ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

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ARE BLOOD GROUPS EFFECTIVE IN INFERTILITY? EVALUATION OF 8-YEAR DATA FROM A TERTIARY CENTER

KAN GRUPLARI İNFERTİLİTEDE ETKİN Mİ? BİR TERSİYER MERKEZİN 8 YILLIK VERİLERİNİN DEĞERLENDİRİLMESİ

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Öz

Amaç

İnfertilite, reprodüktif dönemdeki çiftlerin herhangi doğum kontrol yöntemi kullanmaksızın bir yıl düzenli cinsel ilişkiye rağmen gebelik durumunun sağlanamamasıdır. Bu çalışmada spontan gebe kalan fertil hastalar ile infertilite tanısı nedeniyle tedavi gören infertil kadın hastalar arasında kan gruplarının karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem

Çalışmamız, Ocak 2015-Ocak 2023 yılları arasında Süleyman Demirel Üniversitesi Kadın Hastalıkları Doğum Anabilim Dalı polikliniğine rutin gebelik takibi için başvuran ve spontan gebe kalan 304 fertil hasta ile infertilite tanısı alarak Süleyman Demirel Üniversitesi Üremeye Yardımcı Tedavi (ÜYTE) Merkezi'nde tedavi alan 304 infertil olmak üzere toplam 608 hastanın kan grupları ve demografik verilerinin istatistiksel olarak değerlendirilmesini içermektedir.

Bulgular

Fertil grupta yer alan gönüllülerin yaş ortalaması 30,68±4,70 hesaplanırken, infertil gruptaki gönüllülerin yaş ortalaması ise 32,50±5,35 olarak hesaplanmıştır. Fertil ve infertil grupta yer alan gönüllülerin kan grupları A kan grubunun her iki grupta da baskın olduğu ve bunu sırasıyla 0, B ve AB kan gruplarının izlediği tespit edilmiştir. Gruplar eğitim durumlarına göre karşılaştırıldığında, infertil gruptaki hastaların büyük çoğunluğunun lisans veya lisansüstü seviyede eğitim aldığı tespit edilmiştir. Gruplar arasındaki mesleki dağılımlara göre gelir düzeylerine ait veriler ise düşük, orta ve yüksek gelir düzeyi olmak üzere üç kategoride değerlendirilmiştir. Buna göre her iki grupta da katılımcılarının büyük çoğunluğunun düşük gelir düzeyine sahip olduğu saptanmıştır.

Sonuç

İnfertilite genetik, çevre, yaşam tarzı ve sağlık gibi çeşitli faktörlerin bir araya gelmesiyle ortaya çıkan çok faktörlü bir durumdur. İnfertilite prevalansının yaşla orantılı olarak arttığı ve kan grubu dağılımlarının infertilite üzerinden doğrudan bir etkisinin olmadığı tespit edilmiştir.

Anahtar Kelimeler: İnfertilite, Kan grubu, Yardımcı üreme teknikleri

Abstract

Objective

The aim is to compare blood groups between spontaneously pregnant fertile patients and infertile female patients undergoing treatment for infertility diagnosis

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in terms of demographics and blood groups. Infertility is defined as the failure to achieve pregnancy despite regular unprotected sexual intercourse for one year during the reproductive period without using any contraceptive method.

Material and Method
Our study includes statistically evaluating the blood groups and demographic data of a total of 608 patients, including 304 fertile patients who presented for routine pregnancy follow-up at the Department of Obstetrics and Gynecology, Süleyman Demirel University, between January 2015 and January 2023, and 304 infertile patients receiving treatment at the Süleyman Demirel University Assisted Reproductive Techniques (ART) Center.

Results
The mean age of the volunteers in the fertile group was calculated as 30.68±4.70, while the mean age of the volunteers in the infertile group was 32.50±5.35. Blood group A was found to be dominant in both the fertile and infertile groups, followed by blood groups O, B, and AB. When compared based on education, it was determined that the majority of patients in the infertile group had received undergraduate or postgraduate education. Income levels were categorized as low, medium, and high income based on occupational distributions in both groups, revealing that the majority of participants in both groups had a low-income level.

Conclusion
Infertility is a multifactorial condition resulting from a combination of various factors such as genetics, environment, lifestyle, and health. The prevalence of infertility increases with age, and blood group distribution does not have a direct impact on infertility.

