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EPIDEMIOLOGICAL ASSESSMENT OF MALE INFERTILITY AND ITS ASSOCIATED RISK FACTORS AMONG MEN AGED 18–45 YEARS IN DISTRICT KARAK: A SEMEN ANALYSIS-BASED STUDY

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Abstract

Male infertility is a significant public health concern that contributes substantially to reproductive health problems worldwide. This descriptive cross-sectional study was conducted to assess the pattern and risk factors of male infertility among men aged 18–45 years in District Karak, Khyber Pakhtunkhwa, Pakistan. The study included 100 men who underwent semen analysis for infertility evaluation at different clinical laboratories between 1 October 2025 and 30 November 2025. Participants were selected using a non-probability convenience sampling technique. Data were collected through a structured questionnaire covering socio-demographic characteristics, medical history, lifestyle factors, and potential risk factors, along with semen analysis reports obtained from participating laboratories. Data were analyzed using Microsoft Excel 2010, and descriptive statistics, including frequencies and percentages, were used to summarize the findings. Among the 100 participants, 26% were diagnosed with male infertility, while 74% had normal semen analysis findings. The highest proportion of infertility cases was observed among men aged 31–34 years. Married participants accounted for the majority of infertile cases (18 out of 26), followed by divorced individuals. Government servants showed the highest frequency of infertility, followed by students. Semen analysis revealed that 8 infertile men had reduced sperm count, whereas the remaining participants had sperm counts within the normal range. Reduced sperm motility was more common, with 17 infertile participants demonstrating low motility, while the remainder had normal motility. The findings indicate that male infertility in District Karak is more prevalent among men aged 31–34 years and is strongly associated with impaired sperm motility rather than low sperm count. These results highlight the importance of routine semen analysis, early diagnosis, awareness regarding modifiable risk factors, and targeted reproductive health interventions to improve male fertility outcomes in the study population.

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Introduction:

Infertility, defined by the World Health Organization as the failure to conceive after twelve months of regular unprotected intercourse, is now recognized as a disease of the reproductive system with significant medical, psychological, and social consequences (World Health Organization, 2023). A male factor contributes to roughly half of all infertile unions, either alone or combined with a female factor, yet male infertility remains comparatively under-studied, particularly in low- and middle-income countries such as Pakistan (World Health Organization, 2023; Behboudi-Gandevani et al., 2021). Global evidence points to a worsening picture. Large-scale projections based on the Global Burden of Disease framework show a rising age-standardized prevalence of male infertility across South Asia (Zhao et al., 2024), while a comprehensive meta-analysis by Levine et al. (2023), pooling data from over fifty countries, reported that average sperm concentration has declined by roughly half since the 1970s, with the decline accelerating after 2000 and now extending to Asia, Africa, and Latin America. These findings have intensified interest in identifying the modifiable and non-modifiable drivers of impaired male fertility (Cipriani et al., 2023).

The recognized risk factors are multifactorial. Modifiable lifestyle behaviors, smoking, alcohol use, obesity, and sedentary habits, are consistently linked to poorer semen parameters through oxidative stress and hormonal disruption (Okonofua et al., 2022; Service et al., 2023). Occupational and environmental exposures, including scrotal heat, industrial toxins, and pesticides, add further risk (Shah et al., 2021), as do medical and anatomical factors such as varicocele, genitourinary infections, and comorbidities like diabetes and hypertension, which frequently cooccur in the same patient (Okonofua et al., 2022). Evidence from Pakistan mirrors this pattern while showing locally distinct features. Studies from Karachi and Khyber Pakhtunkhwa report a high prevalence of primary infertility alongside strong associations with tobacco use, obesity, diabetes, hypertension, and varicocele, and note that most existing data come from tertiary-care, urban clinical settings rather than district-level populations. This leaves the pattern of male infertility in semi-rural districts such as Karak, with its distinct occupational, migratory, and dietary profile, largely unexamined. This study therefore aims to determine the pattern of male infertility and its associated risk factors among men aged 18–45 years in District Karak, generating locally grounded evidence to support clinicians and policymakers in designing targeted prevention, screening, and referral strategies for this underrepresented population.

