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CONTRAST-ASSOCIATED ACUTE KIDNEY INJURY AMONG INDIVIDUALS IN SAUDI ARABIA: KNOWLEDGE AND AWARENESS STUDY.

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Abstract

Introduction: While there isn't a single accepted definition, the most widely used ones were an absolute (≥0.5 mg/dL) or relative 25% rise in baseline serum creatinine concentration measured 48–72 hours following a radiological operation**,** Many studies revealed that there is insufficient knowledge and awareness level regarding contrast associated acute kidney injury moreover there is still a considerable gap in the literature about public understanding assessment of CA-AKI, particularly in Saudi Arabia. This study aims to assess level of knowledge and awareness regarding contrast-associated acute kidney injury among the general population in Saudi Arabia. **Methodology:** The study was a community-based cross-sectional study among the Saudi population, who can read Arabic or English, and who participate in the study was included. The data was collected during the period between July-December 2024 via a valid and reliable questionnaire that was distributed to participants. Quantitative data was analyzed using the t-test, and the Chi-square test was used to assess qualitative variables. A P value ≤ 0.05 is considered significant. Statistical analysis was performed with IBM SPSS version 25.0 Statistical software package. **Results**: The total number of participants was 1010. Findings revealed that 31.7% of participants were unaware of intravenous contrast materials, and 47.5% demonstrated low knowledge levels regarding CA-AKI. While 48.5% reported receiving information about the risks of iodinated contrast media, 34.0% had not received any such information. Additionally, 74.9% believed that iodinated contrast is not universally safe. The results highlight significant gaps in public understanding, emphasizing the need for targeted educational initiatives to improve awareness and informed decision-making regarding CA-AKI. **Conclusion:** The findings of this study underscore a critical need for enhanced educational initiatives aimed at improving public understanding of contrast-associated acute kidney injury. The significant gaps in knowledge and awareness identified among the Saudi population highlight the importance of targeted interventions to educate patients about the risks associated with iodinated contrast media.

Keywords: Interventional contrast, Kidneys, Knowledge, awareness, Contrast Media, Nephropathy, Acute Kidney Injury (AKI), Saudi Arabia.

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Introduction:

Iodinated contrast medium (ICM) is one of the indispensable agents prescribed in the diagnosis of many disorders. ICM is used to increase tissue visibility and improve the precision and ability of diagnosis [1]. Acute kidney injury (AKI) associated with ICM has traditionally been termed contrast-induced nephropathy (CIN). However, due to the difficulty in excluding other potential causes of AKI, in many clinical and research contexts, the term "CA-AKI" has also been adopted by nephrology and radiology communitie [2]. The term CI-AKI shows a direct correlation between AKI and the injection of contrast therefore, in critically ill patients exposed to contrast media, the term CA-AKI provides a clearer picture of the heterogeneity and multifactorial etiology of AKI [3]. While there isn't a single accepted definition, the most widely used ones were an absolute (≥0.5 mg/dL) or relative 25% rise in baseline serum creatinine concentration measured 48–72 hours following a radiological operation [4]. Initial reports of occurrences date back to the 1950s when patients with pre-existing renal disease had intravenous pyelography using contrast chemicals. This procedure was linked to a significant risk of acute kidney damage as well as other side effects [5]. After renal hypoperfusion and drug-induced nephropathy, ICM-induced AKI is the third most frequent cause of acute renal failure in hospitalized patients. It is responsible for 11% of AKI causes [6]. It was shown that the pathophysiology of CIN may entail the direct nephrotoxic effects of contrast agents, hemodynamic alterations, oxidative stress, apoptosis, immune/inflammatory responses, and epigenetic regulation [7]. To prevent CIN, many strategies have been employed. These consist of the following: using nonionic, low-osmolar, or iso-osmolar contrast medium (IOCM), decreasing the volume of contrast media supplied, administering N-acetylcysteine, expanding volume with sodium chloride, bicarbonate, or both [8]. The patient, the type, amount, and route of administration of ICM, and the medication all affect the chance of developing CI-AKI [9]. A study conducted in 2019, a study assessed patients' awareness and perception of risks associated with contrast-enhanced CT (CECT) examinations, as well as the impact of information sheets. Conducted with 263 patients, the study found that the doctors who refer patients are the ones who teach them most of the time, and they often miss some crucial information. More often, patients are afraid of the examination's outcome than any other hazards [10]. Additionally, in 2020, a study was conducted to evaluate the awareness of intravenous contrast media's (IVCM) renal effects among the general public visiting King Abdulaziz University Hospital in Jeddah. This observational cross-sectional study used an electronic questionnaire to gather data. The results indicated that 56.8% of participants had no knowledge of IVCM and its associated risks [11]. Exploring public awareness of Intravenous contrast and its risks in Saudi Arabia, a study in 2021 Conducted via an online questionnaire it included 9,912 participants. The findings revealed that 45.7% of respondents were unaware of IV contrast, and 79.9% of those who had undergone an examination experienced side effects [12]. Focusing on clinicians' knowledge and attitudes, a 2021 study in Qassim Saudi Arabia examine the safe use of intravenous contrast media in medical imaging. This cross-sectional study, involving 227 participants, revealed that 85.9% had insufficient knowledge and 80.2% had negative attitudes towards safe use [13]. Despite extensive research on the therapeutic advantages and hazards of contrast media, there is still a considerable gap in the literature about the public understanding assessment of CA-AKI, particularly in Saudi Arabia. Therefore, this study aims to address this gap by evaluating the current level of knowledge and awareness regarding contrast-associated acute kidney injury among the general population in Saudi Arabia.