Keywords: Assisted reproductive techniques, Blood group, Infertility

Introduction

Infertility refers to the inability to achieve pregnancy despite regular sexual intercourse without using any birth control methods for a year among couples in their reproductive age. The prevalence and causes of infertility vary significantly in different etiologies, affecting approximately 15-20% of couples worldwide (1, 2).

The causes of infertility are categorized into three groups: female, male, and unexplained factors. In female infertility primary factors such as age, ovarian reserve, oocyte quality, endometriosis, polycystic ovary syndrome, and tubal factors. In male-factor infertility, sperm conditions like azoospermia, oligospermia, and varicocele are often influential. Additionally, genetic disorders, certain medications, obesity, excessive stress, smoking and alcohol consumption, exposure to chemicals, as well as treatments like chemotherapy and radiotherapy contribute to the causes of infertility (3, 4).

ART, developed for infertility, has shown high success rates (5). However, due to factors like the costs endured by patients, medication burden, and physiological and sociological processes involved in the treatment, the search for alternative methods to address infertility continues (6, 7).

Several studies indicate the associations between ABO blood groups and various diseases (8-13). As research on the causes and treatment of infertility continues, investigations have also been conducted to determine whether blood groups have an impact on infertility (14-18).

The aim of this study is to compare blood groups among spontaneously pregnant fertile patients who present to the Süleyman Demirel University Department of Obstetrics and Gynecology for routine pregnancy examination and infertile female patients undergoing an Assisted Reproductive Techniques Treatment at the Süleyman Demirel University ART Center, having received a diagnosis of infertility.

The study addresses the question of whether blood groups play a role in infertility by evaluating blood group data that could contribute to infertility. Alongside blood groups, socio-demographic characteristics such as age, education level, and occupation of patients who volunteered to participate in the study will also be retrospectively assessed. The study aims to introduce new perspectives that could contribute to infertility treatments based on the obtained outcomes, enriching the existing literature.

Material and Method

The study was conducted by retrospectively scanning the data of 304 fertile patients who presented to the Süleyman Demirel University Department of Obstetrics and Gynecology for routine pregnancy examination between January 2015 and January 2023, and 304 infertile female patients undergoing an

Assisted Reproductive Techniques Treatment at the Süleyman Demirel University Assisted Reproduction Treatment (ART) Center, having received a diagnosis of infertility.

Ethics Statements

This study was conducted with the permission of the Clinical Research Ethics Committee of Süleyman Demirel University Faculty of Medicine, numbered 132, and dated 22.06.2023. The study was carried out with fertile patients who presented to the Süleyman Demirel University Department of Obstetrics and Gynecology for routine pregnancy examination and became pregnant spontaneously, as well as infertile female patients undergoing an Assisted Reproductive Techniques Treatment at the Süleyman Demirel University Assisted Reproduction Treatment (ART) Center, having received a diagnosis of infertility.

Experimental Groups

G-Power 3.1.9.7 software was used to determine the sample size for the study. In determining the sample size, an effect size of 0.3 was taken for the Wilcoxon-Mann-Whitney test (two groups) comparison, with a type I error rate of 0.05 and a power of 95%, resulting in a sufficient sample size of 304 in each group, totaling 608 patients (19, 20).

When determining the experimental groups, inclusion and exclusion criteria were established as follows:

1. Consent and agreement to participate in the study.
2. Spontaneously achieving pregnancy (fertile group).
3. Achieving pregnancy through assisted reproductive techniques (infertile group).
4. Being diagnosed with primary infertility (secondary infertile patients were not included in the sample).
5. Age between 23 and 39.
6. No chronic or systemic diseases.
7. No alcohol or tobacco use.

Statistical Analysis

For the evaluation of demographic data such as blood groups, age, education level, and occupation in the fertile and infertile groups, the Wilcoxon-Mann-Whitney test was applied. SPSS 29.0 software was used for all statistical analyses. Continuous variables were expressed as mean ± SD, and the significance level was defined as $p < 0.05$.

Results

Blood groups, age, education level, and occupation were evaluated for 304 fertile and 304 infertile volunteers who participated in the study.

The mean age of volunteers in the fertile group was calculated as 30.68 ± 4.70, while the mean age of volunteers in the infertile group was calculated as 32.50 ± 5.35.

