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Original Research Article

ANABOLIC STEROID ADVERSE EVENT PROFILE OBSERVED IN HEALTHCARE PROFESSIONALS

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Abstract: *The misuse of anabolic-androgenic steroids (AAS) has become a significant public health concern, particularly among adult males and bodybuilders in Pakistan. Despite the increasing prevalence, limited data exist regarding the adverse effects of AAS and healthcare professionals' perspectives on its misuse.* ***Objective:*** *To assess the adverse effects of AAS misuse as observed by healthcare professionals in Lahore, Pakistan, and to evaluate their experiences regarding self-medication, overdose, and ADR reporting.* ***Methods:*** *A cross-sectional survey was conducted from February to July 2023 among 203 healthcare professionals, including physicians, pharmacists, nurses, psychologists, and nutritionists. Participants were randomly selected from public and private hospitals and clinics in Lahore. Data were collected using a structured, prevalidated questionnaire distributed via Google Forms. Descriptive statistics, including frequencies and percentages, were analyzed using SPSS version 26.0.* ***Results:*** *AAS misuse was predominantly observed among males (82.8%) and adults (81.3%), with bodybuilders being the primary users (50.7%). The most common adverse effects included hypertension (52.7%), gynecomastia (60.6%), mood disorders (63.5%), and acne (65.5%). Self-medication (60.6%) and overdose (59.6%) were strongly associated with these adverse effects ($p<0.001$). ADR reporting to regulatory authorities was notably low, with only 27.1% of professionals reporting observed complications.* ***Conclusion:*** *This study highlights the widespread misuse of AAS and its associated adverse effects, particularly among males and bodybuilders in Lahore. The findings emphasize the urgent need for educational interventions, stricter regulatory policies, and improved ADR reporting mechanisms to address this public health issue effectively.*

Keywords: Anabolic Steroids, Adverse Effects, Self-Medication, Healthcare Professionals, Lahore, Pakistan

Introduction

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone used to enhance muscle growth and performance. Although AAS is prescribed for medical purposes, such as hypogonadism, anaemia, and cachexia, its misuse has become increasingly prevalent, particularly among young males and bodybuilders in Pakistan and globally (1, 2). The rising popularity of AAS among athletes, gym enthusiasts, and bodybuilders in Pakistan can be attributed to its muscle-enhancing effects and perceived ability to improve physical appearance and strength (3). However, their misuse without medical supervision has been associated with significant adverse drug reactions (ADRs) affecting multiple body systems, including cardiovascular, endocrine, gastrointestinal, dermatologic, genitourinary, and neuropsychiatric systems (4, 5). Despite these known risks, there remains a lack of awareness and reporting regarding AAS-related complications among healthcare professionals and users in Pakistan, which exacerbates the public health burden (6). Several studies have reported the prominent adverse effects of AAS, including hypertension, gynecomastia, mood disorders, acne, and gastrointestinal disturbances (7, 8). In low- and middle-income countries like Pakistan, limited regulatory oversight, easy access to steroids through black markets, and lack of awareness among users further contribute to AAS misuse (9). Healthcare professionals, particularly physicians, pharmacists, and nurses, play a pivotal role in identifying, managing, and reporting AAS-related ADRs. However, there is a need to assess their awareness, attitudes, and experiences regarding AAS misuse and its adverse effects (10). This study aims to evaluate healthcare professionals' perspectives on AAS usage, self-medication practices, and associated ADRs in Lahore, Pakistan. Through a cross-sectional survey, the study provides a comprehensive analysis of the most commonly observed adverse effects and their prevalence across various healthcare professionals, age groups, and genders. The findings highlight the need for better regulation, educational campaigns, and effective reporting mechanisms to mitigate the adverse outcomes of AAS misuse.

