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The Effect of Swimming Pool Water Quality on Health Complaints of Child Athletes Using the Swimming Pool (FIKK UNY)

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ABSTRACT: The study aims to determine the effect of swimming pool water quality on the health complaints of children and athletes using the FIKK UNY swimming pool. The research method used was descriptive correlational research. Primary data collection techniques include observation, questionnaires, and interviews, as well as secondary data obtained from books, journals, literature, documentation, and theses related to this research. This research was conducted at the FIKK UNY swimming pool with a population of all children's swimming athletes who use the FIKK UNY swimming pool, as many as 75 children. The sample was determined by random sampling, which amounted to 50 children who were given a questionnaire several times in January 2024. The data analysis techniques used in this research are descriptive analysis and inferential analysis using the SPSS version 26.0 computer program.

The results showed that: 1) The description of the water quality of the FIKK UNY swimming pool is in the high value category (meeting health requirements) (64%); 2) The description of user health complaints at the FIKK UNY swimming pool is in the high value category (no health complaints) (56%); 3) Swimming pool water quality has a positive and significant influence on health complaints of child athletes using the FIKK UNY swimming pool (significance value $\alpha = 0.00 < 0.05$).

Based on the results of the study, the authors suggest to swimming pool managers that they pay attention to the quality of their swimming pool water so that it meets the requirements of PermenKES RI Number 32 of 2017 concerning swimming pool water management, which includes physical, chemical, and microbiological parameters. Parties related to swimming pools are expected to provide counseling on the importance of swimming pool water quality for child athletes in particular and all pool users in general.

KEYWORDS: swimming pool water quality, health complaints, child athletes, and swimming pools

I. INTRODUCTION

A swimming pool is a place and public facility in the form of a pool construction containing treated water equipped with comfort and safety facilities, both located inside and outside the building, used for swimming, recreation, or other water sports (Menteri Kesehatan Republik Indonesia 2017). A swimming pool is an artificial construction designed to be filled with water and used for swimming, diving, or other water activities. It is usually a sought-after place to unwind, cool down, and relax (Praja, Imansyah, and Arvan 2022). Swimming pools are artificial ecosystems for bathing where people mimic natural water conditions (Schets et al. 2020).

Swimming is a safe sport for all ages (Apriyanty 2021). Swimming is one of the sports that can improve fitness, quality of life, and human health. In fact, sometimes swimming triggers the onset of several diseases (Citra DW 2013); (Schets et al. 2020). Various diseases, from mild to severe, can be transmitted through swimming pools, such as symptoms of fever, cough, cold, or pharyngo conjunctivitis infection caused by adenovirus (Aldi Lumbantobing et al. 2022); (Keluhan et al. 2017). In fact, several studies have revealed that the effect of chlorine at certain levels and over the over the long term is at risk of causing various organ disorders, including asthma, and increasing the risk of cancer (Sudarma et al. 2018).

Pollution in swimming pool water can be caused by chemical pollution and microbiological pollution. Chemical pollution of swimming pool water can come from chemicals attached to the swimmer's body such as sweat, urine, soap residue, and cosmetics (WHO 2006), (Pools and Environments n.d.), while microbiological pollution of swimming pool water can come from faecal

contamination from swimmers, faecal contamination from animals in the swimming pool environment, and faecal contamination in the water source used as swimming pool water (WHO 2006); (Pools and Environments n.d.).

One of the measures taken to kill pathogenic microorganisms in swimming pool water is disinfection. Among the several commercially available water disinfection solutions chlorination, bromination, ozonation, ultraviolet radiation and mixed oxidant electrochemical materials (Teo, Coleman, and Khan 2015). Chlorine-based products are usually preferred for controlling the microbiological hazards of water due to their effectiveness and relative low cost (Gabriel et al. 2019). The type of chlorine that is often used is chlorine (CaOCl). In the chlorination process, the residual level of chlorine produced in water should be maintained at 0.2 mg/l because this value is the safety limit of chlorine in water to kill pathogenic germs that contaminate water (Keluhan et al. 2017). Water that does not meet the standards will be dangerous if used or entered the body because it can disrupt human health (Afkarina 2023).