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Material and Methods:

Study Design and Setting:

This is a cross-sectional study that was carried out in Saudi Arabia using community-based observational analysis. The participants in the study were Saudi Arabian citizens who were recruited between July to December 2024, when the questionnaire was administered.

Sample size:

With a 95% Confidence interval and the margin of error (=0.05). The minimum sample size required is 384 according to the Raosoft calculator estimation. This sample size is large enough to achieve the desired statistical power of the study.

Inclusion and Exclusion Criteria:

Participants who are at least eighteen years old are included, Individuals who agree to participate in the study and Residing in Saudi Arabia were included.

Those incapables of reading or understanding Arabic or English, People, who refuse to give their informed consent, those who are younger than 18 and People whose cognitive impairment may make it difficult for them to comprehend and complete the survey were excluded.

Method for data collection, instrument, and score system:

A self-administered questionnaire was used to collect the data for this study. This questionnaire is a valid and reliable method for gathering data on awareness and knowledge levels[11,12]. The Google Forms website was utilized to generate the questionnaire, which was distributed randomly among the general public by data collectors in Saudi Arabia via different social media platforms. Participants received the final version and were asked for their consent before participating. The survey has two parts. The first portion includes socio-demographic data such as gender, age, residential location, educational qualifications, kind of work, and income. The second portion involved knowledge and awareness questions consisting of 15 items, which combine false-true, yes-no, and multiple-option questions.

Scoring system:

A set of 29 statements was utilized, 3 were concerned with the participants' awareness, 12 were concerned with participants' knowledge level, 7 statements for personal questions, in addition to 7 statements were concerned with previous radiographic investigation with contrast. Participants earned one point for each correct response, while incorrect answers or responses of "I don't know" were awarded zero points, Likert scales (Dichotomous, Three-Point, and Quality Scales) were utilized for scoring where the minimum score 0 in both knowledge and awareness, while the maximum score is 25 in knowledge part and 6 in awareness part, the participants divided into three categories based on their scores using bloom’s cut-off points, 80%-100% as a high level of knowledge and awareness (category 1), 79%-60 as a moderate level of knowledge and awareness (category 2), 59%-0% as Low level of knowledge and awareness (category 3).

The Knowledge score which varied from 0-25 points was categorized into three levels as the following: participants who scored 14 points or less were categorized as having a low level of knowledge, while participants who scored between 15-19 points were categorized as having a moderate level of knowledge, those with a score of 20 and more points categorized as having a high level of knowledge.

The awareness score which varied from 0-6 points was categorized into three levels as the following:

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participants who scored 2 points or less were categorized as having a low level of awareness, while participants who scored between 3-4 points were categorized as a moderate level of awareness, those with a score of 5 and more points categorized as having a high level of awareness.

Pilot test:

Twenty individuals were given the questionnaire and asked to complete it. This was done to assess the study's viability and the simplicity of use of the questionnaire. The pilot study's results were not included in the study's final analysis.

Analyzes and entry method:

The t-test was used to examine differences between quantitative data, and Chi-square tests was employed to evaluate qualitative factors. P values less than 0.05 are regarded as significant. The statistical software program IBM SPSS version 25.0 used to conduct the statistical analysis.

