories

Patient characteristics	Type II diabetes		*p*	Hypertension		*p*	Dyslipidemia		*p*	Hyperglycemia		*p*
	n	%		n	%		n	%		n	%	
BMI												
18.5-24.9	11	0.8		39	2.8		91	6.5		35	2.5	
25-29.9	26	1.9	0.05	124	8.9	0.00	219	15.7	0.000	79	5.7	0.00
30 to >40	20	1.4		86	6.2		134	9.6		65	4.7	
Age												
18-25 years	1	0.1		2	0.1		2	0.1		0	0	
26-34 years	7	0.5		21	1.5		32	2.3		18	1.3	
35-44 years	21	1.5	0.02	74	5.3	0.04	143	10.2	0.07	53	3.8	0.45
45-54 years	13	0.9		80	5.7		150	10.7		62	4.4	
55-65 years	15	1.1		73	5.2		120	8.6		46	3.3	
Sex												
Female	27	1.9		132	9.4		229	16.4		78	5.6	
Male	30	2.1	0.59	118	8.4	0.62	218	15.6	1.00	101	7.2	0.03
Total	**57**	**4.1**		**250**	**17.9**		**447**	**32.0**		**179**	**12.8**	

Note: p-value represents the overall comparison across all BMI categories, age groups and sex

Table 3 outlines the distribution of BMI categories in men and women according to age. The inclined distribution of BMI categories depicts that overweight as well as obesity are on the increase with age in both men and women.

Only one case has been identified in each of the young male HCWs (18-25 years) what is less when compared with old studies. Overweight and obesity class 1 in the 26–34 group was 3.7% and 4.7%, respectively, rising in the 35–44 and 45–54 groups, reaching its maximum values of 17.6% and 19.3%. Among 55–65-year-olds, overweight drops to 14.1% and obesity class 1 is still at a high 17.1% prevalence.

The same pattern holds for women. There were no cases in the youngest category but in the 26–34 age group, those listed as overweight and as obesity class 1 are increased to 4.2% and 2.5%. The prevalence peaks at 17.4% and 14.2%, respectively, among those aged 35–44 and 45–54, after which the prevalence of overweight declines to 12.3% in individuals aged 75–89. Meanwhile, the prevalence of class 1 obesity remains constant at 13.8%.

Table 3. Distribution of BMI categories by sex and age among study participants

	BMI Categories					
Sex	**Underweight n(%)**	**Normal n(%)**	**Overweight n(%)**	**Obesity class 1 n(%)**	**Obesity class 2 n(%)**	**Obesity class 3 n(%)**
Men overall	1(0.15)	154(22.78)	346(51.18)	157(23.22)	15(2.2)	3(0.4)
18-25 years	0	0	1(0.1)	1(0.4)	1(2.9)	0
26-34 years	0	10(2.6)	25(3.7)	13(4.7)	1(2.9)	0
35-44 years	0	45(11.9)	104(15.2)	43(15.6)	4(11.4)	1(20.0)
45-54 years	0	53(13.8)	120(17.6)	53(19.3)	6(17.1)	1(20.0)
55-65 years	1(12.5)	46(12.0)	96(14.1)	47(17.1)	3(8.6)	1(20.0)
Women overall	7(0.9)	230(32.12)	337(47.0)	118(16.4)	20(2.7)	2(0.2)
18-25 years	0	0	0	0	0	0
26-34 years	0	13(3.4)	29(4.2)	7(2.5)	0	0
35-44 years	2(25.0)	82(21.4)	105(15.4)	39(14.2)	8(22.9)	0
45-54 years	3(37.5)	70(18.2)	119(17.4)	34(12.4)	7(20.0)	0
55-65 years	2(25.0)	65(16.9)	84(12.3)	38(13.8)	5(14.3)	2(40.0)
Total	**8(0.5)**	**384(27.5)**	**683(49.0)**	**275(19.7)**	**35(2.5)**	**5(0.3)**

