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Blood Pressure in a Sample of Al-Ramadi City: A Quantitative Genetic Study

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ABSTRACT

It is commonly known that genetics plays a part in blood pressure and the risk of hypertension. Nevertheless, few studies have been done to identify the genetic differences that contribute to the heritability value. Therefore, the current work uses full-sib analysis on Iraqi individuals in Ramadi, west of Iraq, to assess the genetic influences on intra-individual variance of blood pressure limitations. 100 people in all, including 27 families, were identified. This study looks at the advancements and challenges of research. This study presented that communal genetic differences in a narrow set of genes that influence blood pressure is unlikely to impact the genetic manner of blood pressure control in the inhabitants. Rare variation, which primarily affects pedigrees rather than the population, may instead be responsible for heritability. In the coming years, high blood pressure genetics is expected to concentrate on rare variants across a wide range of genes. The difficulties that need to be overcome and the methods being developed to find this genetic diversity are described.

Therefore, findings propose that diastolic and systemic pulse pressure is crucial characteristics that influence the blood pressure phenotype, and any blood pressure management program would be most effective based on these characteristics.

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1. INTRODUCTION

Hypertension, affecting 16% to 32% of adults and impacting around one-third of the older population in Western countries, has now also become a major concern in the Middle East [1, 3]. By 2025, an estimated 1.5 billion individuals globally will have systemic arterial hypertension [2, 4]. High blood pressure is a significant risk factor in 49% of cardiovascular instances and 69% of stroke cases, both of which account for half of all cardiovascular mortality [5,6]. Several research studies have shown substantial genetic variations in wild populations. The degree of genetic diversity between phenotypic features in a population determines their ability to react to many circumstances [7]. Genetic variations can have a minor influence on it. It's incredibly encouraging to discover genetic variants that necessitate this. In human population genetics investigations, environmental exposures cannot be controlled [8,29]. These can be investigated via rigorous subject profiling. Though it may be necessary to examine people with considerably different environmental exposures to identify big impacts, the cost and complexities involved with this type of research are a barrier [1,7,8]. The heritability estimate, which is often expressed in the first place in disclosing character, is the first phase in deciphering the hereditary roots of an illness or traits in comparison to the many environmental contributions that an individual receives.

Numerous studies have been conducted to determine heritability estimates for various traits and disorders. The next step is to publish the findings later to help determine the sample size required for the study to have a beneficial impact on identifying the susceptible gene [1,31]. Highly heritable qualities may be associated with significant or complicated features, and these relations are critical in any program designed to explore the effect of genetic and environmental variables on blood pressure measurements [9]. While the heritability has been extensively studied in several groups, including the Western and East African populations [10,11], little information is available for the Iraqi population [21,29, 30]. Therefore, the current work uses full-sib analysis on a sample of Iraqi individuals in Ramadi, west of Iraq, to assess genetic effects on intra-individual variance of blood pressure considerations.

2. METHODS

Subjects:

This research involved twenty-seven households. The study population consisted of 100 healthy people aged 18 to 61 years. All individuals gave informed consent. Measurements of anthropometric variables such as gender, waist circumference, height, and weight were measured at home using normal procedures. The body mass index (BMI) was calculated as weight/height2 (kg/m2).

Throughout the study, blood pressure readings were obtained. In the a.m. and the p.m., blood pressure was taken twice. A traditional mercury sphygmomanometer was used to take the patients' blood pressure after they had been seated for five minutes.

The individuals lie supine. An initial reading was obtained, followed by a second reading after a two-minute interval. The average of two consecutive readings taken that are less than 10 mmHg apart was utilized. Participating siblings were in their second and third decades of life.

The following blood pressure measurements are measured: morning systolic (MSBP), morning diastolic (MDBP), evening systolic (ESBP), evening diastolic (EDBP), and the mean of morning systolic (MMSBP), mean of morning diastolic (MDBP), mean of evening systolic (MESBP), mean of evening diastolic (MEDBP), morning pulse pressure (MPP), and evening pulse pressure (EPP).

Mean BP (MBP) was estimated as follows:

MBP = DBP + [(SBP-DBP) / 3] ……………… (1).