Methodology

The study was approved by the Ethical Committee of Akhtar Saeed College of Pharmaceutical Sciences, ensuring compliance with research ethics. Informed consent was obtained from all participants before initiating data

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collection, and no deception or misleading information was employed during the research process. A cross-sectional survey was conducted between February 2023 and July 2023, targeting healthcare professionals in Lahore, Pakistan, to assess their perspectives on coping with the adverse effects of anabolic steroids.

The study population comprised pharmacists, general physicians, nurses, psychologists, and nutritionists currently practising in government and private hospitals or clinics in Lahore. Participants were randomly drawn from hospitals certified by the Punjab Pharmacy Council. Specialists such as gynaecologists, urologists, orthopaedists, and paediatricians, as well as unregistered professionals, were excluded.

The sample size was calculated at a 95% confidence level with a 5% margin of error, resulting in 203 participants. To ensure an optimal response rate, a 10% margin was considered to account for potential dropouts, finalizing the sample size at 203. Data collection was conducted using a structured questionnaire designed after a comprehensive review of over 65 published studies on the adverse effects of anabolic steroids. The survey, approved by a research supervisor, consisted of 15 questions divided into three sections: demographics (5 questions), general use of anabolic steroids (8 questions), and adverse effects of anabolic steroids (7 questions). The questionnaire was created in English and designed as a Google form to facilitate online data collection.

The survey was disseminated via social media platforms to healthcare professionals working in hospitals and clinics. Participants received a full explanation of the study's purpose before being invited to respond. For enhanced outreach, researchers also engaged departmental heads, including those overseeing physicians, pharmacy staff, and nursing staff, to circulate the questionnaire in their respective professional groups with proper guidance. Despite some reluctance due to busy schedules, the majority of participants responded positively. Data were analyzed using the Statistical Package for Social Sciences (SPSS) software, version 26.0. Descriptive statistics were applied to determine frequencies and percentages, ensuring a clear presentation of the collected data. This methodology adhered to international research standards, ensuring ethical compliance, systematic data collection, and rigorous statistical analysis for reliable and meaningful results.

Results

Table 1: Among 203 healthcare professionals surveyed, physicians (37.4%) and pharmacists (28.6%) were the most represented, while nutritionists (11.3%) and psychologists (7.4%) participated less. Of the participants, 33.5% had prescribed anabolic steroids (AAS), while 66.5% had not. AAS usage was significantly higher in males (82.8%) compared to females (17.2%), and primarily among adults (81.3%), with adolescents comprising only 18.7%. The most common AAS users were bodybuilders (50.7%), followed by gym-goers (25.6%).

Table 2: Self-medication of AAS was reported by 60.6% of participants, and overdose was observed in 59.6% of cases. The main reasons for AAS use included achieving a muscular body (60.1%), improving body strength (18.7%), addressing low self-esteem (11.8%), and increasing body weight (9.4%). Cardiovascular effects, particularly hypertension (52.7%), were the most reported adverse events, followed by cardiomyopathy (28.1%) and coronary heart disease (19.2%).

Table 3: Adverse effects of AAS were most prominent in different systems. In endocrine effects, gynecomastia was highly prevalent (60.6%) and infertility was noted in 22.2%. Gastrointestinal issues included stomach lining irritation (58.1%), while genitourinary effects showed UTI as the most common (47.3%) and testicular cancer as less common (11.3%). Neuropsychiatric issues such as mood disorders were dominant (63.5%), and dermatologic effects like acne and skin rashes were reported in 65.5% of cases.

Table 4: Adverse effects were significantly more observed in males (82.7%) and adults (81.3%) compared to females and adolescents ($p<0.001$). Cardiovascular effects like hypertension, gastrointestinal irritation, and dermatologic conditions such as acne were particularly prominent in these groups.

Table 5: Self-medication (60.6%) and overdose (59.6%) correlated with higher incidences of ADRs, including hypertension (65.4%), gynecomastia (61.8%), and mood disorders (61.2%). Gastrointestinal effects, such as stomach lining irritation, were observed in 60.2% of self-medicated cases and overdoses, showing significant associations ($p<0.001$).