The following table shows the output of a logistic regression analysis investigating the relationships between BMI, gender, and age with four health conditions: hypertension, dyslipidemia, hyperglycemia, and type 2 diabetes mellitus. It turns out, that the BMI significantly predicts hypertension ($p=0.00$, OR=1.45), dyslipidemia ($p=0.00$, OR=1.42), and hyperglycemia ($p=0.00$, OR=1.48) and that higher BMI confers risk for the development of these conditions. Gender and age showed no statistically significant correlations with hypertension, dyslipidemia, or hyperglycemia ($p > 0.05$). Regarding type 2 diabetes, neither gender nor age were statistically significant predictors ($p > 0.05$), and BMI had no significant effect (OR = 0.043, $p = 0.58$) (Table 4).

Table 4. Association of BMI, gender, and age with study health conditions: logistic regression analysis

		B	SE	WALD	DF	*p*	OR
Hypertension	**BMI**	0.37	0.07	35.39	2	0.00	1.45
	Gender	-0.18	0.14	1.66	1	0.19	0.83
	Age	-0.01	0.07	0.06	1	0.08	0.98
Dyslipidemia	**BMI**	0.42	0.058	30.08	2	0.00	1.42
	Gender	-0.74	0.11	0.4	1	0.52	0.92
	Age	-0.05	0.06	0.7	1	0.4	0.94
Hyperglycemia	**BMI**	0.38	0.8	20.93	2	0.00	1.48
	Gender	0.29	0.16	3.2	1	0.07	1.34
	Age	-0.08	0.08	1.02	1	0.312	0.917
Diabetes Mellitus (type 2)	**BMI**	-3.15	0.135	5.68	2	0.58	0.043
	Gender	0.103	0.274	0.142	1	0.7	1.1
	Age	-0.268	0.143	3.49	1	0.06	0.76

Note. B; Coefficient: SE; Standard Error: DF; Degrees of Freedom: OR; Odds Ratio

4. DISCUSSION

To the best of our knowledge, this is one of the first studies to identify the prevalence of obesity among HCWs at the University Clinical Center of Kosovo in Pristina, Kosovo. A total of 1399 tertiary healthcare workers, aged 18 to 65, (717 women and 682 males), participated. Most participants fall into the overweight category (49.1%), while considerable percentage of participants are classified as obese class 1 (19.8%). Based on these findings, we confirm the first hypothesis of our study, which states that "HCWs of the University Clinical Center of Kosovo report a considerable prevalence of overweight and obesity".

Obesity is recognized as a public health concern in Kosovo (Morina & Brestovci, 2021; Bytyci-Katanolli et al., 2022) and elsewhere (Sari et al., 2023; Zubery et al., 2021; Kyle et al., 2017; Firouzbakht et al., 2019). As documented in other studies, the present research finds that HCWs are disproportionally affected by these conditions, similar to trends around the globe. Indeed, studies indicate that chronic stress, depression, and anxiety are often among the causes of overweight and obesity (Guo et al., 2023; Dadar Singh et al., 2022). For instance, the findings of the current study, which showed 49.1% of HCWs were overweight and 19.8% were obese class 1, are similar to those of Kynyahami et al. (2021), who reported that 33.1% of healthcare workers were overweight and 21.1% were obese. Studies show that cumulative stress, sadness, and anxiety are frequently the cause of overweight and obesity (Guo et al., 2023; Dadar Singh et al., 2022). It is also recognized that low physical activity and poor eating habits contribute to the development of overweight and obesity (Chatterjee et al., 2020). Therefore, HCWs are believed to have knowledge about healthy lifestyles and

commonly have the duty of imparting the knowledge about the adverse health effects that accompany physical inactivity to the public (Abu Saad et al., 2020).

According to recent research, healthcare professionals throughout the world have a high rate of physical inactivity (Chin et al., 2016; Phetla & Skaal, 2017; Kunene & Taukobong, 2015) and those who are obese are more likely to engage in physical inactivity (Iwuala et al., 2015; Ramli et al., 2023). So far, very little is known, to our knowledge, about the level of physical activity among healthcare professionals in Kosovo. Nevertheless, studies with adults and older people in Kosovo have slowly appeared to show that the majority do not meet the minimum amount of required physical activity, predisposing them to chronic diseases, such as obesity, diabetes, and cardiovascular disease (Jerliu et al., 2015; Bytyci Katanolli et al., 2022).

