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Original Papers

Dyslipidemia in Internally Displaced Middle-aged Women in Kharkiv During the War

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Abstract

Background. Kharkiv is a hub for internally displaced persons (IDPs). The impact of war on general health in perimenopausal women is still a challenging issue.
The study **was focused** on the detection of possible relationships between metabolic disorders in IDPs and residents among perimenopausal women in Kharkiv.
Methods. In total 82 patients were enrolled in the descriptive cross-sectional study. The number of Kharkiv's residents was 42, and the IDP's number was 40. The variables of body mass index (BMI) and menopausal Cooperman's score were determined after inclusion in the study. All selected women were tested for serum lipids. The atherogenic index (AI), which is the logarithm of atherogenic (triglycerides) and antiatherogenic (high-density lipoprotein cholesterol) fractions of cholesterol, was also calculated. The levels of glycemia and insulin were detected with subsequent calculation of the HOMA index. C-reactive protein (C-RP) as a marker of chronic inflammation was investigated.
Results. The values of BMI, Cooperman's score, HOMA index, insulin, glucose, and C-RP did not reveal any statistical distinction between subgroups of the study population. Some variables of lipid metabolism differed between kharkovites and IDPs. The results of the multivariate regression model with IDP sign showed a statistically significant relationship with AI.
Conclusion. The enhanced atherogenicity was typical for perimenopausal women among IDPs in Kharkiv. This peculiarity could be used as an initial stage in future research on advanced health programs during wartime.

Keywords: internally displaced persons, cardiovascular disease, menopause, atherogenicity.

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BACKGROUND

Kharkiv is located near the area of armed conflict from the very beginning of the war in Ukraine. The rural population of several parts of the Kharkiv region was displaced to safer territories. Some internally displaced persons (IDPs) moved to Kharkiv. The local healthcare systems were modified to provide IDPs with appropriate medical care. The real medical needs of IDPs in Ukraine are not completely clear. The mortality is higher in IDPs compared to the local population[1]. The increased influence of stress is known both for IDPs and refugees[2]. The process of relocation abroad might be emotionally traumatic. However, reproductive and obstetric disorders were found in a young contingent of IDPs[3-5]. The impact of war on general health in perimenopausal women is still a challenging issue.

Menopause is a trigger for aging. It is associated with multiple comorbidities. Healthy aging is an achievable goal for all women in their transitional years. The systemic atherogenic vasculopathy becomes evident in women during perimenopausal years. The increased body weight due to hypoestrogenicity is a cause of insulin resistance[6]. The antiaging programs protect cardiovascular health in elderly people[7]. Dyslipidemia is involved in the pathogenic scenario of atherosclerosis. Chronic inflammation is one of the main parts of systemic atherogenicity[8]. Thus, developing diagnostic screening programs for IDPs during the perimenopausal period could be an efficient measure for protecting cardiovascular health.

The study **was focused** on the detection of possible relationships between metabolic disorders in IDPs and residents among perimenopausal women in Kharkiv.

METHODS

This descriptive cross-sectional study was performed among perimenopausal women who were admitted to the gynecological department of Kharkiv Municipal Perinatal Center between 1 February 2024 and 30 June 2024. The data were obtained from the hospital automation system. Ethics approval was received from the Research Council and Ethical Committee of Kharkiv National Medical University, No23.0224p. Informed consent was obtained from all the patients. The eligible participants were informed about the study's methodology, its aims, objectives, indications, and eventual complications before enrollment. Patients from the gynecological department were selected randomly. Inclusion criteria: women of 45-55 years old without any evident internal diseases. Exclusion criteria: medical disorders like diabetes mellitus, cardiovascular disease, renal disease, thyrotoxicosis, malignancies, etc. In total 82 patients were enrolled in the study. The number of Kharkiv's residents was 42, and the IDP's number was 40.