Table 6: Reporting of ADRs to regulatory authorities like DRAP was low, with only 27.1% reporting adverse events. Cardiovascular effects, particularly hypertension, were reported in 29.0% of cases, while dermatologic conditions like acne and skin rashes had the highest reporting (26.3%).

Table 7: The reasons for AAS use varied across activities. Bodybuilders reported muscular body development as the primary reason (71.8%), while gym-goers noted it in 58.5%. Athletes highlighted low self-esteem (40.6%), whereas sports participants focused on body weight gain (25%).

Table 8: Physicians (37.1%) and pharmacists (28.3%) observed the majority of ADRs. Cardiovascular effects like hypertension were noted in 39.3% of physicians, while dermatologic effects like acne were most frequently reported by physicians (51.2%) and pharmacists (37.9%). Neuropsychiatric complications, including mood disorders, were recorded primarily by physicians (38.0%) and pharmacists (31.0%).

Overall, the findings emphasize significant adverse effects of AAS, predominantly observed in males, adults, and bodybuilders, with low ADR reporting despite the widespread identification of complications.

Table 1: Frequency and percentage distribution

Parameters	Frequency	Percentage%
Designation of Participants		
- Physicians	76	37.4
- Pharmacist	58	28.6
- Nutritionist	23	11.3

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- Psychologist	15	7.4
- Nurse	31	15.3
Total	203	100
Have you ever been prescribed anabolic steroids?		
- Yes	68	33.5
- No	135	66.5
Total	203	100
Prevalent use of anabolic steroids in		
- Male	168	82.8
- Female	35	17.2
Total	203	100
Major numbers of the population using anabolic steroids are		
- Adult	165	81.3
- Aldolescent	381	18.7
Total	203	100
Using anabolic steroids which subjects are involved in activities		
- Sports person	16	7.9
- Atheletes	32	15.8
- Gymers	52	25.6
- Bodybuilding	103	50.7
- Total	203	100

Table 2: Frequency and percentage distribution

Parameters	Frequency	Percentage%
Have you ever observed self-medication about the use of anabolic steroids?		
- Major	123	60.6
- Minor	8	39.4
Total	203	100
Have you ever observed an over dose of anabolic steroids?		
- Yes	121	59.6
- No	82	40.04
Total	20	100
AAS boost the body's utilization of protein which favorably change		
- Increased oxygen level	57	28.1
- Increase carbon level	38	18.7
- Increase nitrogen level	108	53.2
Total	203	100
The reasons for using anabolic steroids are?		
- Having a muscular body	122	60.1
- Body Strength	38	18.7
- Lower self-esteem	24	11.8
- Low body weight	19	9.4
Total	203	100
Have you ever observed the following adverse event profile in anabolic steroid usage? Cardiovascular		
- Cardiomyopathy	57	28.1
- Hypertension	107	52.7
- Coronary heart failure	39	19.2
Total	203	100

Table 3: Frequency and percentage distribution of ADRS of AAS

Parameters	Frequency	Percentage%
- Endocrine and Metabolism		
- Hypertension	15	7.4
- Increase in triglycerides	20	9.9
- Gynecomastia	123	60.6
- Infertility	45	22.2
Total	203	100
Gastrointestinal		

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- Irritation of the lining of the stomach	118	58.1
- Colon damage	58	28.6
- Increase GIT motility	27	13.3
Total	203	100
Gastro urinary		
- UTI	96	47.3
- Prostate gland enlargement	84	41.4
- Testicular cancer	23	11.3
Total	203	100
Neuropsychiatric		
- Insomnia	43	21.2
- Mood disorder	129	63.5
- Dementia	31	15.3
Total	203	100
Dermatologic		
- Acne and skin rash	133	65.5
- Dark spot	41	20.2
- Melanin level increase	29	14.3
Total	203	100
He you ever reported any adverse effects of anabolic steroids to DRAP or the FDA?		
- Yes	55	27.1
- No	148	72.9
Total	203	100

