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Knowledge and Awareness of Steroid Use and Adverse Effects: A Cross-Sectional Study among Medical Students in Sialkot Pakistan

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Abstract

Steroids are widely utilized in clinical practice for managing a broad range of health conditions, including autoimmune diseases, allergic reactions, and inflammatory disorders. Despite their therapeutic value, inappropriate use and the risk of significant side effects make it essential for future healthcare professionals to have a solid understanding of their proper use. This cross-sectional study was designed to evaluate the level of awareness among medical students in Sialkot regarding the indications, benefits, and potential harms associated with steroid therapy. A total of 425 students were randomly selected from multiple medical colleges and universities within the region. The majority of participants were between 18 and 30 years of age. Information was obtained using a structured, self-administered questionnaire specifically designed to evaluate students' understanding of steroid mechanisms, indications, and adverse effects. Data were analyzed using SPSS version 21, utilizing both descriptive and inferential statistical tools and presented through tables and graphs. The results indicated a moderate overall level of knowledge. Although 97.2% of students correctly recognized general indications for steroid use, awareness of specific side effects ranged between 40% and 70%, revealing notable knowledge gaps. Female students constituted 68.0% of the sample, and 61.4% were from urban areas. No statistically significant association was found between knowledge levels and age or gender ($p > 0.05$). However, significant associations emerged with residence, profession, and monthly family income ($p < 0.05$). Students from higher income backgrounds and specific academic disciplines demonstrated better understanding of steroid indications, contraindications, adverse effects, and usage practices. These findings highlight the influence of demographic and socioeconomic factors on steroid knowledge and emphasize the need for targeted educational strategies to enhance understanding and promote the safe use of steroids in clinical settings.

Keywords: Rural areas, willingness, doctors, DHQ hospitals

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1. Introduction

Steroids are complex organic molecules characterized by a four-ring structure that perform essential roles in multicellular organisms. They serve as structural components of cell membranes, such as cholesterol, and act as

regulatory molecules by functioning as endogenous endocrine hormones that facilitate communication between distant cells and organs (Cole, Short et al., 2019).The measurement of steroid hormones dates back to their discovery in the late 1920s, with estrone being the first isolated steroid (Karashima and Osaka et al., 2022). Early detection methods relied on immunological techniques like radio immunoassays (RIAs) and enzyme immune sorbent assays (ELISA) (Nayak, Kumari et al., 2022).

Steroid hormones influence cellular processes by binding intracellular receptors, which then modulate gene expression after trans locating to the nucleus (Cato, Nestl et al., 2002). Inhaled corticosteroids (ICS), also known as glucocorticoids, are the primary treatment for asthma due to their potent anti-inflammatory effects, even at low doses (Barnes et al., 2010). Topical corticosteroids are widely used to alleviate inflammatory skin conditions, but prolonged use may cause adverse effects such as steroid addiction and red face syndrome (Marripalli, Ganachari et al., 2023). Anabolic-androgenic steroids (AAS), derivatives of testosterone, are prescribed for various medical conditions but are also frequently abused by athletes to enhance muscle mass and performance (Tahtamouni, Mustafa et al., 2008).

Steroids are critical in treating autoimmune diseases like rheumatoid arthritis and multiple sclerosis and have been lifesaving in severe COVID-19 cases, with the World Health Organization recommending their use under medical supervision (Thakur, Datusalia et al., 2022). Despite their therapeutic benefits, corticosteroids carry risks of side effects including osteoporosis, hyperglycemia, hypertension, skin atrophy, cataracts, and neuropsychiatric symptoms (Oray, Abu Samra et al., 2016). In Pakistan, irrational prescribing and overuse of steroids are prevalent, leading to negative health outcomes. Evaluating medical students' knowledge of steroid use and side effects is vital to improving future prescribing practices, enhancing patient care, and reducing healthcare costs. This study aims to assess the current knowledge levels among medical students regarding the therapeutic uses and adverse effects of steroids, thereby informing healthcare policymakers and educational strategies.