When evaluating the blood groups of volunteers in the fertile and infertile groups without distinguishing the Rh factor, it was determined that the A blood group was dominant in both groups, followed by the 0, B, and AB blood groups, respectively (Table 1). When evaluated according to the Rh+ and Rh- factors, it was observed that in both groups, A+, 0+, B+, AB+, A-, 0-, B-, and AB- blood groups were predominant (Table 1).

When evaluated based on education level, among the 304 participants in the fertile group, 116 had primary education, 105 had high school or associate degree education, and 83 had university or postgraduate education. Among the 304 infertile participants, 91 had

Table 1 The distribution table according to the Rh factor and blood types

		A	0	B	AB	Total
Fertile Group	**Rh+**	102	80	55	27	
	Rh-	15	15	7	3	
	Total	117	95	62	30	**304**
Infertil Group	**Rh+**	127	68	41	31	
	Rh-	11	14	10	2	
	Total	138	82	51	33	**304**

primary education, 97 had high school or associate degree, and 116 had university or postgraduate education (Table 2).

When evaluating income levels based on occupational distribution, income level data were categorized into three levels: low, medium, and high. Among the female volunteers included in the study, those who did not work officially and were classified as housewives were categorized as low-income level, those who earned a salary at the minimum wage level on average were categorized as medium-income level, and those who belonged to professions such as doctor, teacher, architect, engineer, and academician and earned income above the minimum wage level were categorized as high-income level. Income level distributions for both the fertile and infertile groups are shown in Table 3.

In addition to these evaluations, an examination was conducted to determine whether blood groups affected the etiology of infertility. Therefore, among the 304 infertile volunteers who were treated at the Süleyman Demirel University ART Center, etiologies were examined, and infertile patients were classified into five groups: those diagnosed with female factor infertility due to polycystic ovary syndrome (PCOS), diminished ovarian reserve (DOR), and tubal factors, as well as a male factor and unexplained (UNEXP) etiology reasons. Blood group distributions among these groups were evaluated (Table 4).

Table 2 Distribution based on education level among groups

Group	Primary Education	High School or Associate Degree	University or Postgraduate	Total
Fertile Group	116	105	83	304
İnfertile Group	91	97	116	304

Table 3 Distribution based on income levels among groups

Group	Low-Income Level	Medium-Income Level	High-Income Level	Total
Fertile Group	241	12	51	304
Infertile Group	163	52	89	304

Table 4 Distribution of blood groups among infertile groups based on the etiology of infertility

Infertility Cause	A Rh^+	0 Rh^+	B Rh^+	AB Rh^+	A Rh^-	0 Rh^-	B Rh^-	AB Rh^-	Total
PCOS	32	19	10	12	4	6	3	0	86
UNEXP	33	15	7	4	3	2	0	1	65
DOR	20	18	12	7	1	4	0	0	62
Tubal	3	1	2	1	0	0	1	0	8
Male	39	15	10	7	3	2	6	1	83
									304

Discussion

Infertility is defined as the inability to achieve pregnancy despite regular sexual intercourse without using any contraceptive method for a year among couples in their reproductive years, and according to the World Health Organization data, it affects 15% of couples. Infertility prevalence is approximately 5.5% in the 25-29 age group, 9.4% in the 30-34 age group, and 19.7% in the 35-39 age group (21).

According to the results obtained from this study, the average ages were calculated as 30.68±4.70 in the fertile group and 32.50±5.35 in the infertile group. The age range of 23-39 years stated in the inclusion criteria for volunteers was considered when forming the sample.

In today's world, changing living conditions have numerous effects in various areas and contribute significantly to the increasing infertility rates. Especially women planning for postgraduate education or having such an education tend to postpone their desire to have children to later ages (22). When looking at the educational status of the groups in this study (Table 3), it was determined that 83 participants in the fertile group and 116 in the infertile group had undergraduate or postgraduate education. Therefore, the age averages and the data related to educational levels support this trend.

When evaluating income levels based on occupational distributions, income levels were categorized into low, medium, and high. However, the educational statuses and income levels of both the fertile and infertile groups included in the study do not show a parallel trend. This could be attributed to individuals with high school or associate's degrees being housewives or having jobs outside their education or profession.