Results:

Table (1) displays various demographic parameters of the participants with a total number of (1010). The mean age of 32.8 years, with a standard deviation of 12.6, indicates a relatively young demographic, highlighted by a significant proportion of individuals aged 22 to 25, representing 24.6% of the sample. Gender distribution reveals a predominance of females at 65.9%, which may influence various outcomes in health-related studies. Geographically, the southern region is notably represented, housing 55.4% of participants, while the northern region has a mere 2.2%. This geographical skew could affect access to resources and healthcare services. Education levels are striking, with 65.5% holding a bachelor's degree or higher, underscoring a relatively educated population. Employment patterns indicate a substantial number of students (35.6%) and employees (31.3%), alongside a significant unemployment rate of 14.1%, highlighting potential economic challenges within the sample. Monthly income data reveals considerable financial diversity, with over 31% earning less than 1,000 Saudi riyals.

Table (1): Sociodemographic characteristics of participants (n=1010)

Parameter		**No.**	**Percent (%)**
Age ***(Mean: 32.8, STD:12.6)***	21 years and less	192	19.0
	22 to 25	248	24.6
	26 to 35	184	18.2
	36 to 45	190	18.8
	more than 45	196	19.4
Gender	Female	666	65.9
	Male	344	34.1
Residential region	Northen region	22	2.2
	Southern region	560	55.4
	Central region	126	12.5
	Eastern region	124	12.3
	Western region	178	17.6
Type of residence	Village	130	12.9
	City	880	87.1
Educational level	Middle school	12	1.2

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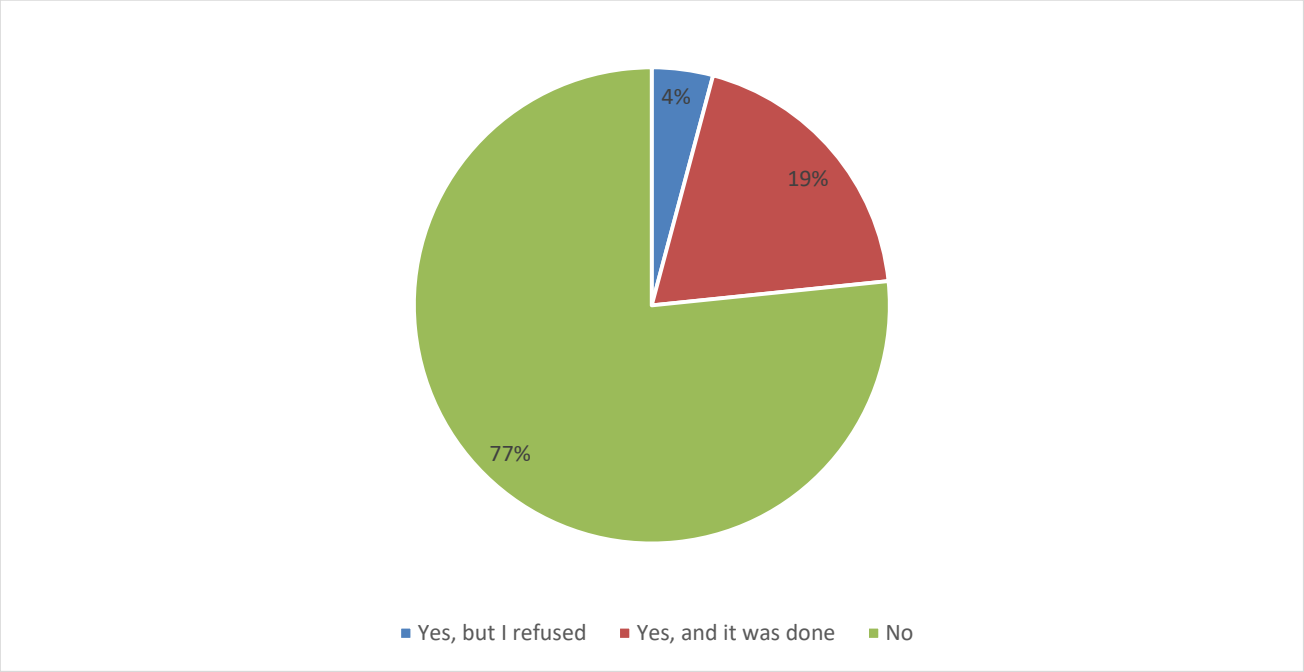
	High school	236	23.4
	Bachelor's degree	662	65.5
	Postgraduate degree	96	9.5
	Uneducated	4	.4
Occupation	Student	360	35.6
	Healthcare worker	90	8.9
	Employee	316	31.3
	Freelancer	40	4.0
	Unemployed	142	14.1
	Retired	62	6.1
Monthly income	Less than 1000 Saudi riyal	322	31.9
	1000 – 5000	210	20.8
	5001 – 10000	130	12.9
	10001 – 15000	174	17.2
	More than 15000 Saudi riyal	174	17.2