2. Materials and Methods

This descriptive cross-sectional study was conducted in the Sialkot district of Punjab, Pakistan—a densely populated area that hosts multiple medical colleges and universities. The purpose of the study was to evaluate knowledge and awareness regarding steroid use and its associated side effects among undergraduate students enrolled in medicine, pharmacy (Pharm-D), and nursing programs. A structured and validated questionnaire was used as the data collection instrument. Cross-sectional studies are observational in nature and are suitable for assessing health-related knowledge and behavior at a specific point in time (Wang and Cheng et al., 2020). Educational institutions were randomly selected across the district, and data were collected in person from students attending different academic departments. All undergraduate medical, pharmacy, and nursing students, aged 18 years and above, irrespective of gender, were eligible to participate in the study. Exclusion criteria included students below 18 years of age, those not enrolled in medical-related programs, those who were mentally unfit to respond, and those who declined participation. Only students who voluntarily provided written informed consent were included in the final analysis. The sample size was calculated using the Raosoft online calculator, with a 5% margin of error and a 95% confidence interval. Based on the formula:

$$n=N\ x\ /\ [(N-1)\ E2 + x] \qquad (1)$$

Where *n* represents the required sample size, *x* is the confidence level, and *E* is the margin of error, a minimum sample size of 385 students was estimated. To account for potential non-responses, an additional 10% was added, yielding a final target sample size of approximately 424. Ultimately, 425 students participated in the study.

A non-probability convenience sampling method was employed. Eligible students who were available and willing to participate during on-campus visits were invited to complete the questionnaire. Although this approach does not provide a fully representative sample, it allowed for efficient recruitment and data collection from accessible respondents (Simkus et al., 2022). The questionnaire used for data collection was developed to assess knowledge regarding the use and side effects of steroids. It consisted of two main sections. Section one captured demographic data, including age, gender, residence, academic program, and monthly family income. Section two included 38 items assessing knowledge about steroid use and its associated risks. The questionnaire was examined under the supervision of subject-matter experts for face and content validity. A pilot study was conducted on 10% of the target sample to evaluate the instrument's internal consistency and clarity. Necessary modifications were made based on feedback to ensure the tool was appropriate and understandable for the intended population.

Ethical approval for the study was obtained from the Research and Ethics Committee of Islam College of Pharmacy, Sialkot. Informed written consent was obtained from all participants, and confidentiality of all personal and response data was maintained throughout the study. Data collection was conducted in person, and all eligible students were approached during regular academic hours. The structured questionnaires were self-administered, and responses were recorded without interviewer interference to minimize bias. Data were entered and analyzed using SPSS version 21.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, such as frequencies and percentages, were used to summarize the demographic characteristics and response distributions. Inferential analysis was performed using the Chi-square test to explore associations between categorical variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

3. Results

In the present study, total 425 medical students were included. Final analysis includes all the duly filled questionnaire. Using SPSS (version 21.0), descriptive and inferential statistics were applied based on study's needs and objectives. In order to summarize the data, descriptive statistics (percentages, frequencies, mean and S.D) were calculated. The chi-square test was employed to explore associations between variables, with p-values < 0.05 indicating statistical significance.

3.1 Demographic characteristics

Table 1 outlines the demographic profile of the 425 medical student respondents. The vast majority were aged between 18 and 30 years (99.1%), with only a small fraction over 30 years of age. Female students comprised 68.0% of the sample, while male students accounted for 32.0%. A larger proportion of participants resided in urban areas (61.4%) compared to rural areas (38.6%). In terms of academic background, nearly half of the respondents were enrolled in medical (MBBS) programs (49.4%), followed by Pharm-D students (28.7%) and nursing students (21.9%). Regarding monthly family income, 45.4% of participants reported a household income above 52,000 PKR, while 27.1% fell within the 42,000–52,000 PKR range. Smaller proportions reported incomes between 32,000–42,000 PKR (14.1%) and below 32,000 PKR (13.4%). This table 1 summarizes the age, gender, residence, profession, and monthly family income distribution of participants from various medical colleges in Sialkot.

