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Evaluation of School Environmental Health and Safety Indicators of Public and Private Schools in Tikrit City

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ABSTRACT
Background: The school is a fundamental institution where intellectual knowledge, manual and behavioral skills, social connection, and the character of future generations have formed. Therefore identifying, managing, and preventing the adverse effects of environmental factors in schools impact the health of the present and future communities they are in.. **Subject, material, and method:** This is a descriptive (cross-sectional) study done in Iraq, Salah Al-Deen Governorate, Tikrit City from the 17th of October, 2022 to the end of May 2023. The study sample was 30 schools (20 public and 10 private) out of 279 schools (252 public and 27 private), including 15 primary schools (five private and ten public) and 15 secondary schools (five private and ten public). A well-designed questionnaire was used to collect information about environmental health and safety indicators. Data was collected by researcher through direct observation and interviews with school manager or assistant in each school after pilot study. **Result:** The study found that proper school location away from hazards and proper area-to-student ratio in 16(53.3%) of schools. Proper schoolyards and sustainable gardens both meet standards in 14(46.7%) of schools. Suitable class size, ventilation, and lighting with class infrastructures in 19(63.3%) schools. **Conclusion:** The study revealed that 19(63.3%) schools in Tikrit City did not meet the health and safety standards regarding school classes and furniture while more than half of the schools 16(53.3%) were fully meeting the standards regarding school location and area. The schoolyard and garden were fully meeting the standards in 14(46.7%) school.

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INTRODUCTION

The school is a fundamental institution where intellectual knowledge, manual and behavioral skills, social connection, and the character of future generations have formed[1]. It is the first route that permits students' contact with an affecting environment other than home[2]. Their learning abilities and their short and long-term health outcomes are highly influenced by the surrounding environmental factors[3]. The best health condition of the younger generation is achieved by proper education and a healthy school environment[1,4].

A healthy school environment aims to ensure students' safety and the community's future[5]. The recent decades have witnessed tremendous advances in maintaining and improving children and adolescents' health, however, the challenges still exist[6]. These challenges expose children and adolescents health to a variety of health issues like communicable and non-communicable diseases, violence, mental problems, psychological issues, and unpredicted accidents[7]. The status quo in Iraq is the outcome of more than 30 years of war, conflicts, a bad economy, and unstable security that led to neglect and deterioration in most of the life aspects[8,9]. As a result, the education sector has been exposed to poor and unhealthy environmental conditions[10]. Achieving a safe and healthy school environment is a sustained gradual multi-disciplinary process that needs the dedication and cooperation of the community, parents, health sector, environmental sector as well as students and school faculty[11,12].

This study aimed to evaluate the public and private schools' environmental indicators related to health and safety in Tikrit City according to the national standards.

SUBJECT MATERIAL, AND METHODS:

This is a descriptive (cross-sectional) study that was carried out among the public and private schools in the urban area of Tikrit City, the center of Salah Al-Deen Governorate in Iraq from the 17th of October, 2022 to the end of May 2023. The sample was selected as a cluster sampling, then a randomized sampling method from each cluster. The study sample was 30 schools out of 279 schools (252 public and 27 private schools), including 15 primary schools (five private and ten public) and 15 secondary schools (five private and ten public).

The data were collected according to a well-designed questionnaire with direct observation and interviews with the school manager or his/her assistant in each school by the researcher. The questionnaire form was specifically prepared to meet the aim of the study according to national standards and based on the previous studies on schools' physical environment in Iran and Nigeria[13-15]. The questionnaire was translated from English to Arabic. The statements from the questionnaire were observed, evaluated, and scaled on a Likert scale: good, accepted, and poor. Analysis of data was carried out

using the available statistical package of SPSS-28. A significant difference between percentages using the Chi-square test (χ^2-test) at 0.05 level. Each domain was categorized as poor (lower than 50%), accepted (50-74%), and good (75-100%) after summation of each domain to obtain the total score by score system.

RESULTS

The total number of schools in this study was 30; 15(50%) were primary and 15(50%) were secondary; 10(33.3%) were private and 20(66.7%) were public; 15(50%) were single-shift and 15(50%) were double-shift, gender attendance was 12(40%) male, 13(43.3%) female, and 5(16.7%) mixed as in (Table 1). The ranges of students' number, age of the building, school areas, school area to student ratio, green areas, and green area to student ratio with arithmetic mean and SD in this study are shown in (Table 2).

Table 1: The distribution of the studied sample regarding general information.

