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Comparison of the Permanent Skin Flora of Children Who Had A Wiping Bath with Two Different Products: A Randomized Controlled Study

İki Farklı Ürün ile Silme Banyo Yapılan Çocukların Kalıcı Deri Floralarının Karşılaştırılması: Randomize Kontrollü Çalışma

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Abstract

Introduction: Microbiota in healthy individuals includes many and different microorganisms. Infections, use of antibiotics, various chemicals (antiseptic solutions, soaps, shampoos, etc.) can change the human microbiota. This study was planned to compare the effect of wiping bath with 2% daily chlorhexidine gluconate and soap-free body washing solution on the skin microbiota of the patients hospitalized in the pediatric intensive care unit.

Methods: The research was carried out as a randomized controlled experimental study with 60 children hospitalized in the pediatric intensive care unit of a training and research hospital in February 2021-January 2022. In the study, the children in group I (n=30) were given a wiping bath with 2% chlorhexidine gluconate, which is the routine application of the unit and the children in group II (n=30) were given a soap-free body wash solution. In both groups, swab samples were taken from the armpits and groin for 3 days just before the application of the wiping bath and 6 hours after the application of the wiping bath.

Results Children participating in the study 36.7% (n=22) were girls and 63.3% (n=38) were boys. The mean age of the participants was determined as 6.05±5.04. When the reproductive changes in the permanent skin flora between the groups were examined, a significant difference was found between group I and group II before and after bathing on the 1st, 2nd and 3rd days (p=0.001). Persistent skin flora decreased significantly in group I on the 1st day, while it disappeared completely on the 2nd and 3rd days. In group II, the permanent skin flora continued to be preserved for 3 days.

Öz

Giriş: Sağlıklı bireylerde flora, çok sayıda ve farklı mikroorganizmaları içermektedir. Enfeksiyonlar, antibiyotik kullanımı, çeşitli kimyasallar florayı değiştirebilmektedir. Bu çalışma çocuk yoğun bakım ünitesinde yatan çocukların günlük %2'lik klorheksidin glukonat ve sabunsuz vücut yıkama solüsyonu ile yapılan silme banyosunun kalıcı deri floralarına etkisinin karşılaştırılması amacıyla yapılmıştır.

Yöntemler: Çalışma, Şubat 2021-Ocak 2022 yılında bir eğitim ve araştırma hastanesi çocuk yoğun bakım ünitesinde yatmakta olan 60 çocuk ile randomize kontrollü deneysel olarak gerçekleştirildi. Çalışmada grup I'deki (n=30) çocuklara ünitenin rutin uygulaması olan %2'lik klorheksidin glukonat ile grup II'deki (n=30) çocuklara ise sabunsuz vücut yıkama solüsyonu ile silme banyosu uygulanmıştır. Her iki grupta da 3 gün boyunca silme banyo uygulamasından hemen önce ve 6 saat sonrasında koltuk altı ve kasıktan sürüntü örnekleri alınmıştır.

Bulgular: Çalışmamıza katılan çocukların %36,7'si (n=22) kız, %63,3'ü (n=38) erkektir. Katılımcıların ortalama yaşı 6,05±5,04 olarak belirlenmiştir. Gruplar arası kalıcı deri florasındaki üreme değişimleri incelendiğinde 1., 2. ve 3. günlerde banyo öncesi ve sonrasında grup I ve grup II arasında anlamlı düzeyde farklılık saptanmıştır (p=0,001). Birinci günde grup I'de kalıcı deri florası anlamlı düzeyde azalırken, 2. ve 3. günlerde ise tamamen yok olmuştur. Grup II'de ise 3 gün boyunca kalıcı deri florası korunmaya devam etmiştir.

Sonuç: Araştırma sonucunda çocuk yoğun bakım ünitesinde yatan çocuklarda %2'lik klorheksidin glukonatlı silme banyosunun

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Conclusion: As a result of the research, it was determined that 2% chlorhexidine gluconate wiping bath in children hospitalized in the PICU significantly reduced the persistent skin flora in the armpits and groin.

Keywords: Microbiota, permanent skin flora, wiping bath, chlorhexidine gluconate, soap-free washing body solution

koltuk altı ve kasıktaki kalıcı deri florasını anlamlı düzeyde azalttığı saptanmıştır.