Table 1. Demographic characteristics of medical student respondents (n=425)

Variables	Frequency (n=425)	Percentage (%)

Age	18-30	421	99.1
	31-45	3	.7
	46-60	1	.2
	>60	0	.0
Gender	Male	136	32.0
	Female	289	68.0
Residence	Urban	261	61.4
	Rural	164	38.6
Profession	Pharm.D	122	28.7
	Nursing	93	21.9
	Doctor	210	49.4
Monthly family income	Less than 32000	57	13.4
	32000-42000	60	14.1
	42000-52000	115	27.1
	More than 52000	193	45.4

Note: All the frequencies (n) and percentages (%) are based upon observed values, missing values were excluded from the analysis.

3.2 Knowledge of Medical Students on Steroid Use and Side Effects

A cross-sectional survey conducted among 425 medical students assessed their knowledge regarding the clinical use and side effects of steroids. The findings revealed that the majority of students (97.2%) were aware of steroid usage, with 67.1% acknowledging their application in emergency conditions and 68.7% recognizing their use in managing pain. While just over half (54.1%) understood that steroid injections should not be administered frequently, 68.9% were aware of the potential for allergic reactions. Awareness of clinical risks was moderate, with 69.6% identifying the risk of infections from intracellular pathogens due to chronic steroid use, 74.8% noting the prevalence of mucocutaneous infections during corticosteroid therapy, 62.6% acknowledging delayed wound healing, and 72.5% recognizing the potential for edema with prolonged use. Regarding specific applications, 68.5% were aware of the use of topical corticosteroids for atopic dermatitis in children, 60.9% acknowledged the risk of hyperglycemia from topical preparations, and 66.6% recognized the use of low-potency corticosteroids for acute inflammatory skin conditions. Additionally, 66.6% of respondents associated anabolic–androgenic steroids with long-term depression, and 68.7% understood the immunosuppressive properties of steroids. Knowledge about pediatric and chronic use was relatively high, with 87.5% aware of their combined use with antibiotics in children, 74.1% recognizing their role in cancer treatment, 66.4% aware of their application in asthma, and 60.2% familiar with their use in liver dysfunction.

Table 2: Knowledge of Medical Students Regarding Steroid Use and Side Effects (N = 425)

Statements	Frequency (n=425)	Percentage (%)
Do you know about the usage of steroids?	413	97.2
Steroids are used in emergency condition.	285	67.1
Steroids can be prescribed to a patient having complaint of pain.	292	68.7
Steroids injections can be prescribed frequently.	230	54.1
Use of steroids can cause allergic reaction.	293	68.9
Chronic steroid use increases risk of infection with intracellular pathogens.	296	69.6
Mucocutaneous infections are common during treatment with corticosteroids.	318	74.8
Corticosteroids delays wound healing.	266	62.6
Prolonged treatment with corticosteroids can cause edema.	308	72.5
Topical corticosteroids are used for atopic dermatitis in children.	291	68.5
Topical preparation of Steroids can cause hyperglycemia.	259	60.9
Anabolic-Androgenic steroids (AAS) have a role in development of long-term depression.	283	66.6
Low potency corticosteroids are used for acute inflammatory skin lesions.	283	66.6
In pediatrics corticosteroids are usually used in combination with antibiotic.	372	87.5
Steroids can be prescribed for cancer patients.	315	74.1
Steroids are used in asthma.	282	66.4
Oral steroids are prescribed for liver dysfunction.	256	60.2
Steroids have immunosuppressive action.	292	68.7

Note: All the frequencies (n) and percentages (%) are based upon observed values, missing values were excluded from the analysis.

3.2.1 Awareness and Clinical Applications of Steroids

Percentage of respondents aware of the clinical indications of steroids, including general use (97.2%), emergency care (67.1%), pain management (68.7%), cancer therapy (74.1%), asthma (66.4%), and liver dysfunction (60.2%).

3.2.2 Knowledge of Steroid-Related Adverse Effects

Awareness levels regarding adverse effects of steroid use, including allergic reactions (68.9%), delayed wound healing (62.6%), mucocutaneous infections (74.8%), edema (72.5%), hyperglycemia (60.9%), and risk of infection from intracellular pathogens (69.6%).