Furthermore, Table 1's display of BMI by sex reveals that men and women have a statistically significant average difference whereby men show a higher average than women (p=0.003). This aligns with studies from other regions where men exhibited similar patterns (Kyle et al., 2017; Chiriboga et al., 2008; Tsai et al., 2016). According to Koceva et al. (2024) sexual dimorphism is another feature of obesity-induced comorbidities, with females more sensitive to psychopathology and men more susceptible to the metabolic effects.

The new research further validates the high burden of comorbidity seen in obesity, and a strong association between body mass index (BMI) and metabolic/cardiovascular conditions. The present study showed a significant positive correlation of BMI with hypertension, dyslipidemia, and hyperglycemia (as shown in Table 2 and Table 4). Moreover, it connects to existing literature linking obesity with both increased rates of diseases of the heart (Das, 2024; Shariq & McKenzie, 2020) and with metabolic conditions like hyperglycemia (Kleain et al., 2022; Wickramasinghe et al., 2018). Additionally, the logistic regression analysis performed in this study validates that BMI is a significant predictor of hypertension, dyslipidemia, and hyperglycemia. Based on these findings, we confirm our second hypothesis which states that "BMI is a significant risk factor for hypertension, type 2 diabetes, dyslipidemia, and hyperglycemia among HCWs", except type 2 diabetes, where BMI was not identified as a risk factor.

In line with the earlier studies, the present study has also established a positive relationship between rising BMI and increased risk of co-morbidities, thereby placing emphasis on attaining good weight as a means of prevention for health issues related to obesity (Pojednic et al 2022; Kanaley et al., 2022). With increasing fat storage, especially in the abdominal cavity, comes higher inflammation

and more disordered metabolism, leading to increased resistance to glucose control. Higher body weight also means more load on the heart and circulatory system, which equates to higher pressure levels with respect to hypertension while simultaneously being linked to dyslipidemic diseases, which include high LDL cholesterol and low HDL cholesterol in obese subjects (Shariq & McKenzie, 2020; Martyn et al., 2008; Klop et al., 2023).

There are indeed many studies that have shown demographic factors like age and gender to affect body mass index and health outcomes. As the rates of obesity do show an increasing trend with age, the old people amongst healthcare workers have also shown increased rates of obesity. Regarding men, being overweight and obesity tended to steadily increase with age, peaking at an obesity rate of 19.3 among men aged 45-54. There was a slight reduction of overweight in this age group to 14.1 by the age of 55-65; however, the levels of class 1 obesity remained high at 17.1. The increase in overweight and obesity in age group 45 to 54 years was also evident with women, where obesity class 1 reached 14.2%. In the 55-65 age group, women had a 12.3% overweight rate while class 1 obesity rate remained unchanged at 13.8%. Therefore, men and women both surge in the overweight and obesity categories as they age, with the most significant changes occuring from ages 45 to 54.

Our report joins that of Younis et al. (2023) who found being overweight and the risk for obesity in a specific age group between the ages of 40 and 49. Low et al. (2009); Addo et al. (2015); El Kishawi et al. (2020) - all have stated that occurrence of being overweight or obese tends to increase with age. There are various reasons to support this. Older people tend to gain weight as a result of metabolic shifts, an increase in sedentary behavior, softer physical exercise, and changes in diets (Abu Saad et al., 2020). Similarly, hormonal changes in middle age may determine fat distribution in the body and directly contribute to obesity and being overweight (Younis et al., 2023).

5. LIMITATIONS

There are certain shortcomings in this research study that need to be addressed. Primarily, the use of a sample from one health institution in Kosovo comprised solely of healthcare professionals does not lend credibility to the conclusions because the findings cannot be applied to a wider population. Additionally, not having precise information on other lifestyle determinants of obesity such as physical exercise, eating habits, and psychological well-being is a limitation. Lastly, because the study was done on a voluntary basis, selection bias was more likely due to the participation of individuals that were more health conscious, thus creating inaccurate output.

