Prevalence of hypertension and diabetes in the population of Kosovo

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Received: 26 August 2020; Accepted: 28 October 2020; Published: 20 September 2021

Abstract: Objectives: To observe the prevalence of arterial pressure and glycemia in Kosovo and to provide free screening service through health promotion.

Methods: This prospective study was conducted over a 3-year period, during 2017–2019. All data were collected by AAB College staff in 11 Kosovo cities prior to a random sample with 7254 observations. Data included demographic information as well as blood pressure and glycemic level measurements.

Results: The overall prevalence of arterial pressure was registered at 27.6% and diabetes mellitus at 9.2%. Arterial pressure in females had a tendency to increase with age ($r = 0.3552$, $P < 0.001$), as well as the glycemic index ($r = 0.1997$, $P < 0.001$). Nevertheless, age had a stronger impact on males than in females, with regard to higher arterial pressure in the year 2017 ($P < 0.001$). In the following years, 2018 and 2019, the ratio had reversed. Glycemia had strong correlation with systolic arterial pressure value ($P < 0.001$). For a 1 mmol/L increase in glycemia, the diastolic value increased by 0.19 mmHg on average.

Conclusions: This study concluded that at younger ages the values of arterial pressure and glycemia remain within the commonly observed range, but over the years the probability for higher blood pressure or glicemia increases. Through continuous control of arterial pressure and glycemia at an early age, it is possible to identify abnormal diagnostics, in order to address them in time. Educational initiatives and screenings should take place in order to increase awareness of the citizens for checking themselves regularly.

Keywords: arterial pressure • glycemia • nursing care • promotion • screening

1. Introduction

Arterial pressure and diabetes mellitus are two common pathologies worldwide. In 2015, 1 in 4 men and 1 in 5 women had hypertension. According to the latest data, an estimated 1.13 billion people worldwide have hypertension. Arterial hypertension has long been considered as the "silent killer," as patients are often asymptomatic. The presence of hypertension is related to the incidence of diseases that decrease the lifespan such as coronary heart disease, cerebrovascular stroke, and kidney disease. However, healthy administration by health care professionals (such as public campaigns), along with good patient compliance, can prevent the occurrence of these diseases.

Another aspect of global health, alongside arterial hypertension, is that of diabetes mellitus. In 2015, the estimated world prevalence of diabetes in adults (20–79 years) was 8.8%, and it is expected to rise to 10.4% by 2040. Also in 2015, it was estimated that 1 in
11 adults had diabetes (415 million), while by 2040 it is estimated that 1 in 10 adults will have diabetes (642 million). Diabetes mellitus was considered an independent factor for cardiovascular diseases, and accompanied by other comorbidities such as hypertension, can further increase this risk. Through monitoring glycemic status, it is possible to achieve optimal blood glucose control.

Approximately 75% of all patients with diabetes have comorbid arterial hypertension. The incidence of hypertension was higher in diabetic patients than in nondiabetic patients. Out of 16%-46% hypertensive cases, the prevalence of diabetes mellitus is significantly higher at around 20%-39% than among normotensive subjects. Data suggest that it may have more benefit in controlling blood pressure than in lowering blood sugar in patients with diabetes.

Especially, in terms of a rapid transition, countries such as Kosovo or Albania have dealt with serious health complications due to hypertension. Unfortunately, in Kosovo, there are no relevant data due to its political status as a post-war country for several years. This is the first study conducted in Kosovo that pertains to the link between arterial pressure and glycemia prevalence. The purpose of this paper was to observe the prevalence of arterial pressure and glycemia in Kosovo and to provide free screening service through health promotion campaigns.

2. Methods

2.1. Design and setting

A prospective study was carried out for the period 2017–2019. Data collection was performed taking a random sample of 7254 citizens in 11 cities of Kosovo, performed by AAB College staff. The idea for this paper originated from the International Day of Nursing, when for an entire week in a month, there were offered free services such as blood pressure and glycemia measurement by AAB college teachers and nursing students. General information such as socio-demographic data, age, gender, and city, as well as arterial pressure and glycemia measurements, were gathered. The JNC-V/ADA classification of average sBP 2140 mmHg and/or dBP 2 90 mmHg, according to The Fifth Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure was considered as hypertension; whereas high glycemic level is considered to be 2 7 mmol/L according to current guidelines.