Anahtar Kelimeler: Mikrobiyata, kalıcı deri florası, silme banyo, klorheksidin glukonat, sabunsuz vücut yıkama solüsyonu

Introduction

It has been found that about 15-20 years ago, the number of microorganisms in the human body was much higher than the human's own cells and the viruses, which are expressed at the quadrillion level, are located in different surfaces and spaces of our body along with approximately 10^{14} bacterial cells.[1] Microbiota is the ecosystem formed by commensal, symbiotic and pathogenic microorganisms (bacteria, eukaryotes, fungi, viruses, archaea, etc.), which are living inside and on the surface of the human body and are non-human cell.

All the genes encoding them are called the microbiome. The microbiota has about 10 times more cells than the human cells. It has been demonstrated in many studies that it is effective in the blood circulation in the tissues they are in and in its environment, immune system, metabolism and bone restructuring.[2,3] Multi-center and comprehensive studies, such as the Human Microbiome Project and the MetaHIT Project, have led to the discovery of important findings in this regard.[4]

It has been determined that microorganisms residing in different body cavities affect human health in various ways and can alter the susceptibility to infection by interacting with the host's immune system, and any change that occurs for any reason leads to pathologies.[1,4] The skin is a critical interface between the human body and its external environment, which prevents moisture loss and prevents the entry of pathogenic organisms. At the same time, the skin flora is an ecosystem that hosts living microorganisms on human skin. It has many functions; it acts as a defense and works as a regulator for the immune system.[5-7]

Flora is generally thought of as two groups; it is known that some microorganisms are "permanent" and some are "temporary" in the environment for a certain period of time. Permanent flora are microorganisms that do not mostly change in certain areas and can regenerate even if they are eliminated for a short time. Permanent flora is generally considered as common, which means that microbes are not harmful and can benefit our bodies. Temporary flora, on the other hand, include the pathogen or non-pathogen microorganisms that can be transmitted from the environment and remain in the body for different periods, besides the permanent flora. When permanent flora members disappear, they are replaced by temporary flora members.[8]

Hygienic care affects the general appearance of the individual and helps him to feel more comfortable. In other words, hygienic care responds to both physical and psychological needs of the person. Bathing of patients constitutes an important part of nursing care. It is a part of the general hygienic care and has a positive/negative effect on the skin flora. Bed bath, which is included in bedside patient care, includes basic purposes such as providing relaxation as well as hygiene of the person. When choosing the solutions used during the bath, care should be taken to ensure that they do not harm the skin, do not deteriorate the skin flora, do not dry the skin and remove dirt.[9-11]

Chlorhexidine is a product developed in the 1940s in research laboratories in England as a result of studies performed to produce an antiviral agent. Introduced as an antiseptic cream in 1953, chlorhexidine has been used since 1957 for the treatment of skin, eye and throat infections and for general disinfection in both humans and animals.[12] In recent years, it is seen that chlorhexidine has been used as an antiseptic cleaning solution in bed baths in hospitals.[13]

In healthy individuals, the flora includes many and different microorganisms. The microbiota, which begins to form immediately after birth, varies according to nutrition, genetics, age, geographical region and climate. Human skin flora may change after infections, antibiotic use, and applications such as various chemicals (antiseptic solutions, soaps, shampoos, etc.). This study was conducted to compare the effects of daily wiping bath with 2% chlorhexidine gluconate and soap-free body wash on the permanent skin flora of children hospitalized in the pediatric intensive care unit.

Research Hypotheses

H_1: Permanent skin flora of children who are applied wiping bath with 2% chlorhexidine gluconate in the pediatric intensive care unit decreases.

H_2: Permanent skin flora of children who are applied wiping bath with a soap-free body wash solution in the pediatric intensive care unit does not change.

Materials and Methods

Participants

The population of the research consisted of children who were admitted to the pediatric intensive care unit for the first time during the research process. At the time of the research, an average of 420 children were hospitalized. In order to determine the size of sample, power analysis was carried out using the G*Power (v3.1.7) program and it was decided to include 30 children in each group, considering that there should be at least 26 children in each group and that there might be losses during the study. The research was carried out between February 2021 and January 2022 in the pediatric intensive care unit of a training and research hospital.