6. CONCLUSIONS

To close, the study results indicate that the prevalence of overweight and obesity is high among 1399 HCWs of the University Clinical Center of Kosovo, whereby men have a higher BMI average compared to women. Association with other health disorders such as hypertension, dyslipidemia, and hyperglycemia, was found and established in this population study. Age was linked to type 2 diabetes and hypertension, but not to dyslipidemia or hyperglycemia. Sex showed no correlation with type 2 diabetes, hypertension, or dyslipidemia, but a significant association with hyperglycemia was observed. Furthermore, obesity and overweight rates increased with age, with the most notable rise observed in healthcare workers aged 45-54 years. However, age and gender did not significantly influence the presence of these conditions, except hyperglycemia. The inclusion of preventive health initiatives in the workplace, through the introduction of personalized physical activity (PA) programs, is vital.

7. RECOMMENDATIONS

Regular health screening for monitoring BMI and any associated comorbidities, such as hypertension, dyslipidemia, and hyperglycemia, is recommended in HCWs based upon the findings of this study. Special consideration should be paid to the workers aged 45-54 years since this age group recorded the highest increase in rates of overweight and obesity. In addition, workplace wellness programs promoting physical activity, nutritional diet, and stress management may be able to reduce the risk of such morbidity. Other aspects of workplace wellness programs promoting physical activity and structured exercise in a health-promoting environment will assist in curbing risk factors for obesity. Further studies are needed to determine the initiating causes of obesity in this population, as well as to assess the effectiveness of interventions specifically targeted at restoring overall health and well-being among HCW.

8. REFERENCES

1. Abu Saad, H., Low, P. K., Jamaluddin, R., & Chee, H. P. (2020). Level of Physical Activity and Its Associated Factors among Primary Healthcare Workers in Perak, Malaysia. *International Journal of Environmental Research and Public Health*, *17*(16), 1-12. https://doi.org/10.3390/ijerph17165947
2. Addo, P. N., Nyarko, K. M., Sackey, S. O., Akweongo, P., & Sarfo, B. (2015). Prevalence of obesity and overweight and associated factors among financial institution workers in Accra Metropolis, Ghana: a cross sectional study. *BMC Research Notes*, *8*, 1-8. https://doi.org/10.1186/s13104-015-1590-1

3. Anderson, E., & Durstine, J. L. (2019). Physical activity, exercise, and chronic diseases: A brief review. *Sports Medicine and Health Science*, *1*(1), 3–10. https://doi.org/10.1016/j.smhs.2019.08.006

4. Aronow W. S. (2017). Association of obesity with hypertension. *Annals of Translational Medicine*, *5*(17), 1-10. https://doi.org/10.21037/atm.2017.06.69

5. Bytyci Katanolli, A., Probst-Hensch, N., Ann Obas, K., Gerold, J., Zahorka, M., Jerliu, N., Ramadani, Q., Fota, N., & Merten, S. (2022). Perceived barriers to physical activity behaviour among patients with diabetes and hypertension in Kosovo: a qualitative study. *BMC Primary Care*, *23*(1), 1-11. https://doi.org/10.1186/s12875-022-01866-w

6. Bytyci-Katanolli, A., Merten, S., Kwiatkowski, M., Obas, K., Gerold, J., Zahorka, M., Jerliu, N., Ramadani, Q., Fota, N., & Probst-Hensch, N. (2022). Non-communicable disease prevention in Kosovo: quantitative and qualitative assessment of uptake and barriers of an intervention for healthier lifestyles in primary healthcare. *BMC Health Services Research*, *22*(1), 1-17. https://doi.org/10.1186/s12913-022-07969-5

7. Chatterjee, A., Gerdes, M. W., & Martinez, S. G. (2020). Identification of Risk Factors Associated with Obesity and Overweight-A Machine Learning Overview. *Sensors*, *20*(9), 1-30. https://doi.org/10.3390/s20092734