Pulse pressure is the term used to distinguish between systolic and diastolic pressure. It is the force that the heart generates with each contraction and is expressed in millimeters of mercury (mmHg). The following formula was used to calculate the systemic pulse pressure:

Systemic pulse pressure = P systolic – P diastolic....................... (2)
Uric acid (UR), cholesterol (CH), and triglycerides (TRI) were evaluated.

Statistical Analysis

Heritability estimations were produced using SAS's maximum-likelihood-based variance decomposition approach [13]. The full-sib was used to evaluate the heritability of a number of the traits under investigation and quantify the percentage of variance in the variables attributable to genetic causes.

All primary effects included in this study were statistically accounted for to decrease the possible exaggeration of genetic variation estimates caused by similarities in various environmental factors. These characteristics included age, BMI, and waist circumference.

Statistical significance was give a P-value of less than 0.05. Under the presumption of a multifactorial model, an estimated heritability of about 0 denotes minimal genetic variation, whereas values near to 1 denote substantial genetic variation [9, 32,33, 34].

3. RESULTS AND DISCUSSION

The estimation of blood pressure heritability ranged between 30% and 70% since it is a complex genetic trait with a wide to moderate range of genetic variation. Due to the progress and improvement in the molecular study of blood pressure, which has helped in discovering the basis of genes that have an impact on blood pressure and different factors related to hypertension, and has reached a high level of investigation. Those studies have a substantial genetic impact and provide information on the molecular basis of hypertension, and recognize many genetic markers that benefit future exploration in this field [1,3,14,15]. The rates of heritability estimation give a clue to projecting the variations in genetic and environmental influences for different characters in the inhabitants under investigation. Table. 1 showed narrow-sense heritabilities of different traits under scrutiny; this estimation was extended from 30% for mean systolic blood pressure up to 86% for early morning systemic pulse pressure.
In this study, estimation of genetic parameters based on full-sib methods was conducted. Whereas, higher values of genetic parameters were estimated by conducting studies on twins rather than other methods of estimation and inference of heritability and other parameters. The same table mentioned above showed the values of h2 for the following traits: MSBP, EDBP, ESBP, MMBP, MEBP, Cholesterol, and Uric acid were low to very high.

Investigators in different twin studies with different backgrounds, like African and Caucasian, stated values of heritabilities ranged from 44% up to 75% for SBP and DBP during day and nighttime. [11,14,16].

Table 1: Heritability, Mean ± Standard deviation (S.E.)

Characters	No.	h2 ± S.E	Mean ± S.E
Morning DBP	100	0 .74 ± 0.26	79.13 ±6.10
Morning SBP	100	0.30 ± 0.20	121.23 ± 7.61
Evening DBP	100	0.39 ± 0.19	76.41 ± 6.73
Evening SBP	100	0.39 ± 0.20	118.50 ± 8.43
Mean Morning BP	100	0.38 ± 0.19	89.66 ± 5.90
Mean Evening BP	100	0.40 ± 0.21	90.01 ± 6.43
Morning Systemic pulse Pressure	100	0.86 ± 0.20	40.09 ± 7.36
Evening Systemic pulse pressure	100	0.30 ± 0.20	42.63 ± 8.57
Cholesterol	100	0.33 ± 0.23	182.22± 23.43
Triglyceride	100	0.59 ± 0.17	199.45 ± 105.11
Uric acid	100	0.41 ± 0.21	6.08 ±4.95
Age	100		41.17 ± 9.88
BMI	100		25.05 ± 7.44
WC	100		88.15 ± 15.42

Characters with low h2 demonstrated minimal involvement of genetic factors, while environmental influences played a more significant role in the phenotypes of those traits under investigation. These traits exhibit relatively minor genetic influence and a greater contribution of environmental factors on the phenotype, allowing for easy manipulation of such characters by altering environmental influences like medication, smoking, and diet due to their low genetic effects and substantial environmental impacts. Furthermore, heritability can change over time as the variance in genetic factors may be modified by shifts in environmental elements or by changes in the relationship between genetic and environmental factors. Differences in genetic variables may be adjusted through alterations in allele frequencies, potentially resulting from inbreeding, mutations, or immigration, which can increase genetic variation. Characteristics assessed during an individual’s lifetime may display various environmental and genetic impacts, with variations attributable to age. This finding aligns with estimates of heritability in populations of East Africans [10, 17,18].