As shown in figure 1, The data presented reveals notable insights regarding patient experiences and responses related to the use of intravenous (IV) contrast in medical imaging procedures. Among the total 1,010 respondents, a significant 774 individuals, constituting approximately 76.7%, indicated that they had not been requested to undergo IV contrast, suggesting a prevalence of non-contrast imaging in their diagnostic processes. Conversely, 194 respondents, representing 19.2%, confirmed that they were requested to undergo the procedure and it was completed, indicating a willingness or necessity for enhanced imaging. Meanwhile, 42 individuals, which is about 4.2%, stated they had been asked to undergo IV contrast but chose to refuse.

Figure (1): Illustrates if participants were requested to do IV contrast before.



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As illustrated in table (2), The data provides valuable insights into patient experiences and perceptions regarding previous radiographic investigations involving intravenous (IV) contrast among a sample of 1,010 participants. A notable 76.6% of respondents reported having never been requested to undergo an IV contrast procedure, indicating a potential awareness or preference against such investigations. Among those who did receive IV contrast, a considerable 38.1% experienced side effects, with dizziness (37.8%) and vomiting (24.3%) being the most frequently reported adverse reactions. This raises important considerations regarding patient information dissemination and the necessity for healthcare providers to thoroughly communicate potential risks associated with IV contrast administration. Furthermore, while nearly half of the individuals surveyed (48.5%) acknowledged receiving information about the harms of IV contrast, a significant proportion (34.0%) reported having received no such information, highlighting a gap in patient education. The primary sources of information were predominantly radiology doctors (28.9%), emphasizing the pivotal role of specialized practitioners in conveying critical pre-procedural knowledge.

Table (2): Parameters related to previous radiographic investigation with contrast (n=1010).

Parameter		***No.***	***Percent (%)***
Have you been requested to do IV contrast before?	Yes, but I refused	42	4.2
	Yes, and it was done	194	19.2
	No	774	76.6
What is the type of investigation? (n=194)	MRI	120	61.9
	CT	44	22.7
	Ultrasound	10	5.2
	X-ray	20	10.3
Have you received any information about IV contrast and its harms? (n=194)	Yes	94	48.5
	No	66	34.0
	I do not remember	34	17.5
Who provided you with the information? (n=194)	Doctor	22	11.3
	Radiology doctor	56	28.9
	Radiology technician	28	14.4
	Nurses	2	0.1
	I do not remember	54	27.8
	I do not know	32	16.5
Did you have any side effects after IV contrast? (n=194)	No	120	61.9
	Yes	74	38.1
What were the side effects that you had? * (n=74)	Irritation	12	16.2
	Vomiting	18	24.3
	Dizziness	28	37.8
	Headache	22	29.7
	High temperature	8	10.8
	Diarrhea	4	5.4
	Other symptoms	24	32.4
What was the severity of the symptoms? (n=94)	Mild	60	63.8
	Moderate	34	36.2

****Results may overlap***

The data presented in figure (2) indicates that a significant majority of respondents, totalling 862

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individuals, affirm the statement that contrast materials can cause serious side effects, which constitutes approximately 85.4% of the total responses collected. In contrast, only 148 respondents, representing about 14.6%, disagree with this assertion. This substantial disparity in responses suggests a prevailing awareness among the participants regarding the potential risks associated with the use of contrast materials in medical procedures.

Figure (2): Illustrates if contrast materials can cause serious side effects among participants.