The variables of body mass index (BMI) and menopausal Cooperman's score were determined after inclusion in the study. Biochemical studies were performed on a Cobas 6000 analyzer (Roche Diagnostics, Switzerland). All selected women were tested for serum triglycerides (TG), total cholesterol (THC), high-density lipoprotein cholesterol (HDL cholesterol), low-density lipoprotein cholesterol (LDL cholesterol), and very-low-density cholesterol (VLDL cholesterol). The concentrations of TG and THC were studied by the colorimetric enzymatic method and HDL cholesterol was investigated by the colorimetric enzymatic method with pre-precipitation of LDL cholesterol and chylomicrons. The atherogenic index (AI), which is the logarithm of atherogenic (TG) and antiatherogenic (HDL cholesterol) fractions of cholesterol, was also calculated. The levels of glycemia and insulin on an empty stomach were detected with subsequent calculation of the HOMA index. C-reactive protein (C-RP) as a marker of chronic inflammation was investigated[9].

The Statistical Package for Social Sciences (SPSS) program (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) was used for statistical analysis. Results were presented as means and standard deviations for numerical variables, and frequencies and percentages for categorical data. The suitability of numerical variables to normal distribution was evaluated using skewness values and histograms.

The independent sample t-test was used in comparing numerical variables fitting normal distribution. Variables that did not conform to normal distribution were analyzed by the Mann-Whitney U test. The Chi-Square (or Fisher's exact) test was used for comparing categorical variables. Depending on their distribution, Spearman or Pearson correlation analysis was used to assess the relationships between numerical variables. For multivariate examinations, a logistic regression analysis with the entered model was used. A p-value of <0.05 was considered sufficient for statistical significance.

RESULTS

The mean age of the study population was 51.6±6.4 years. The indications for hospitalization to the gynecological department were: abnormal uterine bleeding (56.1 %), uterine myoma (47.6 %), endometriosis (34.1 %), and ovarian cysts (25.6 %).

The obtained data demonstrated several differences in detected variables between residents and IDPs (Table 1). However, the values of BMI, Cooperman's score, HOMA index, insulin, glucose, and C-RP did not reveal any statistical distinction between subgroups of the study population. The findings showed the similarities between carbohydrate metabolism indices and the level of inflammation in residents and IDPs. The variables of lipid metabolism (LDL cholesterol, TG, TCH, and AI) differed between kharkovites and IDPs.

Table 1. The variables of BMI, Cooperman's score, and biochemical parameters in the study population.

	Study contingent	Frequency	Mean	Std. deviation	Minimum	Maximum	p-value
BMI	LR	42	30.02	4.55	22	46	p=0.2354
	IDP	40	28.95	3.45	24	41	
Cooperman's score	LR	42	25.36	9.44	6	40	p=0.5770
	IDP	40	24.23	8.8	7	40	
HOMA index	LR	42	3.26	2.32	0.72	12.38	p= 0.6586
	IDP	40	3.06	1.7	0.74	7.85	
Insulin	LR	42	12.64	7.44	3.25	41.52	p= 0.7685
	IDP	40	12.2	5.92	3.46	26.6	
Glucose	LR	42	5.69	0.77	4.65	8.24	p=0.3619
	IDP	40	5.53	0.81	3.98	8.47	
C-RP	LR	42	2.25	3.16	0.3	17.5	p= 0.4897
	IDP	40	2.73	3.1	0.3	13.76	
LDL	LR	42	3.4	0.9	0.68	5.41	**p=0.0017***
	IDP	40	4.06	0.94	1.81	5.9	
HDL	LR	42	1.69	0.39	1.09	2.72	p=0.0574
	IDP	40	1.53	0.36	0.98	2.39	
VLDL	LR	42	0.59	0.68	0.18	4.08	p=0.3200
	IDP	40	0.73	0.58	0.27	3.6	
TG	LR	42	1.15	0.49	0.4	2.55	**p=0.0156***
	IDP	40	1.46	0.64	0.68	3.48	
TCH	LR	42	5.47	0.99	3.9	7.79	**p= 0.0029***
	IDP	40	6.13	0.95	4.37	7.56	
AI	LR	42	2.31	0.62	1.25	4.42	**p=0.0001**
	IDP	40	3.35	0.97	1.73	5.92	

* - the p-value is statistically significant (p<0.05).