Studies in the literature have reported the associations between blood groups and various diseases. This study aimed to investigate whether blood groups affect infertility. When blood groups were evaluated without distinguishing the Rh factor, the most dominant blood group was found to be A in both the fertile and infertile groups, followed by O, B, and AB groups (Table 1). When blood group data were evaluated according to the Rh+ and Rh- status, A blood group was dominant in both groups, followed by O, B, and AB groups. Therefore, no statistically significant difference in blood group distribution was found between the fertile and infertile groups ($p < 0.05$).

Another hypothesis that constitutes the narrative of this study is to investigate whether blood groups affect the etiology of infertility. In this study, infertile patients were categorized into 5 groups based on etiologies, including female factors (PCOS, DOR, and tubal factors), male factors, and unknown causes, to evaluate the distribution of blood groups (Table 4).

As women age, their ovarian reserve tends to decrease. Additionally, metabolic disorders like obesity, hormonal irregularities, and intensive treatment methods such as chemotherapy and radiotherapy can also impact the quantity and quality of ovarian reserve. In a study by Nejat et al., a relationship between blood type and DOR was reported, indicating a predominance of blood type A among patients diagnosed with DOR (3). However, in another study, blood type O was associated with DOR risk, while a study conducted in China suggested that blood type O had a lower risk for DOR, and blood types A and AB were considered risk factors (4).

In our study, among the infertile patients diagnosed with DOR, 21 had blood group A, 22 had blood group 0, 12 had blood group B, and 7 had blood group AB. Considering these data, it can be inferred that racial differences between study populations could influence blood group prevalence and ovarian reserve.

In female factor infertility, PCOS and tubal factors are significant along with age and ovarian reserve, as they influence oocyte quality. Oocyte quality is important for early embryonic development, pregnancy, and fetal development. Although no direct relationship has been established between blood groups and PCOS or tubal factors in the literature, a study involving Indian women reported that AB blood group women had higher oocyte qualities than other blood groups (23).

In our study, among the patients diagnosed with infertility due to PCOS, 36 had blood group A, 25 had blood group 0, 13 had blood group B, and 12 had blood group AB. Additionally, 8 patients were diagnosed with infertility due to tubal factors, of whom 3 had blood group A, 1 had blood group 0, 3 had blood group B, and 1 had blood group AB.

Especially in recent years, there has been an increase in male-factor infertility compared to female-factor infertility. In this study, out of 304 infertile patients, 83 were diagnosed with male factor infertility. When analyzing the blood group distribution of these 83 infertile patients, it was found that 42 had blood group A, 17 had blood group 0, 16 had blood group B, and 8 had blood group AB. According to blood group

distribution among the groups, blood group A was dominant in this study.

However, a study in Pakistan, evaluating blood groups among fertile and infertile male patients, suggested a significant difference between blood group 0 and male infertility (24).

Lastly, when analyzing the blood group distribution of 65 patients diagnosed with infertility due to unexplained reasons, 36 had blood group A, 17 had blood group O, 7 had blood group B, and 5 had blood group AB.

Based on the findings obtained from this study, it has been determined that blood groups do not directly affect infertility. When examining the results of other studies in the literature, it can be emphasized that racial differences particularly influence blood group distributions. Additionally, it has been observed that the prevalence of infertility increases proportionally with age. However, an important point is that infertility is a multifactorial condition arising from the convergence of various factors, including genetics, environment, lifestyle, and health.

Therefore, in order to fully comprehend the impact of blood groups on infertility, further comprehensive research with increased sample sizes is needed. It should be acknowledged that infertility is a complex issue influenced by numerous factors, and a holistic approach that considers genetics, environment, lifestyle, and health is essential for a comprehensive understanding.

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Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Ethical Approval
Ethics Committee approval was received on 22.06.2023 dated, 132 numbered Clinical Research Ethics Committee meeting, School of Medicine, Süleyman Demirel University. The study was conducted in line with the principles of the Helsinki Declaration.

Consent to Participate and Publish
Written informed consent to participate and publish was obtained from all individual participants included in the study.

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Availability of Data and Materials
Data are available on request due to privacy or other restrictions.

Authors Contributions
D.U.K: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Validation, Visualization; Writing-original draft.

M.Ç: Data curation; Formal analysis; Investigation; Methodology; Visualization; Validation; Writing-review & editing.

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