Table 2: An estimation of the correlations among diverse traits.

	MSBP	**MDBP**	**ESBP**	**EDBP**	**CH.**	**UR**	**TG**	**MMBP**	**MEBP**	**MPP**	**EPP**	**WC**	**Age**
MSBP	1												
MDBP	.50**	1											
ESBP	.61**	.40**	1										
EDBP	.38**	.65**	.59**	1									
CH	.16	.05	.11	.06	1								
UR	.05	.032	.05	.05	.08	1							
TG	.20	.10	.13	.04	.25*	-.03	1						
MMBP	.84**	.90**	.56**	.60**	.10	.01	.16	1					
MEBP	.56**	.60**	.80**	.89**	.08	.03	.09	.60**	1				
MPP	.72**	-.21*	.38**	-.18	.13	-.01	.12	.11	.02	1			
EPP	.38**	-.19	.59**	-.28*	.05	-.02	.15	.06	.04	.56**	1		
WC	.39**	.06	.36**	-.07	.20	-.01	.03	.21	.11	.42**	.51**	1	
Age	.34**	.31**	.40**	.30**	-.05	-.08	.06	.30**	.30**	.20	.20	.39**	1
BMI	.51**	.11	.45**	.13	-.26*	.001	.20	.33**	-.27**	.58**	.37**	.61**	.42**

Steel and Torrie [19] indicated that the correlations are degrees of the strength of the relationship among different characteristics involved in research. The positive correlation between different traits showed progression for all other characters and a reversal relationship for negatively correlated characters.

Table 2 shows the correlation coefficient of different characters included in this study, which shows a significantly positive correlation between MSBP and MDBP, ESBP, EDBP, MMBP, MPP, and EPP. These correlations were 0.50** ,0 .61**,0.38**,0 .84**,0.72**, and 0.38**, respectively.

There is no significant difference between morning and evening blood pressure measurements. Also, the results suggest that there is a significant correlation between age and blood pressure parameters, such as MSBP, MDBP, ESBP,EDBP, MMBP, MEBP, MPP, and EPP, which were 0.34, 0.31, 0.40, 0.30, 0.30, 0.06, 0.20, respectively.

In the statistical analysis, gender, body mass index, age, and waist circumference were used as covariates for all statistical models. The BMI was associated significantly with MSBP (0.51**) but not with MDBP (0.13). The relationship between blood pressure measurements and cholesterol, triglycerides, and uric acid displayed no significantrelationship. While the correlation between cholesterol and BMI was significantly negative, -0.26** [20].

The findings support that assortative mating and environmental effects are actualpieces in that they affect heritability assessment, in addition to the aggregation in families of the risk of cardiovascular diseases. Since a considerable amount of this aggregation has a geneticbackground [22, 23]. Since the study was conducted in a population with many consanguineous marriages and multigenerational Arab individuals. Those people were more alike in environmental exposure, social, economic status, a habits associated to health like habitual physical activity, diet, smoking, and the strict religious abstinence from alcohol [7,21].

The study indicated adequate genetic differences between the different characteristics included in this study. Morning measurements have higher heritability, which means they have higher genetic variations, whereas other characteristics showed moderate to low heritability. Consequently, the outcomes propose that morning diastolic blood pressure and morning systemic pulse pressure are significant characteristics that contribute more to the blood pressure phenotype. Therefore, including these traits in any program to control blood pressure would be more effective.

4. CONCLUSION

The findings demonstrated that the sample under study had sufficient genetic variety. Morning diastolic blood pressure and morning systemic pulse pressure were the most heritable characteristics with genetic variation components, according to the study's narrow sense heritability analysis. The other characters also showed moderateto low heritability and genetic variation. Therefore, the results suggest that morning diastolic blood pressure and morning systemic pulse pressure are important characteristics contributing to the phenotype of blood pressure, and based on these traits, would be most effective in any program to control blood pressure.

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