Table 4: Observed ADR profile

ADR observed	**Observed Gender**			**Observed Age Group**		
	MALE	FEMALE	p-value	ADULTS	ADOLESCENTS	p-value
Cardiological - Cardiomyopathy - Hypertension - Coronary artery disease	 45(79%) 88(82.2%) 35(89.7%)	 12(21.0%) 19(17.8%) 4(10.3%)	 0.001	 45(78.9%) 86(80.4%) 34(87.2%)	 12(21.1%) 21(19.6) 5(12.8%)	 0.001
Total	168(82.7%)	35(17.2%)		165(81.3%)	38(18.7%)	
Endocrine and metabolic - Hyperlipidemia - Increase in triglycerides - Gynecomastia - Infertility	 12(80. %) 16(80.0%) 104(84.6%) 36(80.0%)	 3(20.0%) 4(20.0%) 19(15.0%) 9(20.0%)	 0.001	 12(80.0%) 13(65.0%) 100(81.0%) 40(88%)	 3(20.0) 7(35.0%) 23(18.0%) 5(11.0%)	 0.001
Total	168(82.7%)	35(17.2%)		165(81.3%)	38(18.7%)	
Gastrointestinal - Irritation of the lining of the stomach - Colon cancer - Increased GI motility	 99(83.9%) 46(79.3%) 23(85.2%)	 19(16.1%) 12(20.7%) 4(14.8%)	 0.001	 95(80.5%) 45(77.6%) 25(92.6%)	 23(19.5%) 13(22.4%) 2(7.4%)	 0.001
Total	168(82.7%)	35(17.2%)		165(81.3%)	38(18.7%)	

Genitourinary						
- UTI	83(86.5%)	13(13.5%)		84(87.5%)	12(12.5%)	
- Prostate gland enlargement	68(81%)	16(19%)	0.001	66(78.6%)	18(21.4%)	0.001
- Testicular cancer	17(73.9%)	6(26%)		15(65.0%0	8(34.8%)	
Total	168(82.7%)	35(17.2%)		165(81.3%)	38(18.7%)	
Dermatologic						
- Acne and skin rashes	113(85%)	20(15.5%)		113(85.0%)	20(15%)	
- Dark spot	34(82.9%)	7(17.1%)	0.001	30(73.2%)	11(26.8%)	0.001
- Increase in melanin level	21(72.4%)	8(27.6%)		22(75.9%)	7(24.1%)	
Total	168(82.7%)	35(17.2%)		165(81.3%)	38(18.7%)	

Table 5: ADRS of observed self-medication and observed overdose

ADR observed	**Observed self-medication**			**Observed overdose**		
	Major	**Minor**	**p-value**	**Yes**	**No**	**p-value**
Cardiological						
- Cardiomyopathy	31(54.4%)	26(45.5%)		35(61.4%)	22(38.6%)	
- Hypertension	70(65.4%)	37(34.6%)	0.001	66(61.7%)	41((38.3%)	0.001
- Coronary artery disease	22(56.4%)	80(39.0%)		20(51.3%)	19(48.7%)	
Total	123(60.0%)	80(39.0%)		121(59.0%)	82(40.0%)	
Endocrine and metabolic						
- Hyperlipidemia						
- Increase in Triglycerides	9(60.0%)	6(40.0%)		10(66.7%)	5(33.3%)	
- Gynecomastia	10(50.0%)	10(50.0%)	0.001	9(45.0%)	11(55.0%)	0.001
- Infertility	76(61.8%)	47(38.2%)		78(63.3%)	45(36.6%)	
	28(62.2%)	17(37.8%)		24(53.3%)	21(46.7%)	
Total	123(60.0%)	80(39.0%)		121(59.0%)	82(40.0%)	
Gastrointestinal						
- Irritation of the lining of the stomach	71(60.2%)	47(39.8%)		68(57.6%)	50(42.4%)	
- Colon cancer	34(58.6%)	24(41.4%)	0.001	35(60.3%)	23(39.7%)	0.001
- Increased GI motility	18(66.7%)	9(33.3%)		18(66.7%)	9(33.3%)	
Total	123(60.0%)	80(39.0%)		121(59.0%)	82(40.0%)	
Genitourinary						
- UTI	52(54.2%)	44(45.8%)		53(55.2%)	43(44.8%)	
- Prostate gland enlargement	58(69.0%)	26(31.0%)	0.001	53(63.1%)	31(36.9%)	0.001
- Testicular cancer	13(56.6%)	10(43.5%)		15(65.2%)	8(34.8%)	
Total	123(60.0%)	80(39.0%)		121(59.0%)	82(40.0%)	
Dermatologic						