Chlorine will react with water to form hypochlorous acid, which, when it enters the human body, will damage body cells (Sudarma et al. 2018). Based on Sudarma in Norlatifah (2012), the impact of chlorine depends on the level, type of chlorine compound, and most importantly, the toxicity of the compound (Sudarma et al. 2018). Chlorine will also affect swimming athletes because chlorine will be released into the skin, hair, and other body parts when swimming. All pool users are encouraged to shower before and after swimming so that their hair, skin, and other limbs are not exposed to chlorine (Mulyono 2022). Eye irritation due to chlorine exposure causes eye diseases, affects vision, and causes a decrease in eye acuity so that vision becomes blurred or can even cause blindness in severe conditions (Keluhan et al. 2017).

Knowing the quality of water is very important as it can indicate whether the water is heavily, moderately, or lightly polluted (Raokhil, Fariyya, and Yulianti 2021). Environmental Health Quality Standards for Swimming Pool Water Media include physical, biological, and chemical parameters (Menteri Kesehatan Republik Indonesia 2017). Physical parameters in the Environmental Health Quality Standard for swimming pool water media include odor, turbidity, temperature, clarity, and density. Chemical parameters in the Environmental Health Quality Standards for swimming pool water media include six parameters, namely pH, alkalinity, residual free chlorine, residual bound chlorine, total bromine and residual bromine, and oxidation reduction. potential.

Chemical monitoring of swimming pool water quality is one of the sanitation measures taken. Among them is the provision of chemical compounds in the form of chlorine compounds in the form of chlorine ($Ca(OCl_2)$), which functions to reduce organic substances, oxidize metals, and disinfect against microorganisms. However, the use of chlorine must also be considered properly and must comply with existing safe limits. The use of chlorine in low concentrations can cause microorganisms in the swimming pool to not be disinfected properly. While the use of chlorine with excessive concentrations can leave residual chlorine, which has a negative impact on health (Citra DW 2013).

In reality, this problem has not been given much attention because there is no research data on it. The condition of existing facilities and supervision systems allows problems to arise that must be watched out for. The use of chlorine in swimming pool water is very common because chlorine can play a role in maintaining water clarity so that it can be used longer and can kill bacteria in swimming pool water, especially bacteria in swimming pool water that does (Pakaya, Jusuf, and Abudi 2013).

Based on research on 5 public swimming pools in Semarang city, namely Jungle Town Swimming Pool, Manunggal Jati Swimming Pool, Paradise Club Swimming Pool, and Semawis Swimming Pool in 2017, it provides evidence that the five swimming pools have an average chlorine residual exceeding the legal limit PERMENKES RI No. 416 Year 1990 for swimming pool water category. This condition resulted in health complaints from most visitors to the five swimming pools, including eye irritation, skin irritation, and swimming accidents (Luis et. 2008).

However, based on the case example presented above, which discusses more about chemical parameters without paying much attention to physical and chemical parameters and the influence of both on child athletes using the swimming pool. Here, the author focuses more on assessing physical parameters through direct observation, and chemical parameters, especially the residual chlorine in the FIKK UNY swimming pool. These two parameters are the most important because the chlorine contained in kaporit serves to kill various pathogenic bacteria in the water, so the microbiological parameters do not need to be studied further if the residual chlorine does not exceed the threshold set by PERMENKES RI Number 32 year 2017. With this consideration, it is considered to represent other parameters that are not studied.

II. METHODS

Based on the form of data observed, this research is a type of analytical survey, research directed at explaining a situation (Wardaningsih n.d.). The results of survey data are designed to provide information about the status of symptoms at the time the research is carried out, with the hope that the research can describe the variables or conditions that exist in a situation. The method used in this research is the descriptive method, which is a type of correlational study. This research method is intended

to describe existing phenomena that take place at this time or in the past (Nasution et al. 2019). The research includes descriptive correlation because all variables to be observed are described, then correlated between the independent variable (independent variable/X) and the dependent variable (dependent variable/Y).

This research was conducted at the FIKK UNY Swimming Pool, Kuningan Street No. 1, Caturtunggal, Depok, Sleman, YK, in January 2024. Data collection using observation, questionnaires, laboratory tests, and interviews with 50 child athletes using the FIKK UNY swimming pool.