The inclusion criteria for the study were the child's hospitalization in the intensive care unit within the first 24 hours, being hospitalized for internal reasons, having no concomitant disease, receiving no other ongoing treatment, being hospitalized in the pediatric intensive care unit during the data collection process, and parents' willingness to participate in the study. The exclusion criteria were the child's having a history of hospitalization in the intensive care unit, being inconvenient performance of a regular wiping bath every day, hospitalization after surgical procedures, the initiation of antibiotics during the study, having allergy to chlorhexidine gluconate, having conditions in which the skin integrity was impaired (burn, skin disease, etc.), having a history of immunosuppressive agent use containing antibiotics, probiotics or steroids in the last two months, receiving radiotherapy or chemotherapy, having severe septic shock, having tracheostomy, peg, permanent dialysis catheter, etc., parents' not wanting their child to participate in the research or wanting to quit the research while it was ongoing.

None of the participants were excluded from the study during data collection period.

Research Type

The study was a randomized controlled experimental study. The blocked randomization method was used in the randomization of the patients to be included in group I and group II. Based on the numbers obtained from the block randomization performed on the computer, the researcher randomized the children according to the order of hospitalization. The study was carried out as single-blind. The participants did not know which solution to use as a wiping bath.

Variables of the Study

1. Dependent variables of the study: Reproduction status in persistent skin flora.

2. Independent variables of the study: 2% chlorhexidine gluconate, soap-free body cleansing solution.

Data Collection Tools

Child information form: The child diagnosis form, developed by the researcher considering similar studies[4,14-16], consists of questions on demographic information about the child (age, gender, reason for hospitalization, date of hospitalization, etc.).

Wiping bath application chart: The wiping bath application chart was created by the researcher to record information about skin reactions that might occur in the patient during wiping bath and the reproduction status of skin flora in swab samples taken before and after children's bath applications.

Sterile culture swab: Cotton-tipped plastic durable unbreakable swabs are available as sterile in 12x150 mm polypropylene tubes. Culture sticks with sterile swab were used in the study.

Ready to use media plate: Swab samples taken in the study were cultured on Blood Agar base.

Soap-free body wash solution: Soap-free face and body wash solution (Sebamed®) was used for sensitive skin in the study. The product has a pH value of 5.5 for healthy skin to maintain the moisture balance of the skin. It supports and protects the natural barrier function of the skin's natural protective layer.

2% Chlorhexidine gluconate solution: Chlorhexidine, which is a cationic (positively charged) bisbiguanide biocide, has a strong antibacterial effect and is effective against many microorganisms. This makes it ideal for reducing the microbial load on patients' skin and preventing secondary environmental contamination. Chlorhexidine, which has been generally used safely as an antiseptic in recent years, is effective against Gram-positive and Gram-negative bacteria and it has a wide range of effects.[12]

Data Collection

In the study, children in group I (n=30) were performed a wiping bath with 2% chlorhexidine gluconate, which is the routine application of the unit. Before wiping bath, a swab sample was taken from the armpit and groin in a circular manner, covering the entire region, with the help of a sterile swab stick. After taking the sample, the children were applied a wiping bath by the researcher. Necessary materials were prepared before wiping bath. Necessary materials were nonsterile gloves and apron, antiseptic solution containing 2% chlorhexidine gluconate (obtained by diluting 4% chlorhexidine gluconate one to one with warm water), warm water (40 °C), liquid thermometer, kidney tub, hydrophilic gauze, disposable bath towels, clean sheets, clean patient gowns, and dirty laundry bags. The general condition of the child was evaluated. The application to be made for the child was explained and a suitable environment was prepared

considering his/her privacy. Hands were washed; apron and nonsterile gloves were worn. 2/3 of the kidney tub was filled with 40 °C water. The rinsing water was made ready by throwing hydrophilic gauze into the tub. Bed linens were removed, leaving only one sheet on the child, and the child's apron was removed. A swab sample was taken from the right armpit and right groin before the procedure. After the entire body surface under the child's chin was wetted with water, the entire body surface was foamed with 2% chlorhexidine gluconate for 10-15 minutes and washed. The child's body was wiped with hydrophilic gauze in the tub with clear water in the following order, from the clean area to the dirty area. Each gauze was used on one body area; right arm and armpit, left arm and armpit, anterior trunk, right leg, left leg, back, perianal region and groins. After the wiping process was completed, the patient was dried with a disposable bath towel and the gloves were removed. The child was dressed in a clean apron and, if necessary, the bed linen was changed. Dirty tools were removed from the environment. Hands were washed after the procedure. The procedure was recorded in the child's file and on the research data collection forms. The bathing process took 20-30 minutes. A swab sample was taken from the armpit and groin in a circular manner, covering the entire region, with the help of a sterile culture stick at the 6th hour after the wiping bath. The swab sample taken was kept in the transport medium of the swab until it was cultured. After inoculation on blood agar medium, it was kept at +4-8 °C for an average of 18-24 hours. A total of 12 swab samples were taken from each child and from the same regions for 3 days, and the reproductive status in the permanent skin flora was evaluated.