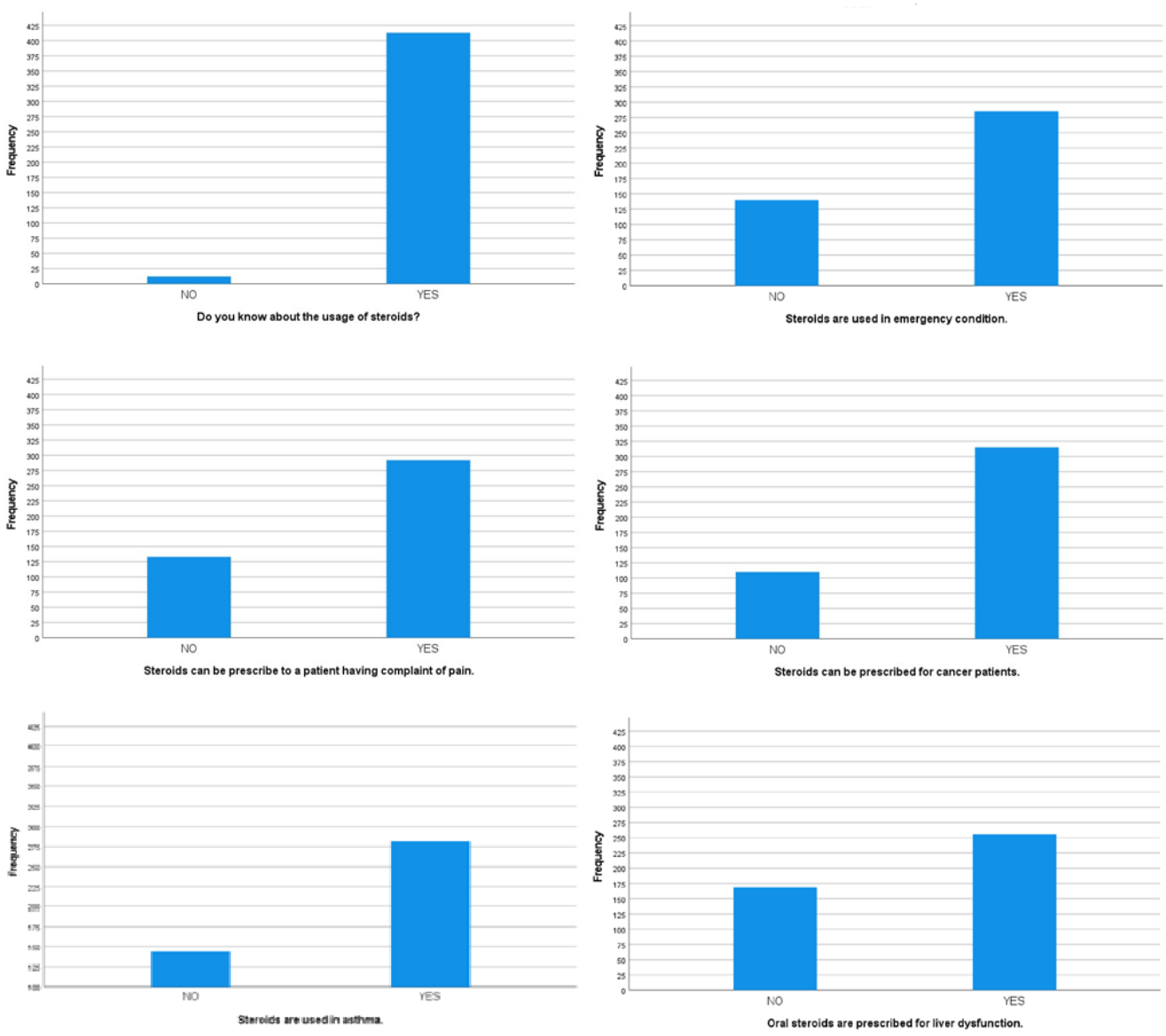

Figure 1. This figure presents the proportion of medical students who demonstrated awareness regarding general steroid use and its clinical **applications, including emergency care, pain management, cancer, asthma, and liver dysfunction.**