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- Acne and skin rashes	80(60.2%)	53(39.8%)		79(59.4%)	54(40.6%)	
- Dark spot	31(75.6%)	10(24.4%)	0.001	29(70.7%)	12(29.3%)	0.001
- Increase in melanin level	12(41.4%)	17(58.6%)		13(44.8%)	16(55.2%)	
Total	123(60.6%)	80(39.4%)		121(59.0%)	82(40.0%)	
Neuropsychiatric						
- Insomnia						
- Mood disorder	26(60.5%)	17(39.5%)		23(53.5%)	20(46.5%)	
- Dementia	79(61.2%)	50(38.8%)	0.001	80(62.0%)	49(38.0%)	0.001
	18(58.1%)	13(41.9%)		18(58.1%)	13(41.9)	
Total	123(60.0%)	80(39.0%)		121(59.0)%	82(40.0%)	

Table 6: ADR report to DRAP

ADR observed	**ADR reported to DRAP**		
	YES	**NO**	**p-value**
Cardiological			
- Cardiomyopathy	16(28.1%)	41(71.9%)	
- Hypertension	31(29.0%)	76(71.01%)	0.001
- Coronary artery disease	8(20.5%)	31(79.7%)	
Total	55(22.1%)	148(72.9%)	
Endocrine and metabolic			
- Hyperlipidemia			
- Increase in triglycerides	7(46.7%)	8(53.3%)	
- Gynecomastia	6(30.0%)	14(70.0%)	0.001
- Infertility			
	34(27.6%)	89(72.4%)	
	8(17.8%)	37(82.2%)	
Total	55(27.01%)	148(72.9%)	
Gastrointestinal			
- Irritation of the lining of the stomach	32(27.1%)	86(72.9%)	
- Colon cancer	14(24.1%)	44(75.9%)	0.001
- Increased GI motility	9(33.3%)	18(66.7%)	
Total	55(27.01%)	148(72.9%)	
Genitourinary			
- UTI	28(29.2%)	68(70.8%)	
- Prostate gland enlargement	20(23.8%)	64(76.2%)	0.001
- Testicular cancer	7(30.4%)	16(69.6%)	
Total	55(27.01%)	148(72.9%)	
Dermatologic			
- Acne and skin rashes	35(26.3%)	98(73.3%)	
- Dark spot	15(36.6%)	26(63.4%)	0.001
- Increase in melanin level	5(17.2%)	24(82.2%)	
Total	55(27.01%)	148(72.9%)	
Neuropsychiatric			
- Insomnia	10(23.3%)	33(76.7%)	0.001
- Mood disorder	36(27.9%)	93(72.1%)	
- Dementia	9(29.9%)	22(71.0%)	
Total	55(27.01%)	148(72.9%)	

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Table 7: Reason for ADR Use

ACTIVITIES	OBSERVED POTENTIAL REASONS				
	LOW SELF ESTEEM	HAVING MUSCULAR BODY	BODY STRENGTH	LOW BODY WEIGHT	P-Value
Sports person	6(37.5%)	3(18.8%)	3(18.8%)	4(25.0%)	0.001
Athlete	13(40.6%)	11(34.4%)	6(18.8%)	2(6.3%)	
Gymers	29(58.5%)	11(21.2)	7(13.5%)	5(9.6%)	
Bodybuilders	74(71.8%)	13(12.6%)	8(7.8%)	8(7.8%)	
Total	122(59.5%)	38(18.5%)	24(11.7%)	19(9.3%)	