Children in group II (n=30) were performed a wiping bath with a soap-free body wash solution. Before wiping bath, a swab sample was taken from the armpit and groin in a circular manner, covering the entire region, with the help of a sterile swab. After taking the sample, the children were applied a wiping bath by the researcher. The wiping bath process was performed in the same way as it was applied to the children in group I. A swab sample was taken again from the armpit and groin in a circular manner, covering the entire region, with the help of a sterile swab at the 6th hour after the wiping bath. The swab sample taken was kept in the transport medium of the swab until it was cultured. After inoculation on blood agar medium, it was kept at +4-8 °C for an average of 18-24 hours. A total of 12 swab samples were taken from each child and from the same regions for 3 days, and the reproductive status in the permanent skin flora was evaluated.

Statistical Analysis

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) software was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used while evaluating the study data. The Pearson's chi-square test, Fisher's Exact test and McNemar test were used to compare qualitative data. Statistical significance was accepted as $p<0.05$.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of University of Health Sciences Turkey, Ümraniye Training and Research Hospital (15.02.2021/28) before starting the study. Before the research, the parents of the participants were informed about the research and written consent was obtained from the parents who agreed to have their children participate in the research. After the ethics committee approval, written permission was obtained from the İstanbul Provincial Health Directorate to conduct the study. The ClinicalTrials (Protocol Registration and Results System) registration number of the trial is NCT04845672.

Results

The study was conducted with a total of 60 children, including 36.7% (n=22) girls and 63.3% (n=38) boys, who were hospitalized in the pediatric intensive care unit. No statistically significant difference was found between the distribution of the groups according to gender ($p>0.05$). There was no statistically significant difference between the groups in age, weight and height measurements ($p>0.05$). The hospitalization period of the cases varied between 3 and 16 days, and the mean duration was determined as 5.92±3.10 days. No statistically significant difference was detected between the groups in terms of the lengths of hospitalization ($p>0.05$). No skin reaction was observed on the 1st, 2nd and 3rd days in any of the children.

In the armpit, there was a significant decrease in the permanent skin flora of the children in the chlorhexidine group compared to the soap-free cleansing solution group after the bathing on the 1st day compared to that in the pre-bathing period ($p=0.001$). On the 2nd and 3rd days, there was no statistically significant difference between the rates of reproduction after bathing and the rates before bathing ($p>0.05$), that is, the negative change in the permanent skin flora continued in the children in the chlorhexidine group compared to those in the soap-free cleansing solution group (Table 1, Figure 1).

In the groin, there was a significant decrease in the permanent skin flora of the children in the chlorhexidine group compared to the children in the soap-free cleansing solution group after the 1st day bath, compared to the pre-bath period ($p=0.001$). On the 2nd and 3rd days, there was no statistically significant difference between the growth rates after bathing and

rates before bathing (p>0.05), that is, the negative change in the permanent skin flora continued in the children in the chlorhexidine group compared to those in the soap-free cleansing solution group (Table 2, Figure 1).

Discussion

This randomized controlled experimental study was conducted to compare the effects of daily wiping bath with 2% chlorhexidine gluconate and soap-free body wash solution on the permanent skin flora of children hospitalized in the pediatric intensive care unit. In the literature, there are studies in which antiseptic solution containing chlorhexidine gluconate or soap is diluted in various proportions and used in different samples.[17-21] When these studies were examined, it was observed that the richness and diversity of skin flora decreased in patients who were daily bathed with chlorhexidine gluconate when compared with controls and/or pre-CG bathing sampling.[22-28] In our country, the number of studies using chlorhexidine gluconate in bathing is quite limited.[16,29-30]