8. Chin, D. L., Nam, S., & Lee, S. J. (2016). Occupational factors associated with obesity and leisure-time physical activity among nurses: A cross sectional study. *International Journal of Nursing Studies*, *57*, 60–69. https://doi.org/10.1016/j.ijnurstu.2016.01.009

9. Chiriboga, D. E., Ma, Y., Li, W., Olendzki, B. C., Pagoto, S. L., Merriam, P. A., Matthews, C. E., Hebert, J. R., & Ockene, I. S. (2008). Gender differences in predictors of body weight and body weight change in healthy adults. *Obesity, 16*(1), 137–145. https://doi.org/10.1038/oby.2007.38

10. Cimperman, R. (2019, February 5). *Healthcare workers are at significant risk of obesity, yet employers must not discriminate*. MarathonHR. https://marathonhr.com/legal/employee-obesity-risk/

11. Dadar Singh, N. K., Loo, J. L., Ko, A. M. N., Husain, S. S., Dony, J. F., & Syed Abdul Rahim, S. S. (2022). Obesity and mental health issues among healthcare workers: a cross-sectional study in Sabah, Malaysia. *Journal of Health Research, 36*(5), 939-945. https://doi.org/10.1108/JHR-07-2020-0269

12. Dakanalis, A., Mentzelou, M., Papadopoulou, S. K., Papandreou, D., Spanoudaki, M., Vasios, G. K., Pavlidou, E., Mantzorou, M., & Giaginis, C. (2023). The Association of Emotional Eating with Overweight/Obesity, Depression, Anxiety/Stress, and Dietary Patterns: A Review of the Current Clinical Evidence. *Nutrients*, *15*(5), 1-18. https://doi.org/10.3390/nu15051173

13. Das. S. (2024). Association of hypertension with overweight and obesity among adults inRangpur region of Bangladesh: A cross-sectional study. *Human Nutrition & Metabolism, 37*, 1-7.

14. Din-Dzietham, R., Liu, Y., Bielo, M. V., & Shamsa, F. (2007). High blood pressure trends in children and adolescents in national surveys, 1963 to 2002. *Circulation*, *116*(13), 1488–1496. https://doi.org/10.1161/CIRCULATIONAHA.106.683243

15. El Kishawi, R. R., Soo, K. L., Abed, Y. A., & Muda, W. A. M. W. (2020). Prevalence and predictors of overweight and obesity among women in the Gaza strip-Palestine: a cross-sectional study. *BMC Public Health*, *20*(1), 1-8. https://doi.org/10.1186/s12889-020-08966-1

16. Esteban C. (2009). Role of physical activity in chronic obstructive pulmonary disease. *Archivos de Bronconeumologia*, *45,* 7–13. https://doi.org/10.1016/S0300-2896(09)72949-7

17. Ezber, R., Acun Pınar, M., Şimşek, C., & Ocaktan, M. (2024). Evaluation of Work-Related Factors Affecting the Frequency of Overweight and Obesity Among Healthcare Workers in Intensive Care Units in a Training and Research Hospital. *Turkish Journal of Diabetes and Obesity*, *2*, 163-170.

18. Firouzbakht, M., Esmaeil Riahi, M., Hajian-Tilaki, K., Ebadi, A., Tirgar, A., & Nikpour, M. (2019). Relationship of social capital with overweight and obesity among female health care workers. *Caspian Journal of Internal Medicine*, *10*(3), 281–288. https://doi.org/10.22088/cjim.10.3.281

19. Guo, X., Gong, S., Chen, Y., Hou, X., Sun, T., Wen, J., Wang, Z., He, J., Sun, X., Wang, S., Feng, X., & Tian, X. (2023). Lifestyle behaviors and stress are risk factors for overweight and obesity in healthcare workers: a cross-sectional survey. *BMC Public Health*, *23*(1), 1-13. https://doi.org/10.1186/s12889-023-16673-w

20. Hill, J. O., & Wyatt, H. R. (2005). Role of physical activity in preventing and treating obesity. *Journal of Applied Physiology*, *99*(2), 765–770. https://doi.org/10.1152/japplphysiol.00137.2005

21. Hoti, F. (2021). Impact of physical activity on longevity: A review of the literature. *Atena Journal of Public Health*, *3*, 1-10.