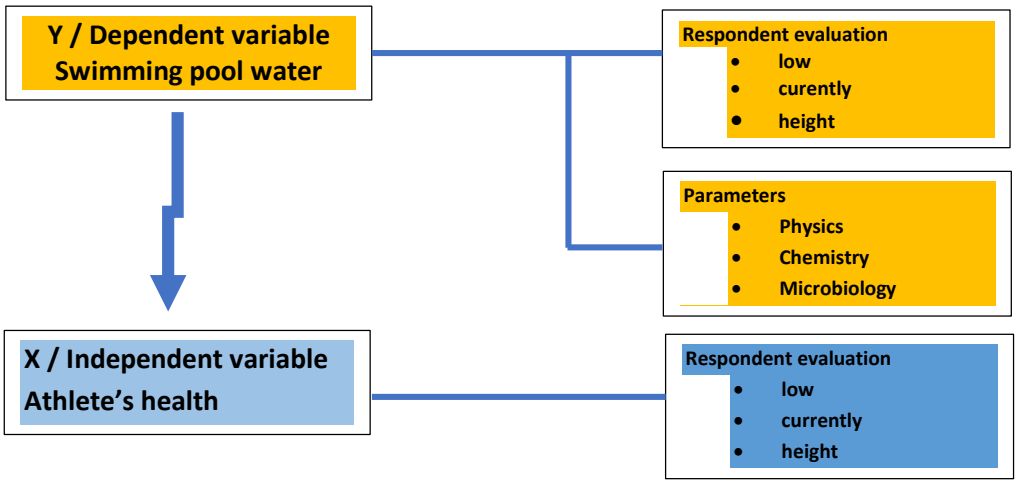


Figure 1. The research conceptual framework

III. RESEACH RESULTS

Table 1. Age distribution and presentation

Age category	Frekuency	Precentage %
< 10 years	12	24
10 – 12 year	38	76
Total	50	100

Based on Table 1, the character of the respondents can be seen from the age distribution and percentage. There are 10 athletes with ages <10 years, or around 24%. While respondents are ages 10–12, there are 38 athletes, or around 76%.

Table 2. Caracter by gender and presentation

Gender	Frekuency	Precentage %
Male	23	46
Female	27	54
Total	50	100

Table 2 shows the characteristics of respondents based on gender, for men as many as 23 athletes (46%), and for women as many as 27 athletes (54%). So the sample character data based on gender shows that female athletes are more than men.

Table 3. Frequency distribution and percentage of pool water quality

Interval	Value Category	Frekuency	Precentage %
7– 10	Low	6	12
11– 14	Currently	12	24

15– 18	Height	32	64
Total		50	100

Table 3 shows the frequency distribution and percentage of FIKK UNY swimming pool water quality that gives an assessment below the average of 6 athletes, or around 12%. At the average value, there are 12 athletes, or about 24%. Most athletes give a high category of water quality in the swimming pool of FIKK UNY, as indicated by 32 athletes, or 64% of all athletes who are used as respondents. From the description, it can be concluded that the variable water quality of the FIKK UNY swimming pool is included in the high category (that is, meeting health requirements). For more details, an overview of the water quality of the Tirta Lontara Makassar swimming pool can be seen in the following histogram.

