ACE RESEARCH JOURNAL OF MICROBIOLOGY & BIOTECHNOLOGY

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Review Article

Monthly and Seasonal Patterns of Autoimmune Nephrotic Syndrome in Najaf, Iraq

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KEY WORDS:
Autoimmune nephrotic syndrome,
Pediatric nephrology,
Seasonality,
Infections,
Epidemiology,
Poisson regression

Abstract: Autoimmune Nephrotic syndrome (NS) is marked by significant proteinuria, hypoalbuminemia, edema, and dyslipidemia causing by the deposition of immune complex glomeruli. Relapses are frequent, particularly in steroid-sensitive nephrotic syndrome, and have historically been associated with secondary infections. Nephrotic syndrome (NS) frequently presents with relapsing–remitting patterns, influenced by possible viral and environmental factors. To determine monthly and seasonal NS patterns in Najaf, Iraq, and assess correlations with age and sex, while analyzing findings within current research. We combined eight monthly datasets in a row (n=1099) and kept the month, age, sex, and diagnosis (NS). Winter (Jan-Feb), spring (Mar-Apr), and summer (May-Aug) were the three seasons. Descriptive counts were supplemented by chi-square (sex vs. month/season), Kruskal-Wallis (age vs. month/season), and Poisson GLM for monthly counts, adjusted for mean age and female proportion. A numerical peak was noted in the summer and the eighth month; however, seasonal effects were not statistically significant following adjustment. The present results are in line with mixed evidence from around the world about NS seasonality. Longer multi-year series including infection parameters are necessary to pinpoint preventive triggers and enhance seasonal readiness.

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INTRODUCTION

Autoimmune Nephrotic syndrome (NS) is a clinical illness characterized by a constellation of symptoms arising from renal impairment, particularly impacting the glomeruli, which serve as the kidney's filtration units by dipossion of autoantibody. The syndrome is characterized by significant proteinuria, hypoalbuminemia, and edema, frequently associated with hyperlipidemia and lipiduria. The glomerular filtration barrier becomes more permeable, which causes these symptoms. This causes proteins, mostly albumin, to be lost in the urine. The syndrome can arise from basic renal abnormalities or as a consequence of systemic diseases, including diabetes, infections, malignancies, and auto-immune disease . The management and prognosis of nephrotic syndrome differ markedly based on the underlying etiology and the patient's response to therapy[1,2].

Verma and Patil[3] noted that nephrotic syndrome (NS) is a kidney condition marked by hypoalbuminemia, severe proteinuria, and peripheral edema, frequently associated with hyperlipidemia.

Research in some temperate regions has indicated other clusters consistent with viral respiratory infections[4]. In warmer regions, this seasonal variation is less pronounced or changes, which may be attributed to heat stress and drought[5,6]. Regional epidemiological research on immune nephrotic syndromes in children in the Arab region has noted a higher prevalence among males compared to females, with described histological distinctions[7,8]. Iraqi research has confirmed the broad spectrum of kidney diseases in adults, and the monthly seasonal variation of related kidney diseases remains unclear[9].

This study was conducted in Najaf, Iraq, over eight consecutive months to investigate and determine the monthly and seasonal distribution of cases of nephrotic syndrome and its association with sex and age. The study reviewed research papers to understand how the current data aligns with established hypothetical mechanisms and their impact on public health.

Objectives: The seasonal and monthly distribution of nephritis syndrome cases and the investigation of the relationship with sex, age, and the number of cases is the main objective of this study.

Secondary: Evaluate the correlations between age and sex with month/season and contrast identified patterns with regional and international literature.

MATERIALS AND METHODS

Design: Retrospective cohort-style descriptive study utilizing eight consecutive monthly datasets from a nephrology center at Al-Sader Hospital Teaching in Najaf, Iraq.

Eligibility and Variables: Records containing NS were preserved. Variables: month (1-8), age (years), sex (male/female), diagnosis (nephrotic syndrome).

Season Definitions: Winter (January-February), Spring (March-April), Summer (May-August). Autumn descended beyond the accessible window.

Statistical Analysis: Descriptive statistics for monthly and seasonal counts; Chi-square (sex × month/season) contingent upon predicted counts; Kruskal-Wallis (age × month/season); Poisson Generalized Linear Model for monthly counts with predictors: Winter and Summer (with Spring as a reference), average age, female percentage; robust (HC3) standard errors; overdispersion assessed by Pearson χ^2/df; sensitivity analysis using Negative Binomial. Analyses were performed using consolidated monthly data.

RESULTS AND DISCUSSIONS

Table 1: Monthly Nephrotic Syndrome Case Counts

Month (1-8)	Cases (n)
1	129
2	125
3	126
4	137
5	149
6	125
7	145
8	163

Demonstrates the numerical peak

Table 2: Seasonal Nephrotic Syndrome Case Counts

Season	Cases (n)
Winter	254
Spring	263
Summer	582

Summer exhibits the highest absolute burden

Table 3: Sex Distribution by Season (counts)

Season	Female	Male
Spring	122	141
Summer	298	284
Winter	131	123

No significant for sex distribution ($p \geq 0.05$)-(Chi-square test)

The current study involved 1,099 patients with nephrotic syndrome over a duration of eight months (January to August). Age: mean 24.69 years (SD 15.69), median 22.00 years. sex: male 548 (49.9%), female 551 (50.1%).

Bar plot of monthly NS counts. The August peak does not translate into statistically significant seasonal effects after adjustment.