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Method and Material



Figure no.1 Region of Karak included in the current study

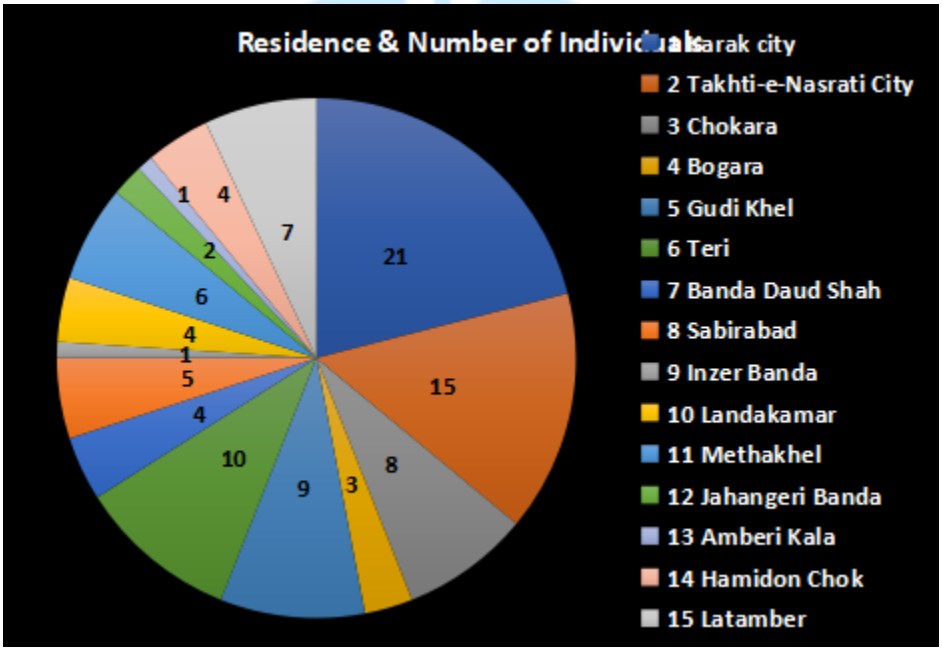


Figure No.2 Individuals participated in the study from the above-mentioned area of Karak

This study employed a descriptive cross-sectional design to assess the pattern and risk factors of male infertility among men aged 18–45 years in District Karak, Khyber Pakhtunkhwa, Pakistan. The study was conducted using semen analysis reports collected from various clinical laboratories located in District Karak. Data collection was carried out over a two-month period, from 1 October 2025 to 30 November 2025. A total of 100 male participants who underwent semen analysis for infertility evaluation in different clinical laboratories were included in the study. A non-probability convenience sampling technique was used to recruit participants. Men aged 18–45 years who were

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suspected of infertility and consented to provide the required information were included. Individuals older than 45 years, those with incomplete records, or those who declined to provide the necessary information were excluded from the study. Data were collected using a structured questionnaire developed for the study and reviewed by subject experts to ensure its clarity and relevance. The questionnaire gathered information on participants' socio-demographic characteristics, medical history, lifestyle factors, and other potential risk factors associated with male infertility. Semen analysis reports were obtained from the participating clinical laboratories and used to determine semen parameters and infertility patterns. All collected data were checked for completeness and accuracy before analysis. The data were entered into Microsoft Excel 2010 for coding, tabulation, and statistical analysis. Descriptive statistics, including frequencies, percentages, tables, graphs, and charts, were used to summarize the demographic characteristics, semen analysis findings, and associated risk factors among the study participants.

Result:

Distribution of Positive and Negative Cases Associated with Male Infertility

Among 100 samples, only 26 samples noted for positive male infertility while remaining 74 are negative for infertility problems as shown in below figure-3.