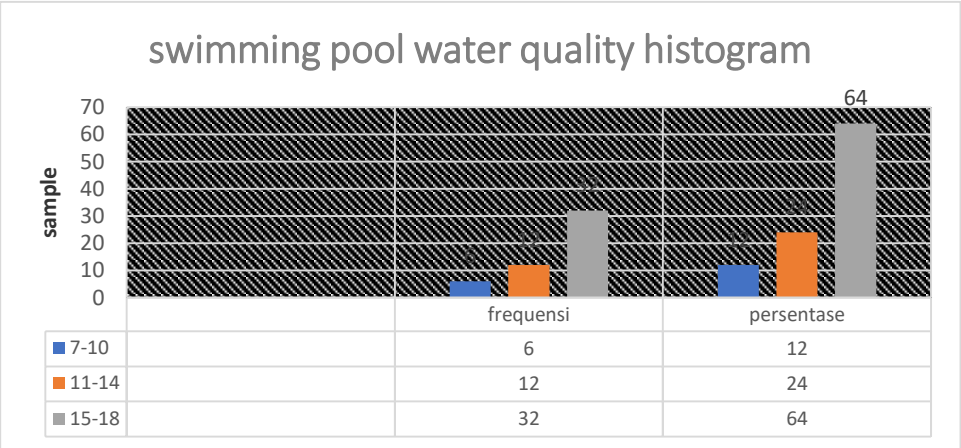


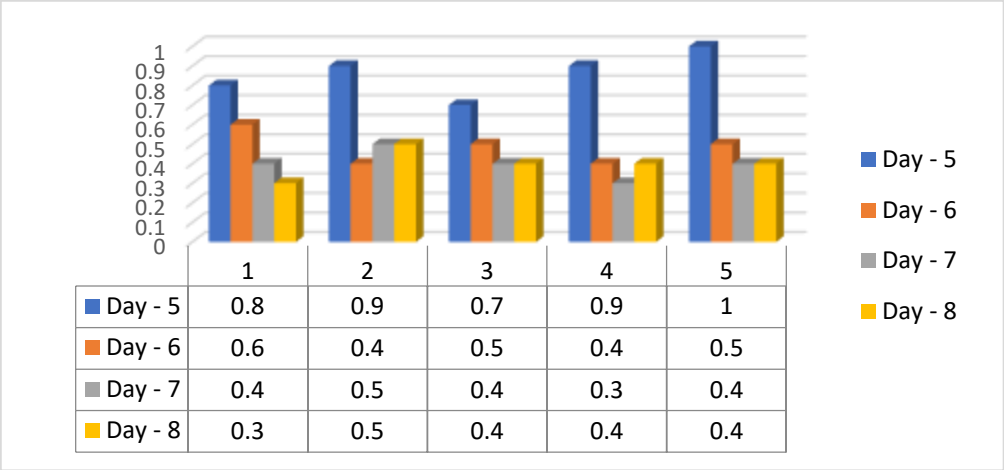
Figure 2. Swimming pool water quality

Table 4. Residual chlorine test results

Day	sample	Sample Discription	Residual Chlorine	Result
Day - 5	I II III IV V	- Water samples were taken at the edge of the swimming pool, 1.2 meters deep (3 samples). - Water samples were taken at a depth of 3.2 meters (2 samples).	I = 0,80 mg/L II = 0,90 mg/L III = 0,70 mg/L IV = 0,9 mg/L V = 1 mg/L	Unqualified Health
Day - 6	I II III IV V	- Water samples were taken at the edge of the swimming pool, 1.2 meters deep (3 samples). - Water samples were taken at a depth of 3.2 meters (2 samples).	I = 0,60 mg/L II = 0,48 mg/L III = 0,50 mg/L IV = 0,4 mg/L V = 0,50 mg/L	Qualified Health
Day - 7	I II III IV V	- Water samples were taken at the edge of the swimming pool, 1.2 meters deep (3 samples). - Water samples were taken at a depth of 3.2 meters (2 samples).	I = 0,40 mg/L II = 0,50 mg/L III = 0,40 mg/L IV = 0,30 mg/L V = 0,40 mg/L	Qualifield Health

Day - 8	I II III IV V	- Water samples were taken at the edge of the swimming pool, 1.2 meters deep (3 samples). - Water samples were taken at a depth of 3.2 meters (2 samples).	I = 0,30mg/L II = 0,50 mg/L III = 0,40 mg/L IV = 0,40 mg/L V = 0,40 mg/L	Qualifield Health

The chlorine content of FIKK UNY swimming pool water is in accordance with or meets the health requirements of 0.05 mg/L, although on the 5th day of collection, the laboratory test results show a number exceeding the residual chlorin content required by KEMENKES No. 32 of 2017. For more details, it can be seen in the histogram graph below:



	1	2	3	4	5
Day - 5	0.8	0.9	0.7	0.9	1
Day - 6	0.6	0.4	0.5	0.4	0.5
Day - 7	0.4	0.5	0.4	0.3	0.4
Day - 8	0.3	0.5	0.4	0.4	0.4

Figure 3. Swimming pool residual chlorine

Table 5. Health Complaint

Class Interval	Value Category	Frequency	Percentage %
7-10	Low	7	14
11-14	Currently	15	30
15-18	Height	28	56
Total		50	100

Based on the table of health complaints of FIKK UNY swimming pool users, there are 28 respondents, or 56%, in the high category (meaning there are no user health complaints). There are 15 respondents, or 30% of FIKK UNY swimming pool users, in the moderate category (meaning that they sometimes feel complaints), and there are 7 respondents, or 14%, who are in the low category (meaning that there are user health complaints even though they are mild).