2.2. Data analysis

The mean value for blood pressure, glycemic level, age, and gender were evaluated. Data were presented as mean values for continuous variables and as a percentage for discrete variables. The statistical analyses were performed using the STATA 15.1 statistical calculation program. Quantitative analyses consisted of data distribution, a chi square test to compare discrete variables, and t-test for continuous and inter-year comparison with confidence interval (CI) = 95%.

3. Results

In total, 7254 participants participated in the study. No age limit criteria were considered when sampling the population. Gender was another important component when analyzing glycemic status and arterial pressure level. Out of the total participants, the majority was male (5129, 70%), while the remaining (2125, 30%) were female. Arterial pressure of females had a tendency to increase with age (r = 0.3552, P < 0.001), as well as glycemic index (r = 0.1997, P < 0.001). Nevertheless, age had a stronger impact on males than in females, with regard to higher arterial pressure in the year 2017 (P < 0.001). Table 1 summarizes the mean, min, and max values for arterial pressure, glycemia, and age in years. Arterial pressure and glycemic values did not change significantly in years (P > 0.05). However, as age increased, the level of arterial pressure and glycemia also increased (P < 0.05). Around 666 participants (9.2%) had a level of glycemia ≥ 7 mmol. Meanwhile, 2001 participants (27.6%) had arterial pressure ≥ 140/90 mmHg (Table 2). Furthermore, in Tables 2, 3, and 4 are summarized the descriptive data (mean, min, and max value) for arterial pressure and glycemia for various cities in Kosovo, thus showing the main cities with the highest prevalence of glycemia and arterial pressure.

Glycemia had a significant correlation with systolic arterial pressure values (r = 0.19; P < 0.001). For a 1 mmol/L increase in glycemia, the diastolic value increased by 0.19 mmHg on average. Age was also significantly associated with changes in diastolic values (P < 0.001). By increasing age by 1 year, the diastolic value increased by 0.13 mmHg on average.

The prevalence of arterial pressure and glycemia was also measured based on geographical distribution. However, no significant differences were noticed between the major cities (P > 0.05).

4. Discussion

This study analyzed the link between arterial pressure and glycemia, in order to increase awareness toward health risk factors and timely screening of citizens, and to reflect nursing care through comparing the results in years. It was difficult to find similar studies to compare the results, since this study is the first of its kind.
conducted in Kosovo considering the prevalence of cardiovascular diseases and glycemia and the link between them. Kosovo, as a postwar country, is undergoing a rapid demographic and epidemiological transition. In all such transitions, lifestyle and timely diagnostics are key components and play an important role. The findings of this study are in line with researches conducted in other Western Balkan countries and further.\textsuperscript{15,17–19} In a similar study conducted in Kosovo, there were identified significant correlates of hypertension such as male gender, older age, physical inactivity, smoking, and hostility ($P < 0.001$).\textsuperscript{20} In this study, only

### Table 1. The comparison in years (2017–2018–2019) for arterial pressure and glycemia measurements.

| Year | Arterial pressure | Glicemia | Age |
|------|------------------|----------|-----|
|      | Min   | Mean   | Max   | Min   | Mean   | Max   | Min   | Mean   | Max   |
| 2017 | 80/50 | 133/83 | 200/120 | 3.4  | 7.06   | 30.9 | 19   | 51   | 82   |
| 2018 | 70/50 | 132/83 | 200/120 | 2.2  | 6.91   | 32.5 | 16   | 54   | 88   |
| 2019 | 80/60 | 131/83 | 210/120 | 3.8  | 7.10   | 29.6 | 18   | 56   | 87   |