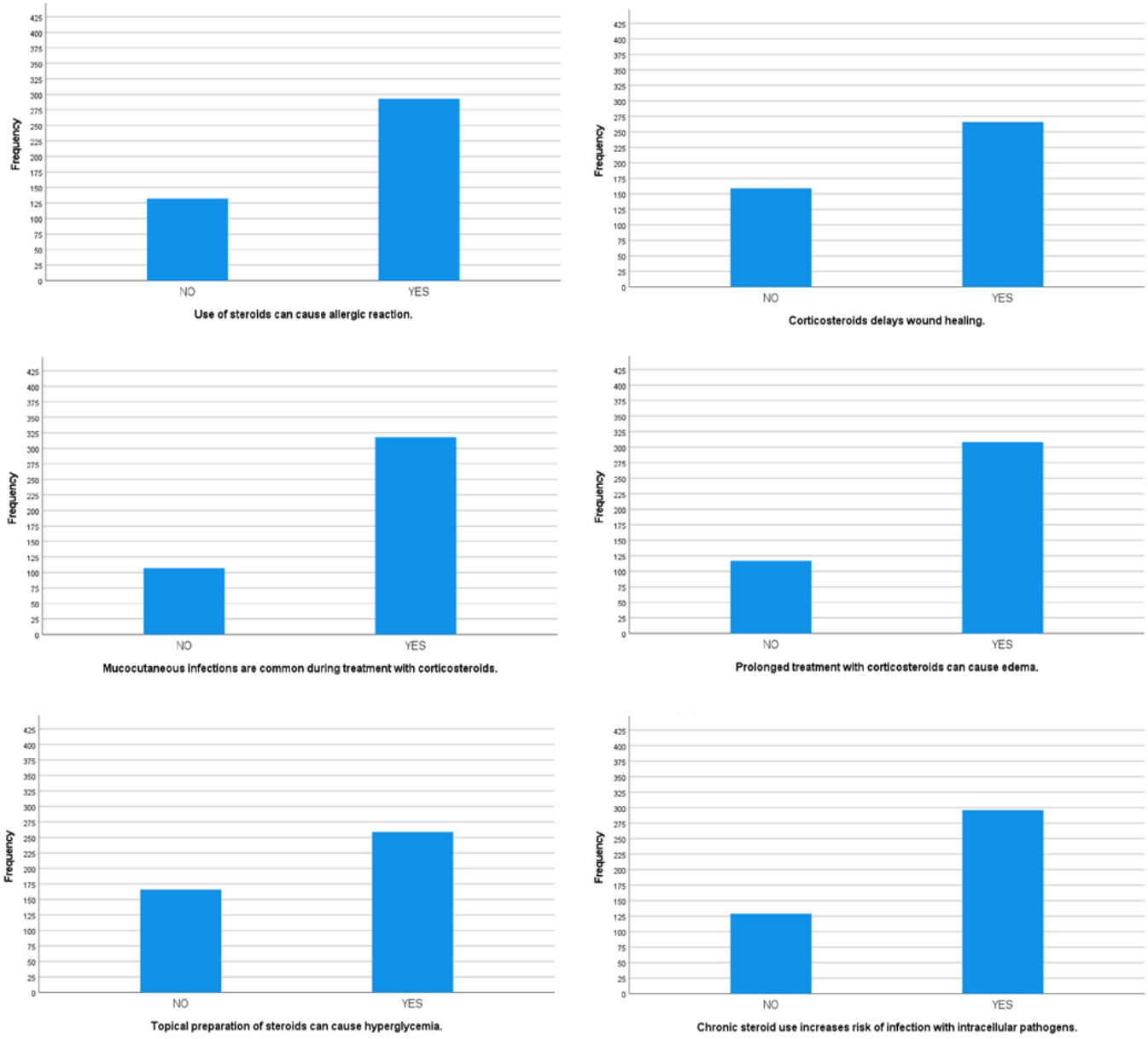

Figure 2. This **figure illustrates medical students' awareness of potential adverse effects of steroid therapy, such as allergic reactions, delayed wound healing, mucocutaneous infections, edema, hyperglycemia, and increased risk of intracellular infections.**