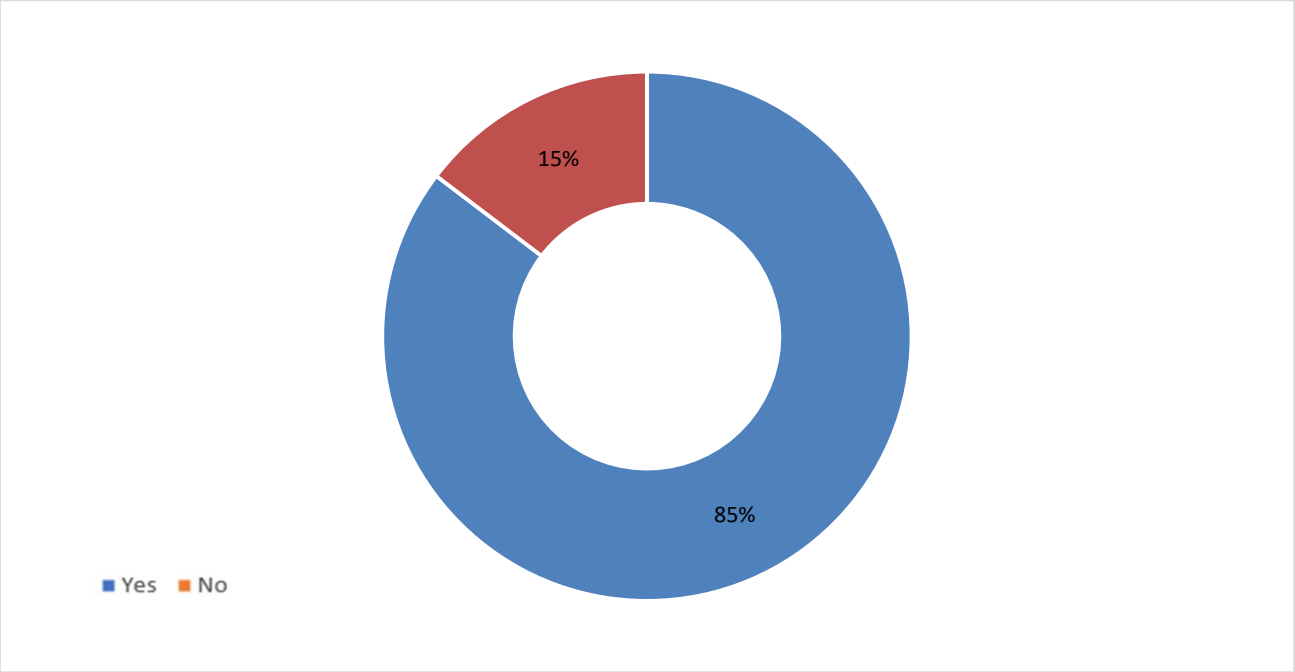

Table (3) reveals significant insights into participants' knowledge and awareness of contrast-associated acute kidney injury (CA-AKI) among a cohort of 1,010 individuals. Notably, a troubling 31.7% of participants reported having no idea about intravenous contrast materials, coupled with a concerning 20.8% who classified their knowledge as insufficient. Despite this lack of understanding, an overwhelming 95.4% correctly acknowledged the aim of intravenous contrast media (IVCMs) in facilitating clear tissue visualization for diagnosis. However, a stark disparity arises regarding the safety of IVCMs, where 74.9% believe that they are not universally safe for all patients. Furthermore, a significant number of participants expressed uncertainty about the risks associated with various conditions, as evidenced by 34.2% admitting they did not know which patients are at risk from IVCM injections.

Table (3): participants' knowledge and awareness regarding contrast-associated acute kidney injury (n=1010).

Parameter		***No.***	***Percent (%)***
How much do you feel you know about intravenous contrast materials?	More than sufficient	40	4.0
	Sufficient	124	12.3
	Partially sufficient	316	31.3

