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Body Composition and Physical Activity of Female Police Officers: Do Occupation and Age Matter?

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Abstract: This study aimed to investigate the differences in the body composition and volume of leisure time physical activity (V-LTPA) of female police officers from two police occupations and to assess the differences when officers are matched by age. Body composition measures including body mass index (BMI), percent body fat (%BF), and percent of skeletal muscle mass (%SMM) of female communal police (n = 56) and general police (n = 90) were compared. Officers were allocated into three age groups: 29 years and younger, 30–39 years, and 40 years and older. We used an independent samples t-test, analysis of variance, and multiple analyses of variance to investigate the differences between occupations, between age groups, and between-occupation-within-age differences in body composition. Communal police officers had significantly ($p < 0.05$) lower BMI and %BF and higher %SMM compared to general police. Significant differences were found between age groups, with the youngest officers having lower BMI and %BF and higher %SMM and V-LTPA. Finally, differences in body composition were no longer significant when officers from different occupations were compared within age groups. Police agencies should consider supporting and motivating officers through policies to encourage leisure time physical activities for female officers. Other mechanisms for the management of body composition should also be considered.

Keywords: occupational health; physical fitness; obesity; exercise

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1. Introduction

Police officers may be required to commence a pursuit, jump, move between covers, overcome a belligerent's resistance, take a quick and high-risk decision, or witness highly stressful scenarios and crime scenes. To perform these tasks, police officers need good body composition, physical fitness, and general health [1–4]. The body composition of police officers influences physical fitness and can enable officers to perform better and be healthier [1–3]. Dawes et al. [4] found officers with a lower percentage of body fat performed better on maximum bench press, push-ups, and vertical jump exercises, while greater lean body mass was positively associated with push-ups, bench press, and vertical jump measures. Kukić et al. [2] reported a significant association between body composition and the Illinois agility test in female police students. Specifically, greater body mass and percentage of skeletal muscle mass were significant predictors of agility performance. Considering health, Charles et al. [1] found that adiposity was significantly and positively associated with several markers of oxidative stress and lower antioxidant defence among police officers.

Like in the general population [5,6], officers' body fat mass tends to increase while skeletal mass decreases with age and time spent in service [7–9]. Boyce et al. [9] conducted a 12-year follow-up study on 327 police officers who were allocated into five groups (lowest-to-highest percent body fat (%BF)) and found significant increases in %BF in each group. A cross-sectional study of 95 female police officers showed significantly higher %BF and lower percentage of skeletal muscle mass (%SMM) in older compared to younger officers [8]. However, although officers of different operational tasks (i.e., SWAT, Gendarmerie, general police) may differ in body composition, with those performing physically demanding tasks being leaner, exercise level was found to be a significant moderating factor [10]. A volume of 150–300 min of leisure time physical activity per week was sufficient for maintaining good body composition in male police officers, while higher volumes were needed for further improvements [10,11].

Policing has been dominantly a male occupation, with specific efforts during the past few decades to increase the number of females in service. However, besides the studies mentioned above, the research literature on female police officers remains scarce [12]. In particular, research examining differences in body composition physical activity by occupation and age is only available for male officers [10]. Considering the occupational health and performance as well as personal health of female officers, it is important to evaluate and determine whether their body composition also differs by occupation and age. Furthermore, Serbia is considered a developing country and as a candidate for the European Union is obligated to consolidate its policies accordingly. To that end, the research in the underrepresented population of females in policing occupations of Serbia is a mandatory step that will help inform sustainable policies. There are two main types of policing occupations in Serbia, general police and communal police, whose duties and jurisdictions are different. Thus, the aim of this study was to investigate the differences in body composition and physical activity level of female police officers from these two policing occupations. Moreover, the study assessed whether officers' age may be more strongly predictive of body composition than their occupation.

2. Materials and Methods

2.1. Research Design

This was a cross-sectional study with a random sample of female police officers. Police officers were invited via official invitation letter sent to the Ministry of Interior and the Ministry of Public Administration and Local Self-Government. Female officers were recruited and voluntarily joined the study. They visited the Methodological-Research lab at the Faculty of Sport and Physical Education, University of Belgrade, Serbia on one occasion, where their body composition and physical activity behavior were assessed.