22. International Diabetes Federation. (2024). *Diabetes facts & figures*. https://idf.org/aboutdiabetes/diabetes-facts-figures/

23. Iwuala, S. O., Sekoni, A. O., Olamoyegun, M. A., Akanbi, M. A., Sabir, A. A., & Ayankogbe, O. O. (2015). Self-reported physical activity among health care professionals in South-West Nigeria. *Nigerian Journal of Clinical Practice*, *18*(6), 790–795. https://doi.org/10.4103/1119-3077.163275

24. Jerliu, N., Krasniqi, P., Berisha, M., & Ramadani, N. (2015). Regular physical activity of older people in Kosovo: a population-based survey. *European Journal of Public Health, 25*, 1-12.

25. Kanaley, J. A., Colberg, S. R., Corcoran, M. H., Malin, S. K., Rodriguez, N. R., Crespo, C. J., Kirwan, J. P., & Zierath, J. R. (2022). Exercise/Physical Activity in Individuals with Type 2 Diabetes: A Consensus Statement from the American College of Sports Medicine. *Medicine and Science in Sports and Exercise*, *54*(2), 353–368. https://doi.org/10.1249/MSS.0000000000002800

26. Kirwan, J. P., Sacks, J., & Nieuwoudt, S. (2017). The essential role of exercise in the management of type 2 diabetes. *Cleveland Clinic Journal of Medicine*, *84*(7), 15–21. https://doi.org/10.3949/ccjm.84.s1.03

27. Klein, S., Gastaldelli, A., Yki-Järvinen, H., & Scherer, P. E. (2022). Why does obesity cause diabetes?. *Cell Metabolism*, *34*(1), 11–20. https://doi.org/10.1016/j.cmet.2021.12.012

28. Klop, B., Elte, J. W., & Cabezas, M. C. (2013). Dyslipidemia in obesity: mechanisms and potential targets. *Nutrients*, *5*(4), 1218–1240. https://doi.org/10.3390/nu5041218

29. Koceva, A., Herman, R., Janez, A., Rakusa, M., & Jensterle, M. (2024). Sex- and Gender-Related Differences in Obesity: From Pathophysiological Mechanisms to Clinical Implications. *International Journal of Molecular Sciences*, *25*(13), 7-18. https://doi.org/10.3390/ijms25137342

30. Koliaki, C., Dalamaga, M., & Liatis, S. (2023). Update on the Obesity Epidemic: After the Sudden Rise, Is the Upward Trajectory Beginning to Flatten?. *Current Obesity Reports*, *12*(4), 514–527. https://doi.org/10.1007/s13679-023-00527-y

31. Kunene, S. H., & Taukobong, N. P. (2015). Level of physical activity of health professionals in a district hospital in KwaZulu-Natal, South Africa. *The South African Journal of Physiotherapy*, *71*(1), 1-6. https://doi.org/10.4102/sajp.v71i1.234

32. Kunyahamu, M. S., Daud, A., & Jusoh, N. (2021). Obesity among Health-Care Workers: Which Occupations Are at Higher Risk of Being Obese?. *International Journal of Environmental Research and Public Health*, *18*(8), 1-9. https://doi.org/10.3390/ijerph18084381

33. Kyle, R. G., Wills, J., Mahoney, C., Hoyle, L., Kelly, M., & Atherton, I. M. (2017). Obesity prevalence among healthcare professionals in England: a cross-sectional study using the Health Survey for England. *BMJ Open*, *7*(12), 1-8. https://doi.org/10.1136/bmjopen-2017-018498

34. Low, S., Chin, M. C., & Deurenberg-Yap, M. (2009). Review on epidemic of obesity. *Annals of the Academy of Medicine, Singapore*, *38*(1), 57–59.