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	Insufficient	210	20.8
	No idea	320	31.7
The aim of the administration of intravenous contrast media (IVCMs) is to visualize tissues clearly and disease diagnosis.	True	964	95.4
	False	46	4.6
Intravenous contrast media (IVCMs) can be administered safely to every patient.	True	254	25.1
	False	756	74.9
Which are at risk from an IVCM injection? (you can mark more than one) *	Patients with cancer	298	29.5
	Patients with cardiovascular disease	326	32.3
	Patients with a history of allergy	446	44.2
	Patients with tuberculosis	84	8.3
	Patients with asthma	178	17.6
	Patients with renal disease	460	45.5
	A patient who received IVCM previously but had no allergic reaction	90	8.9
	I don't know	346	34.2
Contrast materials can cause serious side effects, although rarely.	True	862	85.3
	False	148	14.7
Intravenous dyes given by magnetic resonance imaging (MRI) are more dangerous than dyes for computed tomography (CT) and ultrasound.	Yes	280	27.7
	No	88	8.7
	I do not know	642	63.6
Are intravenous dyes safe for a pregnant woman?	Yes	54	5.3
	No	504	49.9
	I do not know	452	44.8
Continuing to breastfeed after taking an IV dye is not safe.	Yes	86	8.5
	No	336	33.3
	I do not know	588	58.2
Some patients may need to be medically prepared before the contrast is administered to reduce the complications incurred?	Yes	632	62.6
	No	42	4.2
	I do not know	336	33.3
Some diabetic patients who use the drug Glucophage (Metformin) may need to stop it after administering the CT scan for a period of up to two days.	Yes	218	21.6
	No	52	5.1
	I do not know	740	73.3
After an IV dye is injected?	It is excreted in the urine	586	58.0
	It is not eliminated, as it is permanently changing the color of the internal organs**.**	48	4.8
	I do not know	376	37.2
What are the side effects of IV contrasts?	Shortness of breath	288	28.5

ISSN:1624-1940
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(you can mark more than one) *	Irritation	338	33.5
	Nausea	354	35.0
	Diarrhea	222	21.9
	Death	86	8.5
	Vomiting	244	24.2
	Cough	118	11.7
	I do not know	508	50.3
How do you describe your knowledge of contrast-associated acute kidney failure CA-AKI?	Excellent	44	4.4
	Good	124	12.3
	Not enough	276	27.3
	No information	566	56.0
When renal function tests should be done with intravenous contrast administration?	Important pretest only	156	15.4
	Important posttest only	28	2.8
	Important pre and post-test	418	41.4
	Not important	12	1.2
	I don't know	396	39.2
Is it important to discuss the possible adverse effects with your doctor?	Yes	968	95.8
	No	42	4.2

****Results may overlap***

The data presented in Table 4 illustrates the distribution of knowledge levels concerning contrast-associated acute kidney injury among a sample population of 1,010 individuals. Notably, a substantial portion, comprising 47.5% of respondents, demonstrated a low level of knowledge, which raises concerns about awareness and understanding of this critical condition. Conversely, 32.1% exhibited moderate knowledge, while only 20.4% achieved a high level of understanding.

Table (4): Shows knowledge regarding contrast-associated acute kidney injury score results.

	Frequency	**Percent**
High level of knowledge	206	20.4
Moderate knowledge	324	32.1
Low knowledge level	480	47.5
Total	1010	100.0

The data presented in Table 5 concerning awareness levels related to contrast-associated acute kidney injury (CAAKI) highlights a significant concern within the medical community. Notably, most respondents (52.9%) demonstrated low awareness of CAAKI, suggesting a critical gap in understanding among clinicians and healthcare professionals regarding this potentially serious condition. Conversely, only a small proportion (9.7%) exhibited high awareness, while 37.4% maintained a moderate level of knowledge.

Table (5): Shows awareness regarding contrast-associated acute kidney injury score results.

	Frequency	**Percent**
High awareness	98	9.7
Moderate level	378	37.4

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Low awareness	534	52.9
Total	1010	100.0

Table (6) shows that knowledge level regarding contrast-associated AKI has statistically significant relation to age (P value=0.0001), residential region (P value=0.0001), type of residence (P value=0.027), and occupation (P value=0.0001). It also shows statistically insignificant relation to gender, educational level and monthly income.

Table (6): Relation between knowledge level regarding contrast-associated acute kidney injury and sociodemographic characteristics.