2.2. Participants

In total, 158 officers visited the lab. Data from 12 participants who either visited the lab in the afternoon or had a meal prior to testing were not included in this study. Thus, data from 146 officers were analyzed for the study. All participants were informed about the purpose of the study and were assessed after providing informed consent. Data for this study were collected in a de-identified format without obtaining names or any personal identification. To match the different types of data collected, participants were identified using an alphanumeric coding system (e.g., for a communal police officer, the designator CPO and for a general police officer, the designator GPO were used in addition to a sequential number; i.e., CPO1-CPO56 and GPO01-GPO90). Both groups of officers were sub-divided into three age sub-groups: 29 years and younger, 30–39 years, and 40 years and more. These three age groups were used so each group contained a sufficient number of participants for statistical analyses. Ethical approval (no. 484-2) was obtained for this study. The study was conducted in accordance with the Declaration of Helsinki [13].

2.3. Occupational Characteristics

Communal police officers are employees of the Ministry of Public Administration and Local Self-Government whose duties mostly include fieldwork. Their responsibility is to ensure the workings of the local government. Their duties include the control of regulations and laws regarding the protection of the environment, people, goods, land utilization, and the cleanliness of the streets. If an issue occurs, they go to the scene, review the scene, and report it or write a fine. They do not carry weapons and a protective vest on them, and they are not allowed to use physical force to enforce the law. There are no physical fitness requirements for communal police officers for their recruitment into the service, nor are they required to complete an annual fitness assessment.

The duties of police officers with general jurisdiction include patrolling the streets, conducting investigations, completing administrative duties, and responding to reports of crimes, homicides, and other incidents [14]. They are allowed to use physical force to enforce the laws of the Republic of Serbia. Although physical fitness assessment is part of their recruitment and initial training at the academy [15], once they enter the force, their fitness is not rigorously or frequently checked.

2.4. Body Composition

The InBody 720 multichannel bioelectric impendence analyzer was used to determine body composition (IBM, Seoul, Korea). It has been determined that this device is valid and reliable [16,17]. The assessment was conducted during 08:00–10:00 a.m. and according to procedures previously reported [10,11]. The agency informed their respective participants about the timing of the assessment and asked them to abstain from strenuous exercise 24 h prior to testing, eating a large meal the night before (i.e., dinner), or having breakfast and fluids on the morning of the test. However, they were also informed that the testing would take approximately 5–10 min and that they would be provided with water and a snack bar after the assessment. The device's software logged body composition results and printed out a results sheet for each participant containing age, body height (BH), body mass (BM), body mass index (BMI), percent BF, and percent SMM.

Immediately after completing the body composition assessment, participants were provided with the short form of the international physical activity questionnaire (IPAQ-SF), which assessed their leisure time physical activity (LTPA) [18]. It consists of six questions concerning the duration and frequency of vigorous, moderate, and light (i.e., walking) physical activity, and one question concerning the sitting time on a typical day [18,19]. The number of days per week and the time per day spent in walking or moderate or vigorous activity during LTPA were collected and analyzed following procedures reported elsewhere [11]. The days were multiplied with hours for each of the three activities (walking, moderate, vigorous), and then those three numbers were summed to get a total weekly volume of LTPA (V-LTPA).

2.5. Statistical Analysis

The Statistical Package for Social Sciences (IBM, SPSS Statistics 20) was used for the analysis. Descriptive statistics for means and standard deviations were calculated for each occupation and age group. Independent sample t-tests were used to investigate the differences between occupations. Analysis of variance (ANOVA) was used to investigate the differences in body composition by age. Multivariate analysis of variance (MANOVA) followed by Bonferroni post-hoc analysis was used to investigate the between-occupation-within-age differences in body composition. The significance level was set to $p < 0.05$. Cohen's effect sizes (d) were calculated as the ratio of the difference in mean scores to standard deviation, following the formula ES = $(M_2 - M_1)/SD$, where M_1 and M_2 were the means of the groups investigated and the SD was a pooled standard deviation of compared groups. The magnitude of the effects was defined as follows: small = 0.2, moderate = 0.6, large = 1.2, and very large = 2.0 [20].

3. Results

The sample included 56 communal police officers, and 90 were general police officers. The main characteristics of groups were communal police (age = 30.04 ± 5.71 years, BH = 167.03 ± 5.75 cm, BM = 63.77 ± 10.55 kg) and general police (age = 33.66 ± 6.93 years, BH = 168.89 ± 6.88 cm, BM = 69.02 ± 11.56 kg). The average length of service was 7.8 ± 6.9 years (1–24 years). The descriptive statistics for the whole sample are presented relative to age and occupation in Table 1.