General information	Category	Number	%	Total	%
Type of educational level	Primary	15	50.0	30	100
	Secondary	15	50.0		
Ownership	Private	10	33.3	30	100
	Public	20	66.7		
Shifts	Single	15	50.0	30	100
	Doubled	15	50.0		
Gender attendance	Male	12	40.0	30	100
	Female	13	43.3		
	Mixed	5	16.7		

Table 2: Arithmetic Mean and SD regarding general data with range.

General information	Mean ± SD	(Range)
Number of students	300.3±153.0	(73-654)
Age of building	21.5±19.7	(2 Month-73 Year)
School area (m^2)	2066.7±1640.9	(300-8000)
Green area (m^2)	216.3±189.6	(35-600)
Class area(m2)	35.1±9.4	(12-48)
School area/Student	8.3±7.0	(0.90-33.00)
Green area/Student	0.8±0.9	(0.07-4.10)
Class area/Student	1.6±0.4	(0.80-2.40)
Distance between each bench row and another not less than (1m)	90.0±35.3	(30-190)
Distance between board and first raw(1.5-2m)	174.2±38.1	(100-300)

SD= Standard Deviation

The frequency of environmental health and safety indicators indices according to domains shows that school location and area with area with two questions meet the standards in 16(53.3%)of

schools and the schoolyard and garden with four questions meet standards in 14(46.7%) schools. The school classes and furniture with thirteen questions do not meet standards in 19(63.3%) as in (Table 3).

I-School location and area domain. The study revealed that 23(76.7%) schools reported healthy and proper school locations away from gas stations, generators, and noise sources not more than 5m, while 13(43.4%) reported lower than (10-15 m^2) per capita regarding school area suitability to student number and 10(33.3%) were meeting the standard as in (Table 4).

Table 3: Frequency of environmental health and safety indicators indices according to domains.

Environmental Health and Safety domains	**Good**		**Accepted**		**Poor**	
	No.	%	No.	%	No.	%
I-School location and area Q2	16	53.3	12	40.0	2	6.7
II-School yard and garden Q4	14	46.7	6	20.0	10	33.3
III-School classes and furniture Q13	-	-	11	36.7	19	63.3

Table 4: The school location and area indicators of environmental health and safety among evaluated schools in Tikrit City.

Environmental Health and Safety Indicators	**Criteria**	**No.**	**%**	**Total(%)**
1-School location:	Good	23	76.7	30(100)
Quiet and healthy surrounding area.	Accepted	7	23.3	
	Poor	-	-	
2-School area:	Good	10	33.3	30(100)
School area suitable to student number (10-15 m^2) per capita.	Accepted	7	23.3	
	Poor	13	43.4	

II-School yard and garden domain. All schools in this study have a schoolyard, 27(90%) schools had an equal level of surface but 22(73.3%) were not connected to a systematic drainage system for rain drainage. The school garden is available in 24(80%) schools, and sustainable in 21(87.5%) among the available ones. The suitable green area size to student number (0.5m^2 per capita) is in 14(58.3%) but less in 10(41.7%) as in (Table 5).

III-School classes and furniture domain. The study showed that a suitable class area (1-1.5 m^2) per capita appears in 29(96.7%) of schools with an equal number and percentage of 10(33.3%) for the three indices regarding the standard class dimensions: width 6m, length 8m, and height 4m. Suitable natural ventilation as windows area 1/6-1/4 class area appears in 25(83.3%) of the schools, artificial ventilation of class by fans and air conditioners is available and suitable in 24(80%), natural lightening of class using daylight appears enough in 15(50%), and artificial lightening available and enough in 21(70%). Hand sanitizers are absent in

26(96.7%) schools. Class furniture: 28(93.3%) reported a suitable number of school benches with student numbers (one bench for every two students). School benches are suitable for students physically and mentally as students' left hand near the window and seated child's feet on the floor with suitable boards are reported by all schools in this study. The distance between each bench row and another is found not less than 1 m in 13(43.3%) and accepted to little less than 1 m in 14(46.7%). The distance between the boards and the first row (1.5-2m) appears good in 28(93.3%) and intact window glass appears in 27(90%) schools as in (Table 6).

Table 5: Schoolyard and garden indicators of environmental health and safety among evaluated schools in Tikrit City.