The found relationships reflected some regularities showed in Table 2. A significant linear correlation was found between the HOMA index and insulin, glucose, C-RP, LDL cholesterol, and HDL cholesterol. The insulin had a strong correlation with the same variables. The glucose demonstrated a significant correlation with the HOMA index, insulin, and HDL cholesterol. The variables of lipid metabolism showed a correlation between them and AI. All found relations were logical and based on the similar nature of some variables.

Table 2. Correlation between detected variables in the study population.

Variables	Correlation	BMI	Cooperman's score	HOMA index	Insulin	Glucose	C-RP	LDL	HDL	VLDL	TG	TCH	AI
BMI	Correlation	1	0.1	0.15	0.13	0.17	0.04	-0.03	0.1	0.07	-0.08	0.03	-0.02
	p-value		.366	.177	.263	.124	.707	.774	.386	.525	.488	.79	.826
Cooperman's score	Correlation	0.1	1	0	-0.01	0.11	0.19	-0.03	-0.15	0	0.06	-0.05	0.12
	p-value	.366		.968	.912	.315	.082	.774	.182	.999	.596	.663	.285
HOMA index	Correlation	0.15	0	1	**0.97**	**0.54**	**0.35**	**-0.23**	**-0.3**	0.17	0.19	**-0.24**	0.19
	p-value	.177	.968		**.001***	**.001***	**.001***	**.035***	**.005***	.136	.084	**.03***	.09
Insulin	Correlation	0.13	-0.01	**0.97**	1	**0.36**	**0.32**	**-0.24**	**-0.28**	0.16	0.17	-0.24	0.17
	p-value	.263	.912	**.001***		**.001***	**.003***	**.028***	**.01***	.161	.118	.029	.125
Glu-cose	Correlation	0.17	0.11	**0.54**	**0.36**	1	0.19	-0.2	**-0.26**	0.1	0.14	-0.24	0.09
	p-value	.124	.315	**.001***	**.001***		.088	.078	**.017***	.35	.204	.029	.446
C-RP	Correlation	0.04	0.19	**0.35**	**0.32**	0.19	1	-0.1	-0.05	0.11	0.14	-0.08	0.01
	p-value	.707	.082	**.001***	**.003***	.088		.381	.637	.318	.203	.487	.908
LDL	Correlation	-0.03	-0.03	**-0.23**	**-0.24**	-0.2	-0.1	1	0.08	0.21	**0.24**	**0.91**	**0.42**
	p-value	.774	.774	**.035***	**.028***	.078	.381		.487	.055	**.031***	**.001***	**.001***
HDL	Correlation	0.1	-0.15	**-0.3**	-0.28	**-0.26**	-0.05	0.08	1	**-0.25**	**-0.31**	0.26	-0.65
	p-value	.386	.182	**.005***	.01	**.017***	.637	.487		**.024***	**.005***	.019	<.001
VLDL	Correlation	0.07	0	0.17	0.16	0.1	0.11	0.21	**-0.25**	1	0.53	0.36	0.57
	p-value	.525	.999	.136	.161	.35	.318	.055	**.024***		<.001	.001	<.001
TG	Correlation	0.08	0.06	0.19	0.17	0.14	0.14	**0.24**	**-0.31**	**0.53**	1	**0.24**	**0.52**
	p-value	.488	.596	.084	.118	.204	.203	**.031***	**.005***	**.001***		**.028***	**.001***
TCH	Correlation	0.03	-0.05	**-0.24**	**-0.24**	**-0.24**	-0.08	**0.91**	**0.26**	**0.36**	**0.24**	1	**0.37**
	p-value	.79	.663	**.03***	**.029***	**.029***	.487	**.001***	**.019***	**.001***	**.028***		**.001***
AI	Correlation	0.02	0.12	0.19	0.17	0.09	0.01	**0.42**	**-0.65**	**0.57**	**0.52**	**0.37**	1
	p-value	.826	.285	.09	.125	.446	.908	**.001***	**.001***	**.001***	**.001***	**.001***	

* - the p-value is statistically significant ($p<0.05$).