It can be concluded that the variable of user health complaints at the FIKK UNY swimming pool is included in the high category (meaning there are no user health complaints). For more details, an overview of user health complaints at the FIKK UNY swimming pool can be seen in the following histogram.

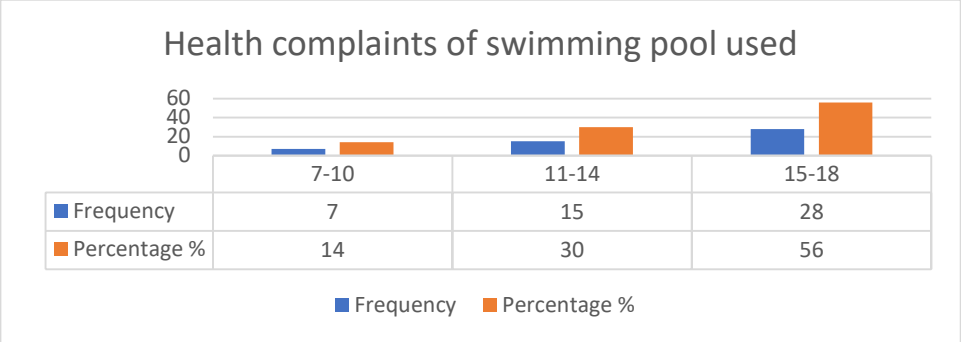


Figure 4. Health complaints about swimming pools used

Table 6. The effect of water quality (X) on health complaints (Y)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.133	1.085		1.044	.302
	water quality	.893	.075	.865	11.952	.000

a. Dependent Variable: Health Complaints

Y = 1,133 (α)+ 0,893 (X) + e

Meaning consanta (α) = 1.133 means that if the water quality is constant or fixed, then health complaints are 1.133. Regression direction coefficient / β (X) = 0.893 (positive value) means that water quality increases (1) unit, then health complaints increase by 0.893.

1. a = 1.133, meaning that without taking into account the effect of swimming pool water quality (X), the level of the absence of user health complaints (Y) at Tirta Lontara swimming pool Makassar is 1.133 units. Or, in other words, that the number = 1.436 is an estimate of the magnitude of the absence of user health complaints (Y) at Tirta Lontara swimming pool Makassar, which reaches 1.436%, which is not influenced by the pool water quality factor (X) but is influenced by other factors outside the model.
2. b = 0,893; artinya bahwa setiap kenaikan 1 (satu) satuan kualitas air kolam renang (X), maka besarnya tingkat tidak adanya keluhan kesehatan atlet anak-anak (Y) pada kolam renang FIKK UNY adalah 0,893%. Atau dengan kata lain, bahwa koefisien regresi X (kualitas air kolam renang) sebesar 0,893 menyatakan bahwa setiap penambahan kualitas air kolam renang yang diidentifikasi dalam penelitian ini sebesar satu satuan atau kualitas air kolam renang dioptimalkan, maka dampaknya akan menaikkan tingkat tidak adanya keluhan kesehatan atlet anak-anak (Y) pada kolam renang renang FIKK UNY sebesar 0,893% dengan asumsi faktor lainnya, adalah konstan (ceteris paribus).

The significance value is 0.000 <0.05 and the t value is 11,952> t table 1.68. Based on this data, it can be concluded that water quality has a positive and significant effect on health complaints, meaning that the higher the value of water quality, the higher the value of health complaints (few health complaints).

The comparison of t count 11.952 > t table 1.68 shows that the estimation of the regression coefficient parameter β1, namely b1 = 0.893 is also real with a positive direction. So it can be explained that swimming pool water quality (X) has a positive and significant influence on health complaints of child athletes using the FIKK UNY swimming pool.