### Table 2. Descriptive data for arterial pressure and glycemia as regards cities of Kosovo in 2017.

| Cities       | Arterial pressure | Glicemia |
|--------------|------------------|----------|
|              | Min   | Mean   | Max   | Min   | Mean   | Max   |
| Prishtinë    | 90/60 | 134/84 | 190/110 | 3.9  | 6.70   | 29.0 |
| Drenas       | 90/60 | 131/84 | 190/120 | 3.8  | 6.37   | 13.7 |
| Ferizaj      | 80/50 | 131/83 | 180/110 | 3.4  | 7.000  | 19.7 |
| Kluënë       | 100/70| 131/82 | 200/120 | 3.8  | 7.3    | 19.5 |
| Malishevë    | 100/60| 124/80 | 180/120 | 4.2  | 7.39   | 21.6 |
| Mitrovicë    | 90/55 | 132/83 | 200/105 | 4.1  | 7.21   | 22.8 |
| Pejë         | 100/60| 134/82 | 175/110 | 4.1  | 6.71   | 22.0 |
| Prizren      | 100/60| 136/83 | 200/120 | 3.9  | 7.40   | 30.9 |
| Skënderaj    | 100/70| 131/81 | 180/110 | 3.4  | 6.79   | 19.8 |
| Suharekë     | 110/75| 135/84 | 185/120 | 4.4  | 7.49   | 23.9 |

### Table 3. Descriptive data for arterial pressure and glycemia as regards cities of Kosovo in 2018.

| Cities         | Arterial pressure | Glicemia |
|----------------|------------------|----------|
|                | Min | Mean | Max | Min | Mean | Max | Min | Mean | Max |
| Prishtinë      | 90/50| 128/82| 200/120 | 2.2 | 6.26 | 25.5 |
| Drenas         | 80/50| 130/82| 200/120 | 3.5 | 6.82 | 30.1 |
| Ferizaj        | 80/60| 137/85| 200/120 | 3.6 | 7.21 | 26.3 |
| Kluënë         | 70/60| 129/81| 180/120 | 3.5 | 6.47 | 21.6 |
| Malishevë      | 100/60| 135/87| 200/120 | 3.7 | 6.11 | 14.2 |
| Mitrovicë      | 100/60| 136/82| 200/110 | 3.2 | 7.37 | 24.2 |
| Pejë           | 90/60| 134/85| 180/120 | 3.6 | 6.88 | 18.9 |
| Gjakove        | 90/60| 131/82| 190/100 | 4.1 | 7.71 | 24.3 |
| Kaqanik        | 90/50| 131/85| 190/100 | 3.4 | 6.47 | 21.3 |
| Lipjan         | 80/60| 80/60| 200/120 | 3.9 | 6.78 | 23.5 |
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Age, gender, and geographical distribution were analyzed. Taking into account the average age of our population (55 years old), mean arterial pressure had values within the normal range, from 131/83 to 133/84 mmHg and glycemic index from 6.91 mmol to 7.1 mmol, similar to other studies. The overall prevalence of hypertension was about 27.6%. In a previous study conducted in Kosovo, the overall prevalence of hypertension was 34% (39% in men and 29% in women), a higher value compared to our study, probably due to a smaller sample that was not representative of the whole population. Similar to our study, an Albanian study measured a prevalence of hypertension among men at 27.3% and women at 20%, where gender difference was statistically significant ($P < 0.01$). In the other Balkan countries were recorded higher prevalence values of hypertension: Serbia 47%, Bosnia Herzegovina 40%, Slovenia 66%, Bulgaria 39.5%, Croatia 37.5%, Turkey 31.8%, and Greece 31.1%. These values differed due to the different population characteristics.

A significant correlation was noticed between the participants' age and arterial pressure ($P < 0.001$). Similarly, in a Romanian study was recorded the highest prevalence of hypertension for the age group >65 years old (81%; $P < 0.001$). Hypertension among both genders significantly increased with age; an increase of 1 year of age was associated with an increase in the odds of hypertension by 5% in men and 9% in women. Similarly, Lise et al. (2014) demonstrated a significant correlation between age and systolic blood pressure in their patients ($r = 0.53$, $P < 0.001$). The difference in prevalence of hypertension as regards gender has been analyzed in various populations. Age had a stronger impact in hypertension in males than in females, in 2017. But, only 1 year later, the ratio between females and males had reversed: males were no longer more affected than females. This reverse could be attributed to an improvement in the risky behavior in men or convergence of lifestyles between genders. Similarly, age was a relatively good predictor of systolic and diastolic blood pressure, more in women than in men. The prevalence of arterial pressure increased equally for both genders in another study. Several other studies showed that the female gender was a better indicator of success in hypertension control. However, other authors reported no differences between gender, and in contrast to previous studies, men had better control over hypertension. Hence, this issue is still not determined firmly.