Table 1. Descriptive statistics for communal and general police officers and the whole sample, stratified by age.

Variable	Age Category	Communal Police n = 56 (38%)		General Police n = 90 (62%)		Combined n = 146	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
BMI (kg/m^2)	29 and younger	22.63	3.69	23.11	3.52	22.87	3.58
	30–39	22.92	3.83	24.50	4.13	23.96	4.07
	40 and older	24.63	4.27	25.29	3.66	25.18	3.64
	Total	22.87	3.74	24.23	3.92	23.71	3.90
%BF (%)	29 and younger	26	7	27	7	27	7
	30–39	27	8	30	8	29	8
	40 and older	31	4	33	8	32	7
	Total	26	7	30	8	29	8
%SMM (%)	29 and younger	41	3	40	4	40	4
	30–39	40	4	39	4	39	4
	40 and older	37	2	37	4	37	4
	Total	40	4	39	4	39	4
V-LTPA (minutes per week)	29 and younger	230.22	210.40	230.15	221.82	230.19	213.99
	30–39	180.42	226.08	61.04	105.37	102.43	166.56
	40 and older	168.00	166.71	117.33	146.24	125.78	145.81
	Total	203.77	214.11	119.28	169.21	151.68	191.48

BMI—body mass index, %BF—percent of body fat, %SMM—percent of skeletal muscle mass, V-LTPA—volume of leisure time physical activity.

Independent samples *t*-tests revealed significant occupational differences in body composition, with communal police having a slightly lower BMI and %BF and slightly higher %SMM than general police officers (Figure 1). In addition, communal police officers were 3.62 years younger ($t = -3.27$, $p < 0.01$, $d = 0.57$) and reported 84.49 more minutes of V-LTPA ($t = 2.65$, $p = 0.009$, $d = 0.44$) than general police officers.

The ANOVA showed that the youngest officers had lower BMI compared to the oldest group of officers and both a lower %BF and higher %SMM than both groups of older officers. In addition, the effect size analyses indicated small differences in %BF between the youngest and middle age groups of officers and a moderate effect size for differences in the V-LTPA. Effect sizes between the youngest and oldest age groups of officers were moderate, except for a small effect size for the V-LTPA (Table 2).

Once adjusted to occupation and age, the only significant difference occurred in the V-LTPA between communal and general police officers who were 30–39 years old, with communal police officers reporting higher levels of physical activity (Table 3).