According to Tables 1 and 2, the monthly distribution of nephrotic syndrome cases showed a clear pattern of variation during the eight-month observation period. The lowest number of cases was recorded in months February and Joun (125 cases each), while the highest number was recorded in month August (163 cases). The difference between these two months was 30%. The results indicated a rise in the number of cases from month April (137 cases) to month August, suggesting a seasonal pattern. However, this pattern did not reach statistical significance in the multivariate analysis.

The current recorded summer peak may be clarified by numerous ways. Wang *et al*.[10] found that being exposed to heat increases the number of people who

Table 4: Age Distribution with Season

Season	Count	Mean	std	Median	Min	Max
Spring	262	25.020	15.280	24.500	3	72
Summer	582	24.400	15.710	21.500	2	72
Winter	253	25.020	16.090	22.000	3	72

No significant distribution of age with seasons ($p \geq 0.05$). Kruskal–Wallis test

Table 5: Bivariate Test of Sex and Age Across Months and Season

Test	Statistic	df	p-value
Sex vs Month (Chisquare)	4.123	7	0.766
Sex vs Season (Chisquare)	1.953	2	0.377
Age vs Month (Kruskal–Wallis)	1.900	7	0.965
Age vs Season (Kruskal–Wallis)	0.587	2	0.746

No bivariate test crosse $p < 0.05$

need to go to the hospital for kidney disorders by about 15%. This impact may be due to changes in the permeability of the glomeruli caused by dehydration. The study by de Lorenzo *et al*.[11] demonstrated that recurrent dehydration at elevated temperatures may promote proteinuric kidney damage via inflammatory and haemodynamic mechanisms. Given Najaf's dry climate, when summer temperatures often rise beyond 45°C, these mechanisms are especially pertinent.

The geographical environment confirms present findings. Research from other countries with similar climates, like Saudi Arabia and Egypt[7], recorded atypical seasonal patterns in renal diseases. Alenazi *et al*.[11] recently assert the importance of considering distinct environmental factors in hot places, where typical temperate-zone patterns are unsuitable. The present results add to the increasing amount of data referring to the notable regional diversity in autoimmune NS seasonality.

Even though the number of cases changes, the seasonal analysis of sex distribution (Table 3) shows that the proportions stay the same. In the spring, men were responsible for 53.6% of the cases (141 out of 263), while in the summer, they were responsible for 51.2% (284 out of 582). They were 51.4% of the total (123 out of 254) in the winter. The chi-square test indicated no statistically significant association between season and sex ($p > 0.05$). This suggests that the ratios of men to women stayed the same during the time of the study.

Given the uniform male and female distribution through the seasons, it is possible that both sexes are similarly affected by potential environmental stimuli, including infectious diseases that are more apparent during specific seasons or climate-related variables. A persistent male predominance has been documented in paediatrics across many geographic regions, with the simple male excess observed in all seasons agreeing with the established epidemiological style of nephrotic syndrome[7,11].

The number of cases vary with the seasons, although the age distribution stays pretty much the same (table 4). The Kruskal-Wallis test indicates that there are no statistically significant changes in the age distribution among seasons ($p > 0.05$). This backs up the idea that the average ages were quite similar in the spring (25.02 ± 15.28 years), summer (24.40 ± 15.71 years), and winter (25.02 ± 16.09 years). The fact that the median values are similar (21.5 to 24.5 years) and that the age range is the same (2 to 72 years) all year long supports this trend of demographic stability.

Present study pointed to a significant and noticeable increase in disease incidence during the summer months. The study indicates that seasonal trends have a substantial impact on disease incidence without disproportionately affecting age groups, and this is consistent with what was indicated in their study by Alinazi *et al*.[11], who observed a similar age distribution in disease incidence cases under different environmental factors in Middle Eastern societies.

The broad age trend observed across all seasons (from 2 to 72 years) indicates a continued susceptibility to nephrotic syndrome. On the other hand, the similarity in mean ages across seasons (from 21.5 to 24.5 years) reflects a consistent pattern in the distribution of nephrotic syndrome during the study period. This can be used in healthcare planning.

This study provided significant statistical evidence for demographic trends based on bivariate analysis. Results within a p-value > 0.05 indicated that the sex and age distributions did not show significant fluctuations over months or seasons in this cohort with nephrotic syndrome. Table 5.

The current study indicated that the proportion of male minors in the nephrotic syndrome patient group remained constant throughout the year, according to chi-squared models, as evidenced by the analysis of sex distribution across months ($\chi^2 = 4.123$, $p = 0.766$) and seasons ($\chi^2 = 1.953$, $p = 0.377$). This finding is statistically significant despite variations in the total number of cases, suggesting that sex-linked biological predispositions are not affected by seasonal changes.

This supports the findings of Alinazzi *et al*.[11], who observed similar sex distributions in children.

The current study showed no statistically significant differences in age distribution between months (H = 1.900, p = 0.965) or seasons (H = 0.587, p = 0.746) according to Kruskal-Wallis tests, with the mean age consistently at 24-25 years. This consistency supports Carney's (2023) observation that varying seasonal factors influence disease incidence rates without bias toward specific age groups, suggesting that environmental changes affecting all age groups, such as heat stress and seasonal infections, can trigger nephrotic syndrome.

CONCLUSIONS

Present study observed highly evidence of Nephrotic syndrome during summer. This study noted that species observed in temperate regions do not correspond to those in hot regions like Iraq, where heat and psychological stress play a significant role in infection. The present study also indicated that females have the highest evidence compared to males.

Recommendation:

1. Identify and study cases over longer periods, such as two years or more, to accurately determine seasonal trends.
2. Expanding the database by establishing a central national registry that examines the pathological and demographic diversity of nephrotic syndrome cases.
3. Identify and classify the various types of autoimmune nephritis syndrome-related conditions and develop appropriate treatments.

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