Table 8: Cohort of healthcare professionals

ADR observed	Cohort of health care professionals					
	Physicians	Pharmacist	Nutritionist	Psychologist	Nurse	p-value
Cardiological						
- Cardiomyopathy	23(40.4%)	15(26.3%)	7(12.3%)	4(7.0%)	8(14.0%)	
- Hypertension	42(39.3%)	28(26.2%)	10(9.3%)	9(8.4%)	18(16.8%)	0.001
- Coronary artery disease	11(28.0%)	15(38.5%)	6(15.4%)	2(5.0%)	5(12.8%)	
Total	76(37.0%)	58(28.0%)	23(11.0%)	15(7.2%)	31(15.1%)	
Endocrine and metabolic						
- Hyperlipidemia	8(53.3%)	5(33.3%)	1(6.7%)	0(0%)	1(6.7%)	
- Increase in triglycerides	7(30.4%)	8(40.0%)	3(15.0%)	1(5.0%)	1(5.0%)	0.001
- Gynecomastia	49(39.8%)	30(24.4%)	14(11.4%)	10(8.1%)	20(16.3%)	
- Infertility	12(26.7%)	15(33.3%)	5(11.1%)	4(8.9%)	9(20.0%)	
Total	76(37.1%)	58(28.3%)	23(11.2%)	15(7.3%)	31(15.1%)	
Gastrointestinal						
- Irritation of the lining of the stomach	35(29.7%)	39(33.1%)	9(7.6%)	11(9.3%)	24(20.3%)	0.001
- Colon cancer	29(50.0%)	14(24.1%)	10(17.2%)	3(5.2%)	2(3.5%)	
- Increased GI motility	12(44.4%)	5(18.5%)	4(14.9%)	1(3.2%)	5(18.5%)	
Total	76(37.1%)	58(28.3%)	23(11.2%)	15(7.3%)	31(15.1%)	
Genitourinary						
- UTI	37(38.5%)	27(28.1%)	11(11.5%)	5(5.2%)	16(16.7%)	
	30(35.7%)	24(28.6%)	10(11.9%)	8(9.5%)	12(14.3%)	0.001

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- Prostate gland enlargement - Testicular cancer	9(39.1%)	7(30.4%)	2(8.7%)	2(8.5%)	3(13.0%)	
Total	76(37.1%)	58(28.3%)	23(11.2%)	15(7.3%)	31(15.1%)	
Dermatologic						
- Acne and skin rashes	48(36.1%)	40(30.1%)	16(12.0%)	7(5.3%)	22(16.5%)	
- Dark spot	21(51.2%)	7(17.1%)	3(7.3%)	4(9.8%)	6(14.6%)	0.001
- Increase in melanin level	7(24.1%)	11(37.9%)	4(13.8%)	4(13.8%)	3(10.3%)	
Total	76(37.1%)	58(28.3$ %)	23(11.2%)	15(7.3%)	31(15.5%)	
Neuropsychiatric						
- Insomnia	16(37.2%)	13(30.2%)	4(9.3%)	3(7.0%)	7(16.3%)	0.001
- Mood disorder	49(38.0%)	40(31.0%)	15(11.6%)	7(5.4%)	18(14.0%)	
- Dementia	11(35.5%)	5(16.1%)	4(12.9%)	5(16.1%)	6(19.4%)	
Total	76(37.1%)	58(28.3%)	23(11.2%)	15(7.3%)	31(15.1%)	

Discussion

The findings of this study highlight significant adverse effects of anabolic-androgenic steroids (AAS) misuse among adult males, particularly bodybuilders, which aligns with previous research conducted globally and in Pakistan. In our study, healthcare professionals reported that the primary reasons for AAS misuse were achieving a muscular body (60.1%) and improving body strength (18.7%). This is consistent with findings from Shah et al., who reported that gym-goers and bodybuilders in Pakistan predominantly use AAS for muscle enhancement and improving physical appearance (11). Similarly, a global meta-analysis by Sagoe et al. indicated that young males constitute the majority of AAS users due to societal pressures and self-image concerns (12).