Parameters		***Knowledge level***		***Total (N=1010)***	***P value****
		High or moderate knowledge	**Low knowledge level**		
Gender	Female	364	302	666	0.054
		68.7%	62.9%	65.9%	
	Male	166	178	344	
		31.3%	37.1%	34.1%	
Age	21 years and less	86	106	192	0.0001
		16.2%	22.1%	19.0%	
	22 to 25	174	74	248	
		32.8%	15.4%	24.6%	
	26 to 35	82	102	184	
		15.5%	21.3%	18.2%	
	36 to 45	88	102	190	
		16.6%	21.3%	18.8%	
	more than 45	100	96	196	
		18.9%	20.0%	19.4%	
Residential region	Northern region	20	2	22	0.0001
		3.8%	0.4%	2.2%	
	Southern region	306	254	560	
		57.7%	52.9%	55.4%	
	Central region	42	84	126	
		7.9%	17.5%	12.5%	
	Eastern region	66	58	124	
		12.5%	12.1%	12.3%	
	Western region	96	82	178	
		18.1%	17.1%	17.6%	
Type of residence	Village	80	50	130	0.027
		15.1%	10.4%	12.9%	
	City	450	430	880	
		84.9%	89.6%	87.1%	
Educational level	Middle school	4	8	12	0.769
		0.8%	1.7%	1.2%	

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	High school	124	112	236	
		23.4%	23.3%	23.4%	
	Bachelor's degree	350	312	662	
		66.0%	65.0%	65.5%	
	Postgraduate degree	50	46	96	
		9.4%	9.6%	9.5%	
	Uneducated	2	2	4	
		0.4%	0.4%	0.4%	
Occupation	Student	210	150	360	0.0001
		39.6%	31.3%	35.6%	
	Healthcare worker	64	26	90	
		12.1%	5.4%	8.9%	
	Employee	136	180	316	
		25.7%	37.5%	31.3%	
	Freelancer	14	26	40	
		2.6%	5.4%	4.0%	
	Unemployed	76	66	142	
		14.3%	13.8%	14.1%	
	Retired	30	32	62	
		5.7%	6.7%	6.1%	
Monthly income	Less than 1000 Saudi riyal	184	138	322	0.166
		34.7%	28.7%	31.9%	
	1000 – 5000	104	106	210	
		19.6%	22.1%	20.8%	
	5001 – 10000	62	68	130	
		11.7%	14.2%	12.9%	
	10001 – 15000	84	90	174	
		15.8%	18.8%	17.2%	
	More than 15000 Saudi riyal	96	78	174	
		18.1%	16.3%	17.2%	

****P value was considered significant if ≤ 0.05.***

Table (7) shows that awareness level regarding contrast-associated AKI has statistically significant relation to age (P value=0.0001), residential region (P value=0.0001), educational level (P value=0.014), occupation (P value=0.0001), and monthly income (P value=0.0001). It also shows statistically insignificant relation to gender, type of residence.

Table (7): Relation between awareness level regarding contrast-associated acute kidney injury and sociodemographic characteristics.

Parameters	***Awareness level***		***Total (N=1010)***	***P value****
	High or moderate awareness	**Low awareness**		

ISSN:1624-1940
http://magellanes.com/

Gender	Female	320	346	666	0.415
		67.2%	64.8%	65.9%	
	Male	156	188	344	
		32.8%	35.2%	34.1%	
Age	21 years and less	92	100	192	0.0001
		19.3%	18.7%	19.0%	
	22 to 25	164	84	248	
		34.5%	15.7%	24.6%	
	26 to 35	86	98	184	
		18.1%	18.4%	18.2%	
	36 to 45	70	120	190	
		14.7%	22.5%	18.8%	
	more than 45	64	132	196	
		13.4%	24.7%	19.4%	
Residential region	Northern region	18	4	22	0.0001
		3.8%	0.7%	2.2%	
	Southern region	288	272	560	
		60.5%	50.9%	55.4%	
	Central region	40	86	126	
		8.4%	16.1%	12.5%	
	Eastern region	54	70	124	
		11.3%	13.1%	12.3%	
	Western region	76	102	178	
		16.0%	19.1%	17.6%	
Type of residence	Village	70	60	130	0.100
		14.7%	11.2%	12.9%	
	City	406	474	880	
		85.3%	88.8%	87.1%	
Educational level	Middle school	4	8	12	0.014
		0.8%	1.5%	1.2%	
	High school	124	112	236	
		26.1%	21.0%	23.4%	
	Bachelor's degree	314	348	662	
		66.0%	65.2%	65.5%	
	Postgraduate degree	34	62	96	
		7.1%	11.6%	9.5%	
	Uneducated	0	4	4	
		0.0%	0.7%	0.4%	
Occupation	Student	212	148	360	0.0001
		44.5%	27.7%	35.6%	
	Healthcare worker	52	38	90	
		10.9%	7.1%	8.9%	
	Employee	112	204	316	
		23.5%	38.2%	31.3%	