A logistic regression model with an IDP sign as the dependent revealed a Nagelkerke R2 of 0.52. The model itself was meaningful. The results of the multivariate regression model with IDP sign showed a statistically significant relationship with AI (Table 3).

Table 3. Multivariate logistic regression model with IDP sign.

Variables	Coefficient B	Standard error	z	p	Odds Ratio	95% conf. interval
Constant	-10.26	7.14	1.44	.15	0	0 - 41.42
BMI	-0.06	0.08	0.82	.412	0.94	0.81 - 1.09
Cooperman's score	-0.05	0.03	1.56	.119	0.95	0.89 - 1.01
HOMA index	-0.67	1.37	0.49	.627	0.51	0.03 - 7.55
Insulin	0.12	0.37	0.32	.752	1.12	0.54 - 2.33
Glucose	0.38	0.81	0.46	.644	1.46	0.3 - 7.18
C-RP	0.13	0.1	1.22	.224	1.14	0.92 - 1.39
LDL	-0.07	0.95	0.08	.938	0.93	0.14 - 5.96
HDL	4.67	3.42	1.36	.173	106.24	0.13 - 87397.76
VLDL	-0.95	0.59	1.61	.108	0.39	0.12 - 1.23
TG	-0.66	0.65	1.03	.304	0.51	0.14 - 1.83
TCH	-0.98	1.34	0.74	.462	0.37	0.03 - 5.14
AI	4.16	1.69	2.47	**.014***	64.06	2.35 - 1742.63

* - the p-value is statistically significant ($p<0.05$).

DISCUSSION

Cardiovascular health is critically dependent on the efficiency of preventive anti-aging strategies contributing to the re-establishment of carbohydrate and lipid metabolism. Insulin resistance and dyslipidemia are known to induce oxidative stress and endothelial dysfunction[10]. The prevalence of dyslipidemia among metabolic disorders was found in IDPs. There were no signs of obesity or insulin resistance in this contingent. The separate mechanism, which was not associated with imbalanced nutrition, probably played a trigger role in the atherogenicity in IDPs. Therefore, the main metabolic disorder in IDPs was dyslipidemia. It was supported by logistic regression analysis. War is a real disaster for women of different age groups[4,5]. Wartime stress could be speculated as a reason for lipid metabolism disturbances in such a category of middle-aged women. The recent pandemic of COVID-19 demonstrated the significance of metabolic syndrome X as a comorbidity leading to increased mortality[11]. The impact of this aging-associated pathology on cardiovascular health was crucial[12].

The linear correlation between C-RP and variables of carbohydrate metabolism supported conventional pathogenic theories on the role of chronic inflammation in glucose intolerance and diabetes mellitus type 2[13]. Inflammation was crucial for people with metabolic syndrome. Interestingly, the weak relationship found between C-RP and Cooperman`s score ($r=0.19$; $p=0.082$) showed a possible involvement of inflammatory events in menopausal disorders.

An increased arterial stiffness and low autonomic tone were found in postmenopausal women[14]. The investigations of cardiovascular health in IDPs should be continued. The limitations of this study were associated with a single center and a small number of participants. The development of the therapeutic strategy preventing dyslipidemia in crisis-affected populations could be a step forward on the path toward healthy aging[15,16]. The armed conflict in Ukraine changed conventional approaches in different fields of medicine[17]. The personal attitude to successful aging was probably disturbed among IDPs[18]. It is time to gain insight into aging.

CONCLUSION

The enhanced atherogenicity was typical for perimenopausal women among IDPs in Kharkiv. This peculiarity could be used as an initial stage in future research on advanced health programs during wartime.

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The author declares that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study. There are no conflicts of interest regarding this article.

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