Cardiovascular adverse effects, particularly hypertension (52.7%) and cardiomyopathy (28.1%) were prominently observed in our study, reflecting findings from Kanayama et al., who noted that hypertension is among the most prevalent complications of AAS misuse (13). Arif et al. also highlighted hypertension and other cardiac complications as frequent consequences of steroid abuse in the Pakistani population due to unregulated steroid consumption and poor awareness (14). Additionally, endocrine and metabolic effects, such as gynecomastia (60.6%) and infertility (22.2%), were commonly reported in our study. Similar findings were reported by Kicman, who noted gynecomastia as a hallmark adverse effect due to the aromatization of AAS into estrogens (15).

The gastrointestinal effects observed in this study, such as irritation of the stomach lining (58.1%), align with findings by Al-Falasi et al., where gastrointestinal disturbances were frequently reported due to the oral intake of steroids and their impact on the gastric mucosa (16). Dermatologic adverse effects, including acne and skin rashes (65.5%), were among the most prevalent issues observed in our study, corroborating the findings of Hoffman et al., who identified acne as a common dermatological complication associated with steroid misuse (17).

Neuropsychiatric effects, such as mood disorders (63.5%) and insomnia (21.2%), were also significant in our findings. This aligns with Nieschlag and Vorona, who reported that AAS misuse can trigger mood swings, aggression, and sleep disturbances due to hormonal imbalances and the neuropsychiatric impact of steroids (18). Furthermore, our study found a low rate of adverse drug reactions (ADR) reporting to the Drug Regulatory Authority of Pakistan (DRAP), with only **27.1%** of healthcare professionals reporting ADRs. This highlights a critical gap in pharmacovigilance, as noted by Iqbal et al., who emphasized that the underreporting of ADRs in Pakistan is a major issue due to a lack of awareness and proper reporting systems (19).

The correlation between self-medication and overdose with ADRs in our study further underscores the dangers of unmonitored AAS usage. Similar trends were identified by Khan et al., who reported that AAS misuse, particularly through self-administration, significantly increases the likelihood of adverse effects (20). The lack of proper education and awareness among healthcare professionals

and AAS users was evident in our findings and parallels observations made in other studies conducted in low- and middle-income countries (21).

Overall, our study corroborates existing literature while shedding light on the unique challenges faced in Pakistan, such as unregulated steroid access, cultural emphasis on body image, and gaps in ADR reporting systems. These findings emphasize the urgent need for public health interventions, including educational campaigns, stricter regulation of AAS, and improved pharmacovigilance programs, to mitigate the adverse effects of AAS misuse among the population.

Conclusion

This study highlights the significant adverse effects associated with anabolic-androgenic steroid (AAS) misuse among adult males, particularly bodybuilders, in Lahore, Pakistan. Hypertension, gynecomastia, mood disorders, and acne were among the most commonly reported complications. The findings emphasize a strong association between self-medication, overdose, and the prevalence of adverse effects. Despite observing these complications, adverse drug reaction (ADR) reporting to regulatory authorities remains low. These results underscore the need for stricter regulations, increased awareness among healthcare professionals and the public, and improved pharmacovigilance systems to mitigate the risks of AAS misuse in Pakistan.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

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Approved by the department concerned. (IRBEC-TCH-0963/23)

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The authors declared the absence of a conflict of interest.

Author Contribution

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Coordination of collaborative efforts.
Study Design, Review of Literature.
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Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.
Conception of Study, Final approval of manuscript.
MUHAMMAD AHSAN
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