Milstone et al.[22] reported that hand washing with chlorhexidine reduced the skin flora on the hand by 86-92%. In addition, chlorhexidine was shown to have residual activity that inhibited regrowth of persistent organisms on the skin and prolonged the duration of skin antisepsis.[22] In an experimental study conducted to determine the effect of preoperative skin preparation procedures performed by nurses in abdominal surgery on postoperative surgical site infection (SSI), Dizer et al.[29] found that skin preparation with a shaver the night before the operation and a 50 mL chlorhexidine bath performed twice in the preoperative period, excluding the head area, were useful in decreasing postopeative SSI. The strongest evidence for decolonization was for use among surgical patients as a strategy to prevent SSIs.[30] In a quasi-experimental study of 2% chlorhexidine gluconate-impregnated wipes that did not require rinsing Popovich et al.[17] showed that chlorhexidine gluconate concentrations were inversely proportional to Gram-positive colony counts in the skin of intensive care patients and were associated with decreased colony counts. However, the presence of chlorhexidine gluconate was detected in the skin for up to 24 hours.[17] Karki and Cheng[18] reviewed quasi-experimental/experimental studies conducted to evaluate the effect of body bath or skin cleansing with chlorhexidine gluconate-impregnated wipes on preventing healthcare-associated infections and colonization, and in line with the results, the use of chlorhexidine gluconate application that did not require rinsing was shown to significantly reduce the risk of Healthcare Associated Infection, Vancomycin-Resistant Enterococci, Methicillin-Resistant *Staphylococcus aerous* colonization, but not infection. Cassir et al.[13] examined the

Table 1. Comparison of changes in permanent skin flora in the armpits before and after bathing in bathing groups

Armpit			Bathing group							
			Before chlorhexidine bath				Before soap free washing solution bath			
			Reproduction (+) n (%)	Reproduction (-) n (%)	Total n (%)	p	Reproduction (+) n (%)	Reproduction (-) n (%)	Total n (%)	p
1st day	After bathing	Reproduction (+)	2 (6.7)	0 (0.0)	2 (6.7)	K=0.016	30 (100.0)	0 (0.0)	30 (100)	-
		Reproduction (-)	25 (83.3)	3 (10.0)	28 (93.3)	^{c}0.001*	0 (0.0)	0 (0.0)	0 (0.0)	-
		Total	27 (90.0)	3 (10.0)	30 (100)		30 (100)	0 (0.0)	30 (100)	
		Change (+)	25 (83.3)				0 (0.0)			^{a}0.001*
2nd day	After bathing	Reproduction (+)	0 (0.0)	0 (0.0)	0 (0.0)	-	30 (100.0)	0 (0.0)	30 (100)	-
		Reproduction (-)	3 (10.0)	27 (90.0)	30 (100)	-	0 (0.0)	0 (0.0)	0 (0.0)	-
		Total	3 (10.0)	27 (90.0)	30 (100)		30 (100)	0 (0.0)	30 (100)	
		Change (+)	3 (10.0)				0 (0.0)			^{b}0.237
3rd day	After bathing	Reproduction (+)	0 (0.0)	0 (0.0)	0 (0.0)	-	29 (96.7)	0 (0.0)	29 (96.7)	-
		Reproduction (-)	1 (3.3)	29 (96.7)	30 (100)	-	1 (3.3)	0 (0.0)	1 (3.3)	-
		Total	1 (3.3)	29 (96.7)	30 (100)		30 (100)	0 (0.0)	30 (100)	
		Change (+)	1 (3.3)				1 (3.3)			^{b}1.000

^{a}Pearson's chi-square test, ^{b}Fisher's Exact test, K: Kappa coefficient, ^{c}McNemar test, *p<0.01