Table 7. R Square the effect of water quality (X) on health complaints (Y)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	.748	.743	1.45498
a. Predictors: (Constant), water quality				

The table above shows the effect of water quality (X) on health complaints (Y) at the FIKK UNY swimming pool of 0.748, or 74.8%. It can be interpreted that 74.8% of changes in health complaints (Y) of children and athletes using the FIKK UNY swimming

pool can be caused by the variable water quality (X) of the swimming pool. The remaining 25.7% is caused by other variables that are not explained in this study.

The correlation coefficient R = 0.865 means that the correlation between swimming pool water quality (X) and health complaints (Y) of child athletes at the FIKK UNY swimming pool is strong. As in the following table,

Table 8. Qualitative Conversion of IKH Value

IKH Value	Qualitative Interpretation
0,75 – 1,00	Stronge
0,35 – 0,74	Moderate
0, 00 – 0,34	Weak

IV. DISCUSSION

The condition of swimming pool water is important for child athletes due to their high swimming intensity. Almost every day, child athletes practice and have direct contact with swimming pool water. Health complaints due to poor water quality conditions or high chlorine levels are a threat to them. The importance of good water quality for swimming pools is supported by PERMENKES number 32 of 2017 concerning the management of environmental health quality standards for swimming pool water media, including physical, biological, and chemical parameters.

Research has been conducted on the effect of swimming pool water quality on the health complaints of children and athletes using the FIKK UNY swimming pool. First, we obtained data on the character of respondents based on age <10 years: there are 12 athletes, or 24%, and age 11–12 years, there are 38 athletes, or 74%. Second, respondent character data is based on male gender (23 athletes, or 46%), and female gender (27 athletes, or 54%).

The results of the physical analysis obtained a descriptive statistical description of the water quality of the FIKK UNY swimming pool based on the questionnaire in the high (64%), medium (24%), and low (12%) categories. This data shows that the quality or condition of FIKK UNY swimming pool water has met the requirements set by PERMENKES No. 2 Year 2017. While the results of the assessment of water quality based on chemical parameters (residual chlorine) can be described based on laboratory tests on day 5 or sample 1 showing chlorine levels exceeding the limits set by the government, This condition is because at the time of sampling, the swimming pool had not been used and had just been given granule (chlorine/Cl 90%). For the 2nd, 3rd, and 4th laboratory tests, the residual chlorine has decreased and is in accordance with the requirements set by the government because it has evaporated, precipitated, and been partially attached to the skin of swimming pool users.

The description of health complaints of child athletes using the FIKK UNY swimming pool is in the high category of 28 athletes (56%), 15 athletes (30%), and 7 athletes (14%). This data shows that there are no significant health complaints among children and athletes using the FIKK UNY swimming pool. Data showing moderate and low levels are due to the lack of attention researchers paid to the history of disease among respondents. In addition, swimming unconsciously releases nitrogen-component organic substances such as sweat, saliva, and urine (Pools and Environments n.d.). If chlorine mixes with these organic substances, it will produce harmful residual substances, such as chloramine, which can irritate the eyes, skin, and upper respiratory tract. The conclusion can be drawn from the indicators of health complaints experienced by child athletes, which do not occur in the FIKK UNY swimming pool.

The results of the descriptive analysis show that between the quality of swimming pool water and the health complaints of children and athletes using the FIKK UNY swimming pool, each is in the high category. This condition shows that both are directly proportional. If the water quality of the swimming pool is good, then there will be no health complaints from children or athletes using the FIKK UNY swimming pool.

For inferential statistical analysis using a simple linear regression test through the application of a t-test, it can be seen that the quality of swimming pool water has a significant influence on the health complaints of children and athletes using the FIKK UNY swimming pool. With a significance value of $P \leq 0.05$, it can be concluded that water quality has a positive and significant effect on health complaints, meaning that the higher the value of water quality, the higher the value of health complaints (fewer health complaints).

The results of this analysis provide an answer to the hypothesis that "there is a significant effect of swimming pool water quality on health complaints of children using the FIKK UNY swimming pool," which has been proven, or, in other words, the alternative hypothesis (H1) is accepted.

V. CONCLUSIONS

Researchers can draw final conclusions from the research results, which can provide guidance to managers and users: the higher or better the quality of swimming pool water,the greater the impact on the health complaints of child athletes who use the FIKK UNY swimming pool.

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