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	Freelancer	18	22	40	
		3.8%	4.1%	4.0%	
	Unemployed	66	76	142	
		13.9%	14.2%	14.1%	
	Retired	16	46	62	
		3.4%	8.6%	6.1%	
Monthly income	Less than 1000 Saudi riyal	178	144	322	0.0001
		37.4%	27.0%	31.9%	
	1000 – 5000	112	98	210	
		23.5%	18.4%	20.8%	
	5001 – 10000	60	70	130	
		12.6%	13.1%	12.9%	
	10001 – 15000	62	112	174	
		13.0%	21.0%	17.2%	
	More than 15000 Saudi riyal	64	110	174	
		13.4%	20.6%	17.2%	

P value was considered significant if ≤ 0.05.

Discussion:

The objective of this present study is to determine the level of knowledge and awareness of contrast associated acute kidney injury (CA-AKI) among general population in Saudi Arabia Given the increased use of iodinated contrast media (ICM) for diagnostic imaging and the associated risk of acute kidney injury (AKI), this topic is of particular interest. The findings of this study demonstrate large knowledge and awareness gaps that are consistent with previous research demonstrating that public understanding of CA-AKI is still low around the globe, especially in developing regions.

The findings reveal that there is a considerable segment of the surveyed population ignorant of ICM, as 31.7 percent of participants claim to be unaware of intravenous contrast materials. This agrees with previous studies, including that by Mccullough, in that many patients who undergo procedures with interventional contrast medium often are not advised about possible risk when using such agents [14]. Additionally, the large percentage of respondents (74.9%) who do not necessarily feel that ICM is safe for all patients serves as a call to action to better educate and communicate with patients in healthcare settings. This corresponds to what Molen et al. had pointed out: understanding the risk factors related to CA-AKI to reduce its incidence [15].

However, the study also found that nearly half of the participants (48.5%) reported receiving information on the harms of IV contrast but a large proportion (34.0%) had not been informed. The alarming thing about this is that if patient education is not addressed this gap, there is no effective communication about the risks of ICM because effective communication regarding risks of ICM is important for informed consent and shared decision making in clinical practice. Adverse outcomes related to procedures using contrast media are linked to inadequate patient education, and thus the role of healthcare providers particularly radiology practitioners is hugely important as Jiang so well points out [16].

In terms of knowledge levels, the study showed that there was 47.5% of respondents with low level knowledge of CA-AKI. This corroborates the systematic review of Obed et al., which discovered that countless patients remain ignorant of the risk of contrast enhanced imaging procedures [17]. Corroborating the findings of Fähling et al [18], the low awareness levels observed in the present study

(52.9% demonstrated low awareness) indicates that awareness levels can be far low and contribute to increased CA-AKI morbidity and mortality.
The relationships between knowledge and awareness levels about CA-AKI and such demographic parameters as age, residential region, were significant. Such results are consistent with previous research showing that people from urban areas and those younger in age are more likely to have elevated awareness about health problems. The present study's demographic skew towards younger participants may have biased reported levels of knowledge and awareness. This is an important population because studies by Agarwal et al. and Brown et al. have demonstrated that older adults have a greater risk of CA-AKI than less health literate, yet more youth.
Also, the aspects of the present study have to be acknowledged as having some limitations. Although the design is cross-sectional, it is unable to establish the causes of demographic factors and knowledge levels. Furthermore, as self-reported data can be potentially biassed as participants will overestimate their knowledge or awareness on CA-AKI, it reprints. Another important limitation is that the study sample may not be precisely representative of the Saudi population, especially in the rural areas where there is less access to healthcare information.

Conclusion:
What these results underscore is a pressing need for better educational work to educate the public about contrast associated acute kidney injury. The knowledge and awareness gaps identified among the Saudi population are, however, considerable, and targeting interventions aimed at education of patients about risk of iodinated contrast media are therefore essential. Future work should be devoted to the development and evaluation of educational programs that effectively communicate the risk of CA-AKI and encourage informed patient decisions regarding procedures involving contrast media.

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Ethical approval:

After fully explaining the study and emphasizing that participation is optional, each participant gave their informed consent. The information gathered was safely stored and utilized exclusively for study.

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Conflict of interests:

The authors declare no conflict of interest.

Informed consent:

Written informed consent was acquired from each individual study participant.

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Data and materials availability:

All data associated with this study are present in the paper.

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