3.2.3 Formulation-Specific and Special Use Knowledge

Respondents' knowledge of formulation-specific and special use aspects of steroids, including topical use for atopic dermatitis (68.5%), low-potency corticosteroids for skin lesions (66.6%), co-prescription with antibiotics in pediatrics (87.5%), immunosuppressive action (68.7%), and AAS-related depression (66.6%). Chi-square tests revealed no significant association was found between knowledge of steroid use and age or gender ($p > 0.05$). A statistically significant association ($p < 0.05$) was observed between knowledge of steroid use and both residence and profession. Knowledge of indications ($p = 0.02$), adverse effects ($p = 0.03$), contraindications ($p = 0.03$), and overall knowledge ($p = 0.01$) varied significantly with residence. Similarly, profession was significantly associated with knowledge of indications ($p = 0.004$), adverse effects ($p = 0.001$), contraindications ($p = 0.02$), and overall knowledge ($p = 0.01$). A statistically significant

association was observed between respondents' knowledge regarding steroid use and their monthly family income ($p < 0.05$). Knowledge of steroid usage, including awareness of indications, prescribing practices, and adverse effects, varied significantly across income groups. Specifically, significant differences were found in knowledge about steroid usage overall ($p = 0.001$), prescribing steroids for pain ($p = 0.049$), frequency of steroid injections ($p = 0.002$), allergic reactions caused by steroids ($p = 0.022$), mucocutaneous infections during corticosteroid treatment ($p = 0.010$), corticosteroids' effect on wound healing ($p = 0.028$), use of topical corticosteroids for atopic dermatitis in children ($p = 0.024$), anabolic-androgenic steroids and long-term depression ($p = 0.050$), use of corticosteroids in pediatrics combined with antibiotics ($p = 0.041$), and steroid prescription in cancer patients ($p = 0.025$).