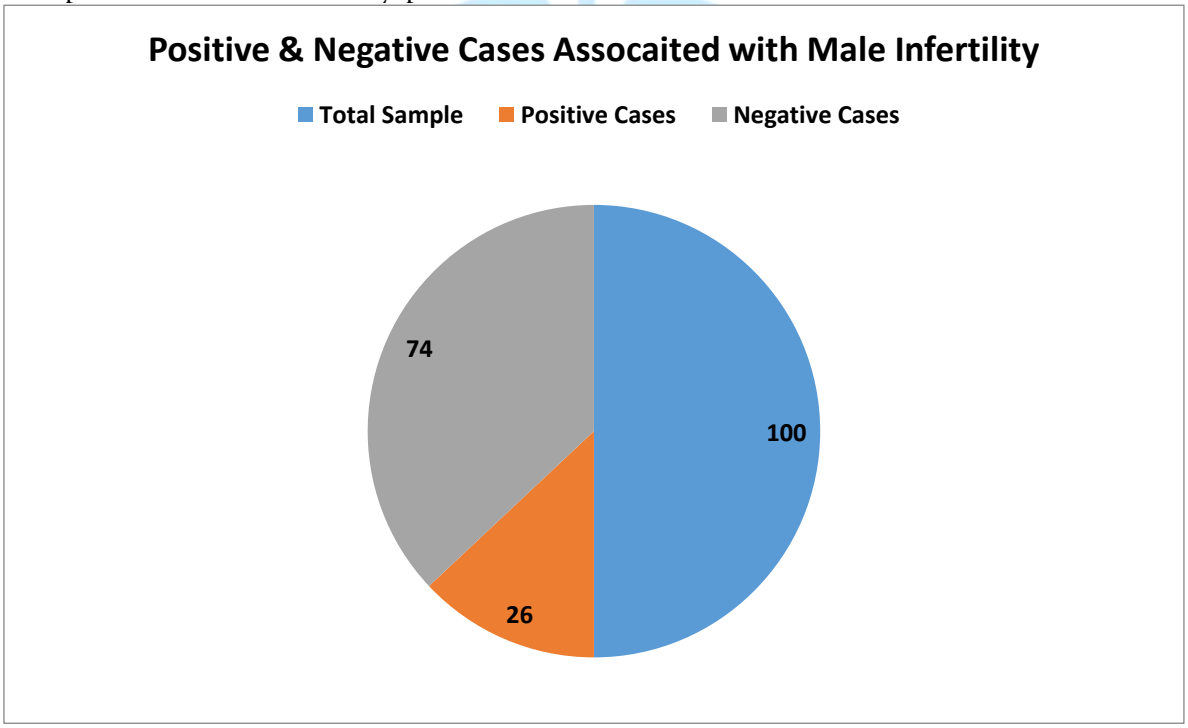


Figure 3: Positive & negative cases associated with infertility

Different Age group Associated with Male Infertility

In current research study different age groups co-relating with infertility problems. The study indicates that, 31 to 34 years people are highly associated with infertility problems as shown in figure no.4.

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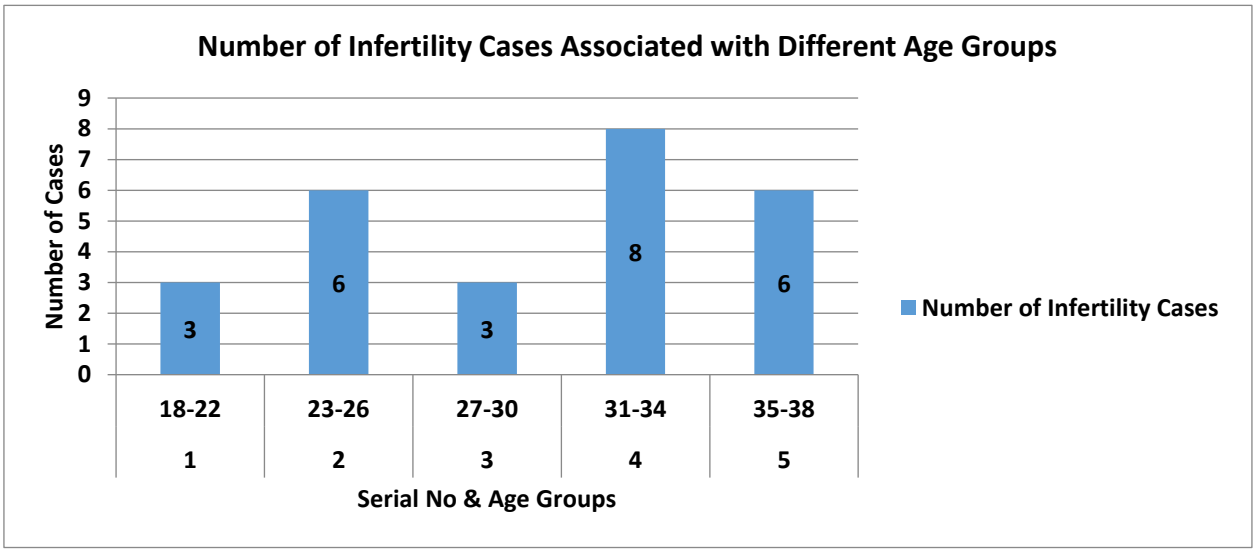