The overall prevalence of glicemia was registered at 9.2% (out of 7254 adults). Similarly, many other studies concluded prevalence values from 6% among young people to 19% among elderly people. An Albanian study after considering the 1999 WHO diagnostic criteria reported unadjusted prevalence of glicemia at 9.7%, which is similar to our study. Also, other studies toward diagnosed diabetes reported low glicemia values of 9% and 6%, respectively, for Italy and Netherlands. In line with this study, the overall prevalence for 2019 worldwide was nearly 9.3% (estimated at half-a-billion adults aged 20–79 years).

A significant correlation between glycemia and systolic pressure value was noticed ($P < 0.001$). For a 1 mmol/L increase in glycemia, the systolic value

| Cities      | Arterial pressure | Glicemia |
|-------------|-------------------|----------|
|             | min    | mean   | max     | min    | mean   | max     |
| Prishtinë   | 90/60  | 129/82 | 180/110 | 3.8    | 6.89   | 24.9    |
| Drenas      | 80/60  | 141/88 | 200/120 | 3.8    | 7.35   | 23.9    |
| Ferizaj     | 80/60  | 133/83 | 180/110 | 3.9    | 7.40   | 22.9    |
| Gjilan      | 85/60  | 127/82 | 190/120 | 4.0    | 7.59   | 24.8    |
| Malishevë   | 90/60  | 131/84 | 200/120 | 3.7    | 7.08   | 26.6    |
| Mitrovicë   | 100/60 | 135/85 | 200/120 | 4.4    | 7.92   | 27.2    |
| Pejë        | 100/60 | 133/83 | 200/120 | 3.8    | 7.17   | 25.2    |
| Gjakovë     | 100/60 | 133/85 | 170/100 | 4.1    | 7.67   | 29.3    |
| Kërçanj     | 80/60  | 134/84 | 210/120 | 3.9    | 7.22   | 20.9    |
| Lipjan      | 100/60 | 130/85 | 180/120 | 3.8    | 6.66   | 25.9    |
| Klinë       | 100/60 | 134/81 | 180/120 | 3.9    | 6.50   | 19.3    |

Table 4. Descriptive data for arterial pressure and glicemia as regards cities of Kosovo in 2019.
increased by 0.19 mmHg on average. In a different study, the prevalence of high blood pressure was approximately twice that of the nondiabetic population. No significant differences were noticed between the major cities involved in the study ($P > 0.05$). On the contrary, an Albanian study concluded that hypertension was higher in the rural areas than in the urban areas (OR = 1.5; 95% CI = 1.26). Many other factors such as genetics and environmental factors influence the prevalence of hypertension, which were not addressed in this study. However, regardless of other contributing risk factors, timely screening and educational programs are likely to increase the quality of life and care provided by nurses, as demonstrated by several studies. The prevalence of arterial pressure and glycemia was lower than expected in Kosovo, compared with other European countries.

5. Conclusions

In conclusion, the prevalence of arterial pressure and glycemia was lower than expected in Kosovo, compared with other European countries. This result could be due to a younger average population in our country, and could not be attributed to developed prevention programs. It is a must for policymakers to consider the risk factors of hypertension in postwar Kosovo, in order to manage them properly.

The study included the majority of Kosovo cities, thus being representative of the whole population. By measuring the prevalence of arterial pressure and glycemia, this study quantified and analyzed data not only in years but also related to gender, age, and geographical distribution. Furthermore, through highlighting the importance of free screening in time for patients and continuous educational programs for nurses, it delivers high academic and practical value, enriches the local literature, and reduces risks from cardiovascular diseases and diabetes mellitus.

Limitations

This study had several limitations. First of all, there are no other relevant data to compare the results within Kosovo. This study was the first of its sort to address the prevalence of arterial hypertension and diabetes mellitus. The lack of data in years, due to the political situation in Kosovo, contributed to the lack of epidemiological data. The cohort analysis was based on a time period of only 3 years (2017–2019). To get in-depth analysis and more reliable results, conducting a longer period of study is often necessary. Another limitation of the study was that measurements were done only in 1 day, excluding the possibility of obtaining several values for one person at different times. A future possible research may consider a study design for a longer time period. Also, another future research that can be undertaken may consist of a comparative analysis between different countries within the region or abroad.

Ethics approval

Each individual who participated in the study gave their approval. They were assured that their data would remain completely confidential and that the database would be destroyed after 5 years.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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