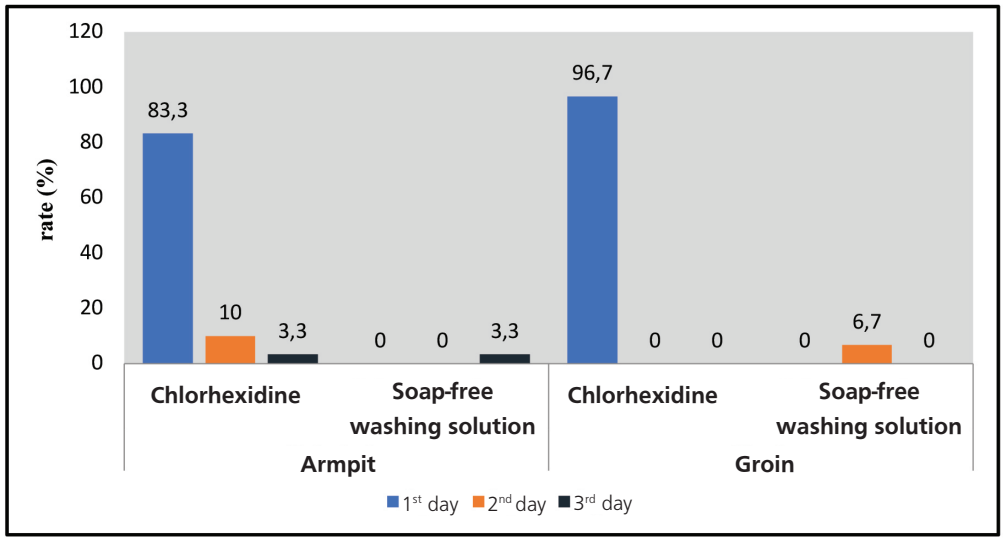

Figure 1. Changes in permanent skin flora before and after bathing according to follow-up days

effect of daily chlorhexidine bath on skin microbiota and bacterial diversity in the skin of patients hospitalized in the intensive care unit, and they mentioned that the skin was a carrier for bacterial pathogens in patients in the intensive care unit. In the study, the risk of colonization with Gram-negative bacteria was found to be higher in the water and soap group. On the other hand, in the chlorhexidine gluconate group, a decrease in bacterial diversity was observed on the skin.[13] In the study of Burnham et al.[24], chlorhexidine gluconate used for decolonization and infection prevention was shown to change the permanent skin flora. Due to its broad spectrum of action, chlorhexidine gluconate may disrupt the health-related persistent flora balance on the skin, which is an important component of colonization resistance to multidrug-resistant organisms, and culture-based studies have shown an overall reduction in microbial density.[26,28] In the cross-design experimental research conducted by Tarakçıoğlu Çelik[16] to evaluate the effect of chlorhexidine gluconate bath on the colonization of Vancomycin-Resistant Enterococci, Methicillin-Resistant *Staphylococcus aerous* in hematology-oncology patients hospitalized in the intensive care unit, it was concluded that wiping bath with chlorhexidine gluconate was effective in reducing nasal methicillin-resistant *Staphylococcus aerous* colonization and rectal Vancomycin-Resistant Enterococcus colonization.[16] In some studies on the use of chlorhexidine gluconate, it has also been observed that patients have persistent Candida auris colonization for long periods of time, despite routine 2% chlorhexidine gluconate bathing.[25,27] In an experimental study examining the effect of bathing with chlorhexidine gluconate on the skin microbiota of adult and pediatric patients, no difference was observed in pediatric patients; however, adults who bathed with chlorhexidine gluconate were found to have significantly reduced beneficial bacteria as well as numerous pathogenic bacteria species.[21]

In summary, when the results of these studies[16-18,21-30] in the literature are examined, it has been found that chlorhexidine gluconate reduces the diversity of the body's permanent skin flora as well as harmful microorganisms. The results are in parallel with our study. The children in our study group were those who were hospitalized and treated in the pediatric intensive care unit for internal reasons. In terms of affecting children's response to treatment, length of hospital stay and immunity, it is very important to preserve the permanent skin flora in these children.

Study Limitations

In our study, patients who were previously admitted to the intensive care unit but then taken to the pediatric intensive care unit as a result of surgical operation, children who received radiotherapy, chemotherapy drugs and antibiotics, and children with tracheostomy or percutaneous endoscopic gastrostomy were not included in the study because changes that may have occurred in the permanent skin flora of such patients before the study would also negatively affect the results of our study and it would be impossible to distinguish whether the changes in the skin flora were caused by these factors or the bathing methods we applied. Therefore, eliminating such confounding factors beforehand increased the reliability of our study results. This situation reveals the strength of our study.