Environmental Health and Safety Indicators	**Criteria**	**No.**	**%**	**Total (%)**
3-Schoolyard: Available	Yes	30	100	30(100)
	No	-	-	
Authorized with an equal level of surface.	Good	27	90.0	30(100)
	Accepted	-	-	
	Poor	3	10.0	
Connected to the systematic drainage system for rain drainage	Good	8	26.7	30(100)
	Accepted	-	-	
	Poor	22	73.3	
4-School garden: Available	Yes	24	80.0	30(100)
	No	6	20.0	
Sustainable	Good	21	87.5	30(100)
	Accepted	-	-	
	Poor	3	12.5	
Green area suitable to student number ($0.5m^2$ per capita)	Good	14	58.3	30(100)
	Accepted	10	41.7	
	Poor	-	-	

Table 6: School classes and furniture indicators of environmental health and safety in schools in Tikrit City.

Environmental Health and Safety Indicators	Criteria	No.	%	Total (%)
5-School classes:	Good	29	96.7	30(100)
Suitable class area (1-1.5 m^2) per capita	Accepted	1	3.3	
	Poor	-	-	
Class dimensions (width 6m, length 8m, height 4m)	Good	10	33.3	30(100)
	Accepted	10	33.3	
	Poor	10	33.3	
Class suitable natural ventilation (windows area 1/6-1/4 class area)	Good	25	83.3	30(100)
	Accepted	5	16.7	
	Poor	-	-	
The artificial ventilation system of the class is available and functioning	Good	24	80.0	30(100)
	Accepted	4	13.3	
	Poor	2	6.7	
Using maximum natural lighting in class	Good	15	50.0	30(100)
	Accepted	1	3.3	
	Poor	14	46.7	
Artificial lighting is available and suitable	Good	21	70.0	30(100)
	Accepted	8	26.7	
	Poor	1	3.3	
Hand sanitizers are available	Good	1	3.3	30(100)
	Accepted	-	-	
	Poor	29	96.7	
6-Class furniture:	Good	28	93.3	30(100)
School bench number suitable with student number(one bench for every two students)	Accepted	-	-	
	Poor	2	6.7	
School benches are suitable for students physically and mentally	Good	30	100	30(100)
	Accepted	-	-	
	Poor	-	-	
Distance between each bench row and another not less than 1 m	Good	13	43.3	30(100)
	Accepted	14	46.7	
	Poor	3	10.0	
Distance between the board and first row (1.5-2m)	Good	28	93.3	30(100)
	Accepted	2	6.7	
	Poor	-	-	
Suitable blackboard	Good	30	100	30(100)
	Accepted	-	-	
	Poor	-	-	
The window glass is intact.	Good	27	90.0	30(100)
	Accepted	-	-	
	Poor	3	10.0	

The school environmental health and safety comparison according to ownership (public and private) showed a statistically significant difference regarding school location and area attributed to private and public schools. A healthy surrounding and a suitable school area for students number are more among public schools 14(70%) where the P-value is 0.034. The total domain of the schoolyard and garden also showed a statistically significant difference attributed to private and public schools where P-Value 0.011, more in public schools12(60%) as in (Table 7). The school environmental health and safety comparison according to the type of educational level (primary and secondary) revealed that there are no statistically significant differences in the school's location and area, school yard and garden, school class and furniture status as in (Table 8).

Table 7: The relation between the schools' environmental health and safety indicators domains and the schools' ownership (public and private).

Environmental health and safety indicators		**Ownership**				**P-value**
		Private(10)		**Public(20)**		
		No.	**%**	**No.**	**%**	
I-School location and area	Good	2	20.0	14	70.0	0.034*
	Accepted	7	70.0	5	25.0	
	Poor	1	10.0	1	5.0	
II-School yard and garden	Good	2	20.0	12	60.0	0.011*
	Accepted	1	10.0	5	25.0	
	poor	7	70.0	3	15.0	
III-School classes and furniture	Good	6	60.0	13	65.0	0.789
	Accepted	4	40.0	7	35.0	
	Poor	-	-	-	-	

Table 8: The relation between the schools' environmental health and safety indicators domain and the schools' educational level (primary and secondary).

Environmental health and safety indicators		**Type of educational level**				**P value**
		Primary(15)		**Secondary(15)**		
		No.	**%**	**No.**	**%**	
I-School location and area	Good	7	46.7	9	60.0	0.747
	Accepted	7	46.7	5	33.3	
	Poor	1	6.6	1	6.7	
II-School yard and garden	Good	8	53.4	6	40.0	0.621
	Accepted	2	13.3	4	26.7	
	Poor	5	33.3	5	33.3	
III-School classes and furniture	Good	10	66.7	9	60.0	0.705
	Accepted	5	33.3	6	40.0	
	Poor	-	-	-	-	

The school environmental health and safety comparison according to the schools' shifts (single and doubled) showed a statistically significant difference regarding schoolyard and garden where P-Value 0.046, more among double shift schools 10(66.7%) as shown in (Table 9). The school environmental health and safety comparison according to the schools' gender attendance(male, female, and mixed) revealed no statistically significant differences in the school's location and area, school yard and garden, school class and furniture status in the studied sample as in (Table 10).