35. Martyn, J. A., Kaneki, M., & Yasuhara, S. (2008). Obesity-induced insulin resistance and hyperglycemia: etiologic factors and molecular mechanisms. *Anesthesiology*, *109*(1), 137–148. https://doi.org/10.1097/ALN.0b013e3181799d45

36. Morina, B., & Brestovci, S. B. (2021). Prevalence of Overweight and Obesity Among Adults in Kosovo. *Спортске науке и здравље – АПЕИРОН, 12*(1), 94-99.

37. Mosteoru, S., Gaiţă, L., & Gaiţă, D. (2023). Sport as Medicine for Dyslipidemia (and Other Risk Factors). *Current Atherosclerosis Reports*, *25*(9), 613–617. https://doi.org/10.1007/s11883-023-01133-y

38. Nnadozie, U. U., Anekwu, E. M., Asouzu, N. C., Maduba, C. C., Madu, C. I., Nnadozie, A. A., Anekwu, E. O., Asouzu, N. C., Odo, C., & Unigwe, U. S. D. (2023). Physical Activity among Healthcare Workers in a Major Tertiary Hospital, Southeast Nigeria. *West African Journal of Medicine*, *40*(1), 72–77.

39. Phetla, M. C., & Skaal, L. (2017). Perceptions of healthcare professionals regarding their own body weight in selected public hospitals in Mpumalanga Province, South Africa. *South African Medical Journal*, *107*(4), 338–341. https://doi.org/10.7196/SAMJ.2017.v107i4.12174

40. Pihlajamäki, M., Uitti, J., Arola, H., Ollikainen, J., Korhonen, M., Nummi, T., & Taimela, S. (2019). Self-reported health problems and obesity predict sickness absence during a 12-month follow-up: a prospective cohort study in 21 608 employees from different industries. *BMJ Open*, *9*(10), 1-12. https://doi.org/10.1136/bmjopen-2018-025967

41. Pojednic, R., D'Arpino, E., Halliday, I., & Bantham, A. (2022). The Benefits of Physical Activity for People with Obesity, Independent of Weight Loss: A Systematic Review. *International Journal of Environmental Research and Public Health*, *19*(9), 19-28. https://doi.org/10.3390/ijerph19094981

42. Pressler, A., & Börjesson, M. (2020). *Impact of Exercise on Cardiovascular Risk Factors: Dyslipidemia.* In: Pressler, A., Niebauer, J. (eds) Textbook of Sports and Exercise Cardiology. Springer. https://doi.org/10.1007/978-3-030-35374-2_37

43. Ramli, A., Leonard J., Vijaykuma P., & Suhaimy R.M. (2013). Obesity and habitual physical activity level among staffs working in a Military Hospital in Malacca, Malaysia. *International Medical Journal Malaysia, 12,* 53–57.

44. Reimers, C. D., Knapp, G., & Reimers, A. K. (2012). Does physical activity increase life expectancy? A review of the literature. *Journal of Aging Research*, *2012*, 1-9. https://doi.org/10.1155/2012/243958

45. Sarı, H., Kılınç, Z., Soysal, Ş., & Özel, M. (2023). Evaluation of the frequency and awareness of obesity among healthcare workers. *European Review for Medical and Pharmacological Sciences*, *27*(10), 4639–4647. https://doi.org/10.26355/eurrev_202305_32475

46. Saridi, M., Filippopoulou, T., Tzitzikos, G., Sarafis, P., Souliotis, K., & Karakatsani, D. (2019). Correlating physical activity and quality of life of healthcare workers. *BMC Research Notes*, *12*(1), 1-6. https://doi.org/10.1186/s13104-019-4240-1

47. Schwendinger, F., Infanger, D., Lichtenstein, E., Hinrichs, T., Knaier, R., Rowlands, A. V., & Schmidt-Trucksäss, A. (2025). Intensity or volume: the role of physical activity in longevity. *European Journal of Preventive Cardiology*, *32*(1), 10–19. https://doi.org/10.1093/eurjpc/zwae295