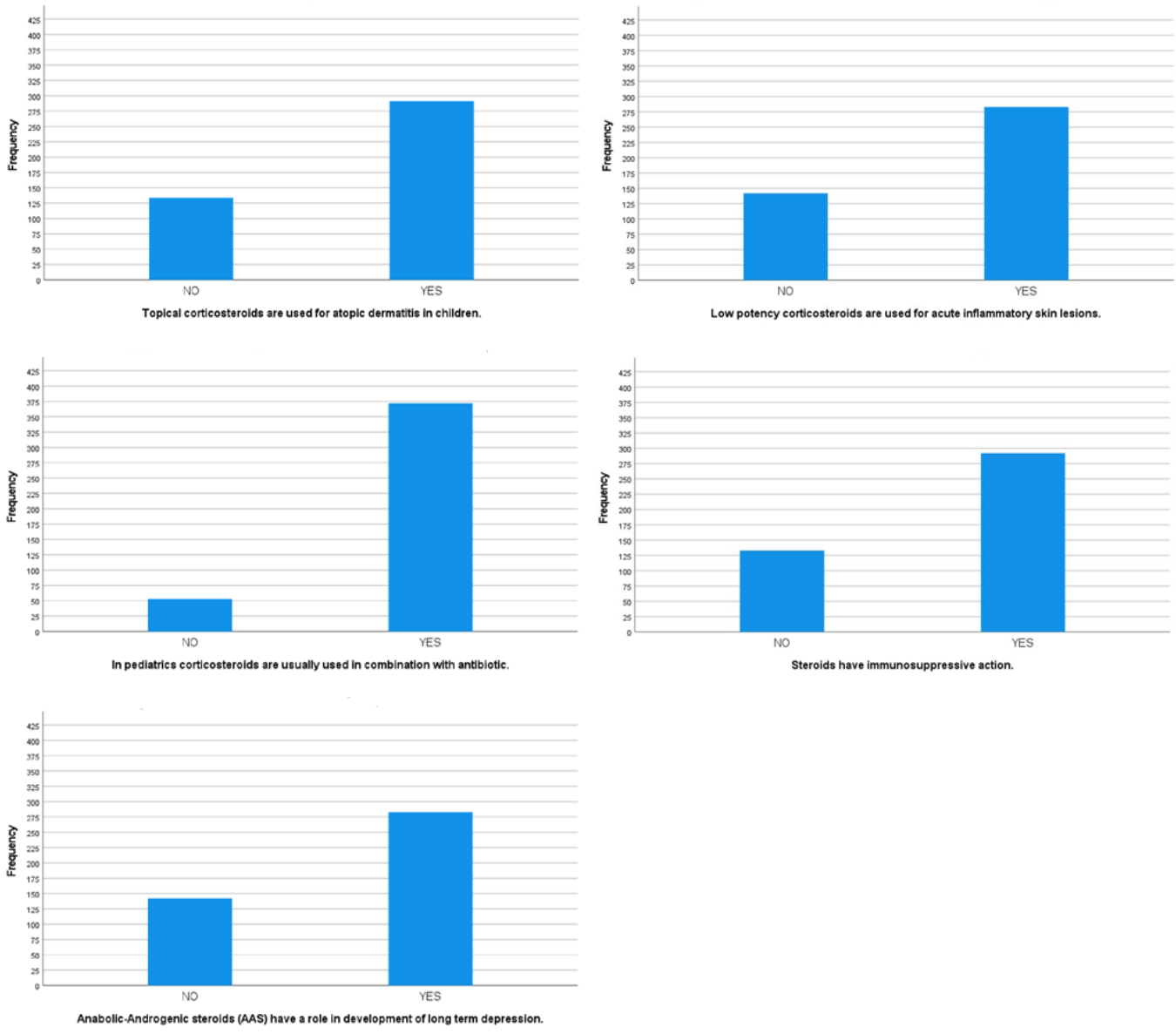

Figure 3. This figure shows students' understanding of specific steroid formulations and special use cases, such as the use of topical steroids for skin conditions**, pediatric co-prescription with antibiotics, immunosuppressive effects, and psychological impacts of anabolic-androgenic steroids (AAS).**

4. Discussion

Steroids are hormonal substances, naturally produced in the body by the adrenal glands and the reproductive organs. They work by interfering with protein synthesis and cellular metabolism by binding with intracellular glucocorticoid receptors. They can be used productively in hormone replacement therapy, or to treat growth disorders and other diseases. This study seeks to enhance understanding of steroid awareness among medical students and emphasizes the need for improved education on the topic. Findings revealed that 97.2% of participants were aware of steroid uses. Natural steroids play vital roles in regulating immune response, metabolism, electrolyte balance, and inflammation, extending well beyond muscle growth. They also help increase hormones like testosterone, which some individuals may produce insufficiently (Rasheed, et al., 2013).

The present study provides insight into the awareness and knowledge of medical students regarding the therapeutic applications and adverse effects of corticosteroids. The findings demonstrate a generally high level of awareness among respondents, with 97.2% reporting familiarity with steroid use. This high percentage indicates that corticosteroids are adequately covered in medical curricula to some extent, and students are at least theoretically aware of their clinical significance.

A substantial number of respondents (67.1%) recognized the role of steroids in emergency situations, which is consistent with their widespread use in acute conditions like severe asthma attacks or anaphylaxis. Similarly, 66.4% were aware that corticosteroids play a role in asthma management. These findings align with clinical practice guidelines, where systemic and inhaled corticosteroids are cornerstone therapies in controlling airway inflammation and preventing exacerbations (Rabe et al., 2018).

The study also revealed that 68.7% of the students acknowledged steroid use for pain, reflecting understanding of their anti-inflammatory properties and their use in managing specific pain types, particularly cancer-related or inflammatory pain conditions. However, the awareness that steroid injections should not be used frequently was present in only 54.1% of students. This limited awareness is concerning, as repeated corticosteroid injections can lead to serious complications such as soft tissue atrophy, joint damage, and hypothalamic-pituitary-adrenal (HPA) axis suppression (Brinks et al., 2010).

In terms of adverse effects, 68.9% of the students identified that steroid use can lead to allergic reactions. While hypersensitivity to corticosteroids is relatively rare, it is an important consideration in patients receiving chronic or repeated treatments, particularly those involving topical or parenteral administration (Vatti et al., 2014). A slightly higher proportion (69.6%) acknowledged the risk of infections due to immunosuppressive effects of prolonged steroid therapy. This is particularly relevant in the context of chronic use, where the suppression of the immune system can increase susceptibility to intracellular pathogens and reactivation of latent infections.