Table 9: The relation between the schools' environmental health and safety indicators domain and the schools' shifts (single and doubled).

Environmental health and safety indicators		**Shifts**				**P value**
		Single(15)		**Doubled(15)**		
		No	%	No	%	
I-School location and area Assessment Q2	Good	6	40.0	10	66.6	0.311
	Accepted	8	53.3	4	26.7	
	poor	1	6.7	1	6.7	
II-School yard and garden Assessment Q4	Good	4	26.7	10	66.7	0.046*
	Accepted	3	20.0	3	20.0	
	Poor	8	53.3	2	13.3	
III-School classes and furniture Assessment Q13	Good	9	60.0	10	66.7	0.705
	Accepted	6	40.0	5	33.3	
	Poor	-	-	-	-	

Table 10: The relation between the schools' environmental health and safety indicators domain and the schools' gender attendance (male, female, and mixed).

Environmental health and safety indicators		**Gender attendance**						**P value**
		Male (12)		**Female(13)**		**Mixed(5)**		
		No	**%**	**No**	**%**	**No**	**%**	
I-School location and area Assessment Q2	Good	8	66.7	8	61.5	-	-	0.059
	Accepted	3	25.0	4	30.8	5	100.0	
	Poor	1	8.3	1	7.7	-	-	
II-School yard and garden Assessment Q4	Good	7	58.3	7	53.8	-	-	0.142
	Accepted	2	16.7	3	23.1	1	20.0	
	Poor	3	25.0	3	23.1	4	80.0	
III -School classes and furniture Assessment Q13	Good	5	41.7	11	84.6	3	60.0	0.083
	Accepted	7	58.3	2	15.4	2	40.0	
	Poor	-	-	-	-	-	-	

DISCUSSION

This study showed that 23(76.7%) of schools were located in a healthy and proper site, 5m away from hazards. This finding is supported by the result in Shiraz, Iran's study in 2016 as 95.3% of schools were in appropriate locations[13]. This finding could be related to following the fundamental legislation in building old schools and also to the lack of industrial factories, landfills, and rail stations in Tikrit City. The proper school area is of

significant value in increasing students' physical activities and social connections hence reducing obesity, improving health, and maintaining psychological well-being[16]. Concerning the suitability of school area to student number, this study reported that less than half of schools 13(43.4%), were lower than (10-15m^2) per capita and only 10(33.3%) were meeting the standard. This may be related to the process of occupying large houses as private schools. The result revealed by a study conducted in Garmsar City, Iran in 2018 disagrees with this study result and it showed that 63% of the schools' areas were smaller for their number of students[17]. The schoolyard is available in all schools in this study, 27(90%) are authorized and systematic, but a systematic drainage system for rain is absent in 22(73.3%). The same result appears in the evaluation of the physical school environment in Kirkuk in 2013[9]. This could be due to an inadequate number of water drain filters and the absence of slopes in the schoolyard. Inappropriate schoolyard design was revealed by a previous study in Sulaimani Governorate of Kurdistan, Iraq in 2011[18]. This result was not consistent with the present study. The current study showed available school gardens in 24(80%) schools, and sustainable gardens in 21(87.5%) of them. The suitable green area size to student number (0.5m^2 per capita) is in 14(58.3%) but less in 10(41.7%). The reason might be related to increasing community awareness and support regarding green areas and plant cover and their benefit for air cleanliness, agricultural learning, mood improvement, and aesthetic value. The proper green space per capita that meets standards in the whole studied sample of urban schools in Abadan, Iran in 2017 was reported by Shokri R et al.[14]. An inadequate garden area per student was revealed in 96% of Kermanshah province in Iran in 2012-2013[19]. The classroom conditions and infrastructures such as lighting, ventilation, humidity, adequate space, and furniture have an obvious effect on students' health and the inadequate monitoring and maintenance in good conditions would result in destructive consequences and health problems[16]. In this study, 29(96.7%) school have a suitable class area (1-1.5 m2) per capita. The study showed that 10(33.3%) schools meet the standard class dimensions: width 6m, length 8m, and height 4m. This may be related to complying with standards and legislation in building schools and distribution of students' number among classes since reducing class area per student is highly related to behavioral conflicts and communicable diseases spread among students and school faculty as well. This result is similar to Iran where appropriate class areas in (87.5%) in Evaz,2017[20]. This study revealed that 25(83.3%) school meet the standard for natural ventilation and the artificial ventilation of class is available and suitable in 24(80%). Since ventilation is considered one pillar of maintaining a healthy environment of a setting, most school buildings were built following the national legislation and instructions to ensure constant air changes within the classroom's parameters preventing air pollution and the spread of diseases. The result is similar to the study in Evaz, Iran where 87.5% of the sample had adequate artificial ventilation in the classrooms[20]. In Iran, disagreeing with this study result, natural ventilation was adequate in the whole assessed sample in Garmsar City[17], while in Kermanshah 54% of schools' windows comply with national standards[19]. The natural lighting of classes in this study meets standards in 15(50%), and artificial lighting is enough in 21(70%). Natural lighting is not adequate due to architectural constraints or