48. Shariq, O. A., & McKenzie, T. J. (2020). Obesity-related hypertension: a review of pathophysiology, management, and the role of metabolic surgery. *Gland Surgery*, *9*(1), 80–93. https://doi.org/10.21037/gs.2019.12.03

49. Sheth, J., Shah, A., Sheth, F., Trivedi, S., Nabar, N., Shah, N., Thakor, P., & Vaidya, R. (2015). The association of dyslipidemia and obesity with glycated hemoglobin. *Clinical Diabetes and Endocrinology*, *1*, 1-7. https://doi.org/10.1186/s40842-015-0004-6

50. Song, M., Nam, S., Buss, J., & Lee, S. J. (2020). Assessing the prevalence of meeting physical activity recommendations among U.S. healthcare workers: Data from the 2015 National Health Interview Survey. *Archives of Environmental & Occupational Health*, *75*(7), 422–430. https://doi.org/10.1080/19338244.2020.1743960

51. Tsai, S. A., Lv, N., Xiao, L., & Ma, J. (2016). Gender Differences in Weight-Related Attitudes and Behaviors Among Overweight and Obese Adults in the United States. *American Journal of Men's Health*, *10*(5), 389–398. https://doi.org/10.1177/1557988314567223

52. Vallis M. (2016). Quality of life and psychological well-being in obesity management: improving the odds of success by managing distress. *International Journal of Clinical Practice*, *70*(3), 196–205. https://doi.org/10.1111/ijcp.12765

53. Wang, I. K., Tsai, M. K., Liang, C. C., Yen, T. H., Huang, C. C., Wen, S. F., & Wen, C. P. (2013). The role of physical activity in chronic kidney disease in the presence of diabetes mellitus: a prospective cohort study. *American Journal of Nephrology*, *38*(6), 509–516. https://doi.org/10.1159/000357133

54. WHO (March 1, 2024). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

55. Wickramasinghe, M., & Weaver, J. U. (2018). *Practical Guide to Obesity.* Elsevier.

56. Wiklund P. (2016). The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, *5*(2), 151–154. https://doi.org/10.1016/j.jshs.2016.04.001

57. World Health Organization. (2010). A healthy lifestyle - WHO recommendations. https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations?utm_source=chatgpt.com

58. World Health Organization. Regional Office for Europe. (2023). *STEPS: Prevalence of noncommunicable disease risk factors in Kosovo, 2019*. WHO Regional Office for Europe.

59. Yamada, T., Kimura-Koyanagi, M., Sakaguchi, K., Ogawa, W., & Tamori, Y. (2023). Obesity and risk for its comorbidities diabetes, hypertension, and dyslipidemia in Japanese individuals aged 65 years. *Scientific Reports*, *13*(1), 1-15. https://doi.org/10.1038/s41598-023-29276-7

60. Younis, J., Jiang, H., Fan, Y., Wang, L., Li, Z., Jebril, M., Ma, M., Ma, L., Ma, M., & Hui, Z. (2023). Prevalence of overweight, obesity, and associated factors among healthcare workers in the Gaza Strip, Palestine: A cross-sectional study. *Frontiers in Public Health, 11,* 1-15. https://doi.org/10.3389/fpubh.2023.1129797

61. Zheng, C., Liu, Y., Xu, C., Zeng, S., Wang, Q., Guo, Y., Li, J., Li, S., Dong, M., Luo, X., & Wu, Q. (2024). Association between obesity and the prevalence of dyslipidemia in middle-aged and older people: an observational study. *Scientific Reports, 14*(1), 23-35. https://doi.org/10.1038/s41598-024-62892-5

62. Zubery, D., Kimiywe, J., & Martin, H. D. (2021). Prevalence of Overweight and Obesity, and Its Associated Factors Among Health-care Workers, Teachers, and Bankers in Arusha City, Tanzania. *Diabetes, Metabolic Syndrome and Obesity, 14*, 455–465. https://doi.org/10.2147/DMSO.S28359

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

COPYRIGHT