Figure 4: showing total number of infertility cases associated with age groups

Marital Status of Infertile Individual

In this study three criteria of marital status were noted for infertility issues, i.e. single, married and divorced. The infertility problem was highly noted in married people (18cases/26cases) followed by divorced (6cases/26cases) as shown below figure-5.

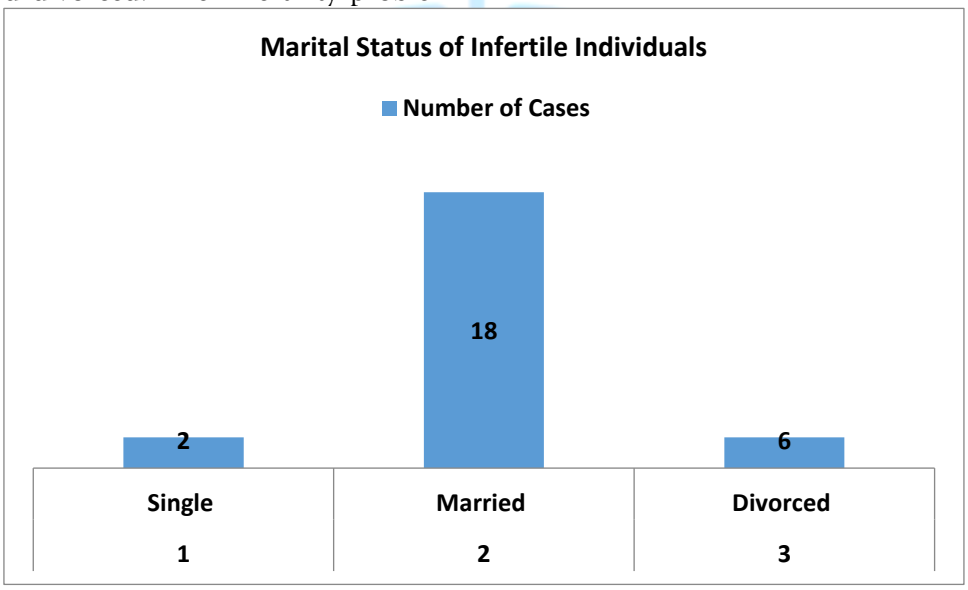


Figure 5: Marital status of infertile individuals

Occupational Status of Infertile Individuals

The occupation statuses of infertile individual were noted for current study i.e. students, labors, government servants, shopkeepers and farmers etc. Typically, infertility problems were highly observed in government servants followed by students, respectively. Overall occupation statuses of infertile individual were mentioned below figure-6.

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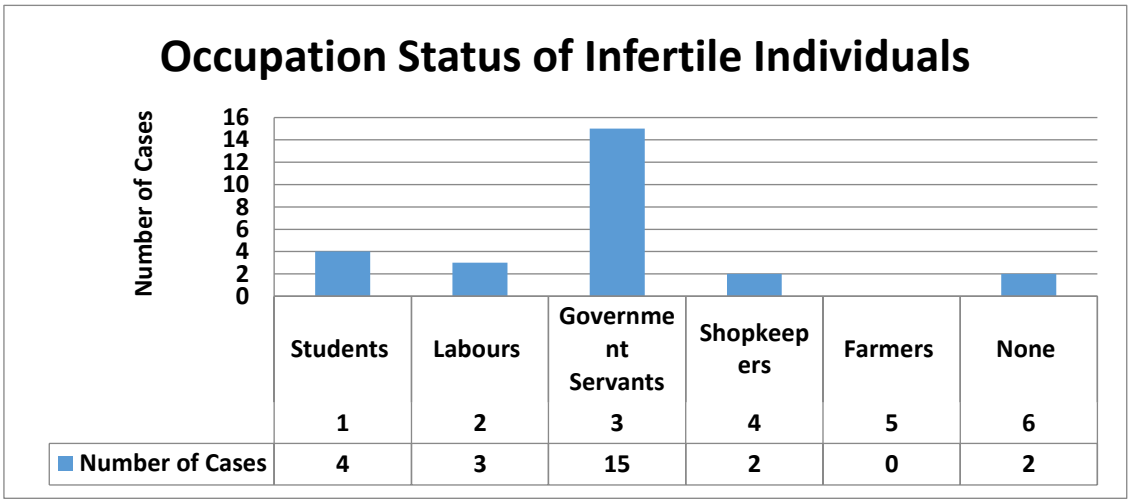