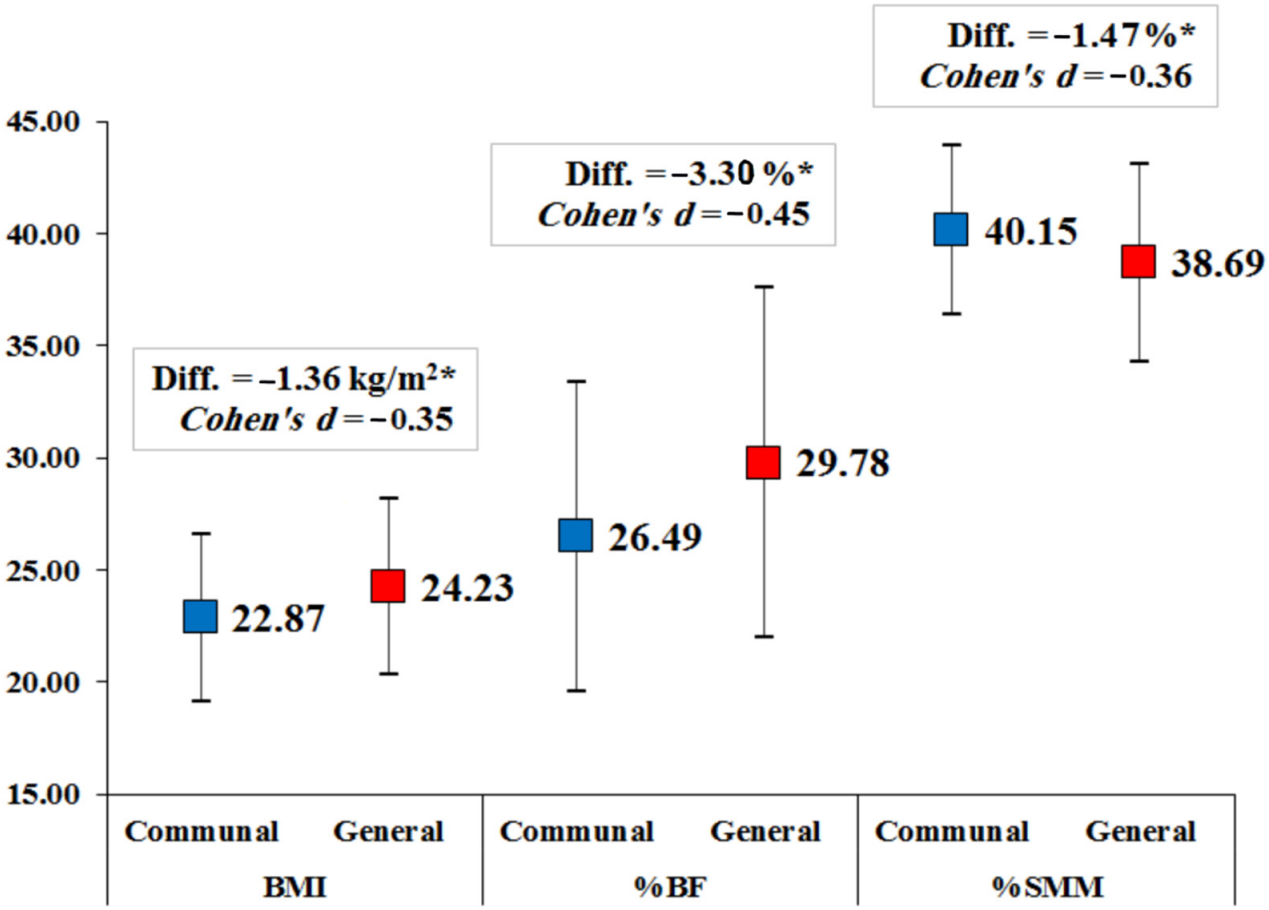

Figure 1. Between-occupation difference in body composition of female communal and general police officers. Diff.—mean difference, * significant at $p < 0.05$.

Table 2. Comparison between the age categories.

Variables	Between-Age Comparison		Mean Difference	*p*	95% Confidence Interval		*d*
					Lower	Upper	
BMI	29 and younger	30–39	−1.09	0.118	−2.45	0.28	−0.28
		40 and older	−2.31	0.029	−4.39	−0.23	0.64
	30–39	40 and older	−1.22	0.228	−3.22	0.78	−0.32
%BF	29 and younger	30–39	−3	0.061	−5	0	0
		40 and older	6	0.005	−10	−2	1
	30–39	40 and older	−3	0.091	−7	1	0
%SMM	29 and younger	30–39	1	0.048	0	3	0
		40 and older	4	0.002	1	6	1
	30–39	40 and older	2	0.060	0	4	0
V-LTPA	29 and younger	30–39	127.76	0.000	63.83	191.70	0.67
		40 and older	104.41	0.035	7.21	201.61	0.58
	30–39	40 and older	−23.35	0.622	−116.87	70.17	−0.15

BMI—body mass index, %BF—percent of body fat, %SMM—percent of skeletal muscle mass, V-LTPA—volume of leisure time physical activity.

Table 3. Comparison between occupation groups adjusted to age.

Variables	Age Categories	Mean Difference (Communal-General)	*p*	95% Confidence Interval		*d*
				Lower	Upper	
BMI	29 and less	−0.484	0.648	−2.57	1.61	−0.13
	30–39	−1.577	0.093	−3.42	0.27	−0.40
	40 and more	−0.659	0.787	−5.47	4.15	−0.17
%BF	29 and less	−2	0.401	−6	2	−0.25
	30–39	−3	0.060	−7	0	−0.44
	40 and more	−1	0.771	−11	8	−0.24
%SMM	29 and less	1	0.442	−1	3	0.23
	30–39	1	0.238	−1	3	0.27
	40 and more	1	0.844	−5	6	0.16
V-LTPA	29 and less	0.068	0.999	−97.83	97.97	0.00
	30–39	119.382	0.007	32.93	205.83	0.72
	40 and more	50.667	0.657	−174.68	276.01	0.32

BMI—body mass index, %BF—percent of body fat, %SMM—percent of skeletal muscle mass, V-LTPA—volume of leisure time physical activity.