The ambient temperature of the intensive care unit during the bathing process was 22 °C on average. In order for the children not to feel cold during the wiping bath, after one area was wiped, the children were partially covered with sheets before moving on to the other area. The limitation

Table 2. Comparison of changes in permanent skin flora of the groin before and after bathing in bathing groups

Groin		Bathing group							
		Before chlorhexidine bath				Before soap free washing solution bath			
		Reproduction (+) n (%)	Reproduction (-) n (%)	Total n (%)	p	Reproduction (+) n (%)	Reproduction (-) n (%)	Total n (%)	p
1st day After bathing	Reproduction (+)	1 (3.3)	0 (0.0)	1 (3.3)	K=0.001	26 (86.7)	0 (0.0)	26 (86.7)	K=1.000
	Reproduction (-)	29 (96.7)	0 (0.0)	29 (96.7)	-	0 (0.0)	4 (13.3)	4 (13.3)	[c]1.000
	Total	30 (100)	0 (0.0)	30 (100)		26 (86.7)	4 (13.3)	30 (100)	
	Change (+)	29 (96.7)				0 (0.0)			[a]0.001**
2nd day After bathing	Reproduction (+)	0 (0.0)	0 (0.0)	0 (0.0)	-	24 (80.0)	1 (3.3)	25 (83.3)	K:0.889
	Reproduction (-)	0 (0.0)	30 (100)	30 (100)	-	0 (0.0)	5 (16.7)	5 (16.7)	[c]1.000
	Total	0 (0.0)	30 (100)	30 (100)		24 (80.0)	6 (20.0)	30 (100)	
	Change (+)	0 (0.0)				2 (6.7)			[b]0.492
3rd Day After bathing	Reproduction (+)	0 (0.0)	0 (0.0)	0 (0.0)	-	25 (83.3)	0 (0.0)	25 (83.3)	K:1.000
	Reproduction (-)	0 (0.0)	30 (100)	30 (100)	-	0 (0.0)	5 (16.7)	5 (16.7)	[c]1.000
	Total	0 (0.0)	30 (100)	30 (100)		25 (83.3)	5 (16.7)	30 (100)	
	Change (+)	0 (0.0)				0 (0.0)			-

[a]Pearson's chi-square test, [b]Fisher's Exact test, K: Kappa coefficient, [c]McNemar test, *p<0.01

of the study is that the ambient temperature could not be increased due to the available resources.

Conclusion

In this study, it was determined that wiping bath with 2% chlorhexidine gluconate in children hospitalized in the pediatric intensive care unit significantly reduced the normal skin flora in the armpits and groin. As seen in this and many similar studies, it has been observed that chlorhexidine gluconate negatively affects the barrier function of the skin by reducing the diversity of the body's permanent skin flora as well as harmful microorganisms.

Implications for Nursing Practices

When many studies and our study are examined, it has been found that chlorhexidine gluconate reduces the diversity of the body's permanent skin flora. In routine practice, wiping bath with 2% chlorhexidine gluconate is used in some pediatric intensive care units to reduce and prevent infections. However, improper use of chlorhexidine can damage the skin, especially sensitive skin. Skin hygiene is one of the basic nursing interventions applied in the care of patients in pediatric intensive care units. The care given to children is extremely important in terms of preventing complications that may develop due to hospitalization in the intensive care unit. As a result of our study, it is thought that it will guide the use of the most appropriate and effective material in wiping bath/skin hygiene in patients hospitalized in the pediatric intensive care unit, thus contributing to safe and quality patient care. However, in line with the findings obtained in this study, it is not recommended to routinely use 2% chlorhexidine gluconate in wiping bath because it disrupts the normal skin flora and negatively affects the protective function of the skin and is a chemical product, and it should be used by nurses without forgetting that it affects the permanent skin flora.

As a result of our study, it is recommended to organize regular in-service training programs for pediatric intensive care nurses for the prevention of skin microbial colonization, to carry out studies evaluating growth by using chlorhexidine gluconate at different intensities, and to conduct new studies in similar/different sample groups using products such as lavender oil, vinegar, baking soda, clove oil etc., the positive outcomes of which are reported in the literature, instead of soap-free body wash solution.

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Ethics

Ethics Committee Approval: Ethical approval was obtained from the Ethics Committee of University of Health Sciences Turkey, Ümraniye Training and Research Hospital (15.02.2021/28) before starting the study.

Informed Consent: The parents of the participants were informed about the research and written consent was obtained from the parents who agreed to have their children participate in the research.

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Authorship Contributions

Concept: B.T., Ç.Ç.Ö., Design: Ç.Ç.Ö., Data Collection or Processing: B.T., Analysis or Interpretation: B.T., Ç.Ç.Ö., Literature Search: B.T., Ç.Ç.Ö., Writing: B.T., Ç.Ç.Ö.

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