Figure 6: Occupation status of infertile individuals

Comparative Study of Male Infertility Based on Semen Analysis

Based on sperm counting

The study shows that, among infertile individuals, 8 of the infertile individuals have low sperms count and remaining have normal sperm count.

Table No 1 shows the sperm count of the infertile individuals

S. No	No. of Cases	Counting Status of Sperm (Million/ml)				
		0-4	5-8	40-60	70-80	80-90
1	3	√	-	-	-	-
2	5	-	√	-	-	-
3	8	-	-	√	-	-
4	4	-	-	-	√	-
5	6	-	-	-	-	√

Based on Sperm Motility

According to our study, it is proved that among infertile individuals, 17 of the infertile individuals have low motility index and remaining have normal motility index.

Table no.2 shows the sperm motility of infertile individuals

S. No	Active Status of Sperm (%)	Number of Cases
1	1-10	13
2	11-20	4
3	50-65	7
4	65-75	2

Discussion

In this study we describe the prevalence of male infertility in district Karak, Kohat division of KP. The study was conducted in the months of October and November 2024. We obtained data of 100 tested male from various

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clinical labs in district Karak. We divide all these cases into 5 groups based on their age (18-22), (23-26) year, (27-30), (31-34), (35-38 year). 14 cases fall into 18-22 years, 30 cases come into 23-26 years, 20 cases into the 27-30 years, 12 into the 31-34 years and remaining into the 35-38 years. All of the cases were the local population of district Karak. Among 100 cases, 26 cases were infertile and remaining 74 were fertile based on semen analysis i-e have normal sperm count and normal morphology and normal motility index. Among 26 infertile cases, 3 cases occurred from age group (18-22year), 6 from (23-26 year), 3 from (27-30) and 8 from (31-34), 6 from (35-38) as shown in figure 3. We also divide the infertile cases into 3 groups on the basis of marital status i-e single, married and divorced as shown in figure 4. The highest number of infertile cases fall into the married group followed by divorced and single. We also divide the infertile cases into 5 groups based on sperm count and motility index as shown in table 1 and respectfully. While on the basis of sperm count among the infertile cases, 3 of the cases sperm count ranging from 0-4 million/ml, 5 of the cases ranging from 5-8 million/ml, 8 cases ranging from 40-60million/ml, 4 ranging from 70-80 million/ml and 6 ranging from 80-90 million/ml as shown in table

Brief and recent study was conducted on male infertility by Ashok Agarwal, Aditi mulgund and Michelle Renee. According to Wang proved from their research, about 15% the couples across the globe, accounting to 48.5 million couples facing the problem of infertile males are responsible for 20-30% of overall in fertility. Apart from that male infertility is more in Europe and North America and the most common factor is decline of sperm count across the globe and the study was conducted by WHO and relevant articles are published in reproductive biology and endocrinology.

Conclusion

The current study concludes that male infertility affects a considerable proportion of men in District Karak, with the highest occurrence among individuals aged 31–34 years. Married men and government servants showed a greater frequency of infertility. Reduced sperm motility was more common than low sperm count among infertile participants, indicating that impaired motility is a major contributing factor. Early screening through semen analysis, increased awareness of risk factors, and timely medical intervention are essential to improve male reproductive health and fertility outcomes.

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