4. Discussion

We found significantly lower BMI and %BF and higher %SMM scores in communal compared to general police officers. However, these differences in body composition were small in effect size and could be attributed to the lower mean age of the communal police officers. For comparisons by age, officers who were up to 29 years and younger had a lower BMI than those who were 40 years and older and a lower %BF and higher %SMM than both age groups, 30–39 and 40 years and older, with mostly moderate effect sizes.

The negative effect of ageing on the body composition of police officers has been previously reported [8,9]. Boyce et al. [9] conducted a 12 year follow up study and found an increase of about 7.4 kg in BM and 5.1% in %BF among 30 female police officers. Kukic et al. [8] compared the body composition of female police officers of different ages and found that officers ages 21–25 years had a lower BM and BMI than the officers who were 31–35 and 36–40 years old. Moreover, the fat mass and fat mass index of the youngest group were also significantly lower than in officers from the 36–40 years group, with 89.8% and 89.0% of the between-subject variance in %BF and %SMM being explained by age. The obtained difference in BMI from the current study was higher than that obtained in Kukic et al. [8]. The obtained difference in %BF was smaller than that obtained in Kukic et al. [8] and similar to that obtained by Boyce et al. [9]. Thus, the negative changes in body composition of female police officers by age are evident, which is why agencies and officers should think of the mechanisms that would support them in healthy ageing. For instance, time allocated for exercise during working hours (i.e., 30 min per working day) and systematic support in healthy eating at work could make a significant difference.

Considering the body composition of both groups of officers, BMIs were similar to age-adjusted Serbian population data [21] and in the normal weight range compared to international standards [22]. Furthermore, %BF was lower, while %SMM was similar to the population data of Serbian females. However, the trend of an increase in obesity seen within our sample is concerning, as participants' %BF was in the poor range [22]. Compared to females in a sample of police officers from Abu Dhabi [8], our sample had about 10% lower %BF and about 7% higher %SMM. About 10% lower %BF could also be observed when compared with the sample from the USA [23]. It is of note that increased body mass due to body fatness negatively affects health [1,23–25] as well as the physical and occupational performance of police officers [2,26,27]. Therefore, monitoring and improving body composition is of importance for female police officers, agencies, and ultimately for public safety and security.

When adjusted to age and then compared between occupation groups, no significant differences remained in body composition, further supporting the evidence that age rather

than occupation affects body composition [6,8]. The increment in body fatness by age could be attributed to a gradual loss of skeletal muscle mass [5,28,29] and decrease in metabolic rate [30,31]. Indeed, physical fitness also decreases by age (i.e., by the time spent in service), whereby the decrease is further amplified if followed by negative changes in fat and muscle tissue ratio [32–34]. However, an increase in body fatness could be mitigated by increases in physical activity [10,11,35,36]. Kukić et al. [10] found that between-occupation differences disappeared once police officers from different occupations were adjusted relative to the amount of physical activity. In addition, the effects of physical activity on police officers' body composition were clearly shown by Vuković et al. [11]. Therefore, while officers' %BF may increase by age, participating in physical activity could be used to stop or slow down this trend.

This study included a sufficient size sample of female police officers whose body composition was measured with one of the most valid bioelectric impedance analyzers on the market. Studies of female police officers are rare, which makes it hard to develop sex-specific policies for female police officers within a predominantly male occupation. To that end, our results provide clear information on the relationships between occupation and age and the body composition and physical activity of female police officers. The main limitation of our study includes the unequal sample sizes between occupation groups. Future research should include objective measures of physical activity and dietary habits of female police officers. Moreover, studies should include experimental approaches that would investigate the effects of changes in physical activity and dietary patterns on body composition and health of officers.

5. Conclusions

The main findings of this study suggest that although communal police officers had lower BMI and %BF, the difference could be attributed to their age rather than to occupation. This was further confirmed in the analysis of differences in body composition relative to age of officers as younger officers had better indicators of body composition. The study's practical implications suggest that the police agencies should develop human-centered policies that would support officers in taking care of their physical fitness and health rather than simply focusing on job performance. Improvements in body composition components such as skeletal muscle and body fat lead to better movement potential and lower health risks, ultimately contributing to agency performance. Good preventive policies are good for both officers and agencies. Providing officers with designated time for physical activity during working hours may be a good start. Fitness and nutrition departments in police agencies are great examples of a sustainable approach to taking care of employees. Unfortunately, these are very rare examples. Future studies should include interventions and longitudinal follow-up studies in order to determine actionable guidelines for officers and agencies on how to improve and maintain body composition.

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