the winter season as daylight is less bright when this study begins, so the authorities relied on artificial lighting, especially with the widespread of electrical generators for support. This result agrees with the schools in Kermanshah, Iran that all had appropriate natural and artificial lighting[19]. Also in Garmsar, Iran, adequate natural lighting in 65%, and electrical lighting in 72% of the studied sample[17]. The result in Evaz, Iran was not consistent with this study's result as adequate artificial lighting in 93.7% of the schools[20]. This study showed the unavailability of hand sanitizers in 26(96.7%) of the assessed schools. Despite the benefit of hand sanitizers in preventing diseases and germs from spreading among students and school faculty, it is still a flammable liquid as alcohol is the main ingredient in it. This study showed the suitable number of school benches to student numbers in 28(93.3%) schools. These benches are suitable for students physically and mentally. This might be related to the need for accommodating in manufacturing the schools' benches for a range of every age group because the classroom seats have a critical impact on student's health, comfort, and learning during class hours. Similar results as School benches were appropriate for students in schools in Kermanshah, Iran[19], and in 68.7% of schools in Evaz, Iran[20]. This study showed the suitable distance between the board and the first row (1.5-2m) appears in 28(93.3%) schools. This may be due to awareness of myopia and the expected future complications in adult life. This result is not consistent with the result in Garmsar City, Iran which revealed that 53% of schools have an appropriate distance of the board from the first row[17].

The appropriate school location and the optimal ratio of school area to student count in this study are significantly higher in public schools 14(70%) compared to private schools with P-Value 0.034. This can be explained by the higher number of public schools compared to private ones in this sample. This is supported by the result revealed by Sanni UA et al. in Nigeria where all public schools were significantly higher 40(100%) than private schools in Gwagwalada, P-Value <0.001[21]. In contrast, comparing a school location study in 2012 in Calabar, Nigeria, the result revealed that a higher score was associated with private schools over the public one P-Value 0.046[22]. This might be explained by complying with the terms of building governmental schools and choosing settings for private ones. The available, authorized schoolyard and properly functioning drainage system along with an available and sustainable school garden that has an area ($0.5m^2$) per capita in this study are significantly higher among public schools 12(60%) as P-Value 0.011. The total domain of schoolyard and garden as available, authorized schoolyard and connected to the systematic drainage system for rain drainage along with available and sustainable school garden with an area suitable to student number ($0.5m^2$) per capita shows a statistically significant difference attributed to single and double shift schools where P-Value 0.046, more among double shift schools 10(66.7%). This may be related to the high number of students occupying these settings and using these facilities during the course of a single day. Gender attendance(male, female, and mixed) does not have any statistically significant differences in the indicators of schools' environmental health and safety status. This might be explained by the similarity of neighborhood environmental exposures for male, female, and mixed-gender attendance.

CONCLUSION

The study revealed that 19(63.3%) schools in Tikrit City did not meet the health and safety standards regarding school classes and furniture while more than half of the schools 16(53.3%) were fully meeting the standards regarding school location and area. The schoolyard and garden were fully meeting the standards in 14(46.7%) of the schools. Public schools have advanced status of health and safety regarding school location and area, and schoolyard and garden over the private schools. Double-shifted schools are better than single-shifted schools regarding the schoolyard and garden. There was a limitation in reaching a sufficient amount of documented studies on environmental health and safety indicators among Iraqi schools due to the lack of an archive process.

CONFLICT OF INTEREST

No conflict of interest during conducting and writing this research.

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