Furthermore, mucocutaneous infections were correctly identified by 74.8% of students, while 72.5% understood the association between corticosteroid use and edema. These results indicate a relatively good understanding of some common systemic side effects. However, awareness was somewhat lower for delayed wound healing (62.6%) and the potential for topical steroid-induced hyperglycemia (60.9%). These findings highlight the need for enhanced instruction around metabolic and healing-related complications of corticosteroid therapy.

Knowledge related to formulation-specific use was moderate. Approximately 68.5% of students recognized that topical corticosteroids are used for treating pediatric atopic dermatitis, while 66.6% identified low-potency corticosteroids as appropriate for inflammatory skin lesions. These findings suggest an adequate, though not complete, understanding of dermatological applications. Notably, the majority (87.5%) were aware that corticosteroids are

often used in combination with antibiotics in pediatric patients, a practice common in upper respiratory infections and inflammatory conditions where bacterial co-infection is suspected (Rahman et al., 2023).

In terms of specialty and chronic conditions, 74.1% acknowledged steroid use in cancer treatment, particularly for reducing inflammation, managing pain, or decreasing tumor-associated edema. Meanwhile, only 60.2% were aware that corticosteroids can be used in cases of liver dysfunction, such as autoimmune hepatitis or alcoholic hepatitis. This gap may reflect limited clinical exposure to hepatology during early medical training.

A significant portion of students (66.6%) also associated anabolic-androgenic steroid (AAS) use with long-term psychological effects, such as depression. Although medical corticosteroids and AAS differ in purpose and pharmacodynamics, the inclusion of this concept in the survey reflects students' broader awareness of hormone-related risks, particularly when used improperly or outside of medical supervision (Terney & McLain et al., 1990).

Chi-square analysis showed that there was no significant relationship between respondents' knowledge of steroid use and their age or gender ($p > 0.05$). This suggests that awareness and understanding of steroid use are consistent across different age groups and between males and females in the studied population. These findings indicate that factors other than age and gender may play a more influential role in shaping knowledge about steroids.

The results demonstrated a significant correlation between the respondents' knowledge about steroid use and their residential area as well as their profession ($p < 0.05$). This suggests that both the location where individuals live and their occupational roles affect their understanding of steroid indications, adverse effects, contraindications, and overall knowledge. These variations emphasize the importance of developing focused educational programs aimed at specific regions and professional groups to enhance awareness of steroid use.

A significant association was found between respondents' knowledge of steroid use and their monthly family income ($p < 0.05$). This suggests that income influences awareness of steroid indications, prescribing practices, and side effects. Higher income groups demonstrated better overall knowledge, particularly regarding steroid use for pain, injection frequency, allergic reactions, infections, wound healing, pediatric use, and related adverse effects. Overall, the results point to a moderate-to-good level of knowledge among medical students, but also reveal notable gaps in specific areas such as injection frequency, metabolic complications, and lesser-known clinical indications. These findings underscore the importance of reinforcing steroid pharmacology and clinical application in the medical curriculum through interactive, case-based learning and clinical simulation. As corticosteroids are among the most commonly prescribed drugs in various specialties, it is crucial that future healthcare professionals are equipped with both theoretical and practical knowledge to ensure their safe and effective use. The study's strength lies in its diverse and sizeable sample and the use of a validated tool, ensuring reliable data collection. However, reliance on self-reported responses may affect accuracy and generalizability. Nonetheless, the findings provide valuable insights to inform future educational strategies aimed at improving steroid use awareness.

Conclusion

This study highlights both the strengths and gaps in medical students' knowledge regarding steroid use. While most respondents demonstrated a solid understanding of general indications, there were clear deficiencies in recognizing specific adverse effects, appropriate dosing, and clinical applications. Knowledge levels were not significantly associated with age or gender but varied notably based on residence, profession, and family income—underscoring the influence of socioeconomic and educational backgrounds. These findings emphasize the importance of integrating comprehensive, targeted education on steroid pharmacology and safety into the medical

curriculum. Enhancing this knowledge is essential to ensure responsible prescribing, improve patient safety, and support effective clinical decision-making in future healthcare practice.

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