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Original Article

The relationship between traditional dress and bacterial contamination in the hospital setting-a cross sectional study

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Abstract

Background/Introduction

Healthcare worker uniforms are a potential reservoir for microorganisms, and thus contaminated dress may transmit pathogenic organisms in hospital settings. This study aims at isolating the bacteria from traditional dresses used in a tertiary care hospital, Saudi Arabia, and compares them with whitecoat. Also, this study explores the relationship between bacterial contamination and type of department, type of provider specialty, and dress textile material.

Methods

A Descriptive Analytic cross-sectional study was conducted. Multiple culture swabs were obtained from these traditional dresses and whitecoats of the healthcare workers and were analyzed for the rate of bacterial contamination. This study also compares the bacterial contamination rates between medical workers and non-medical personnel like the administrative staff. A Sample size of 742 swabs from 139 participants,from multiple sites was obtained.Data analysis was presented as mean± SD, or as median and range according to the type of distribution of each variable. The Chi-square test was used to test for the association and/or difference between two categorical variables and p-value for statistical significance.

Results

It was seen that bacterial contamination of 29.7% was seen in traditional dress compared to 22.5% of those wearing Whitecoat. Concerning the type of traditional dress, the highest rate of bacterial contamination was observed with Thop (40%), followed by Niqab (36.1%). Regarding the source textile material, the mixed type had the highest rate of bacterial contamination (35.7%).

Conclusion

The traditional dress showed to be higher in the rate of bacterial contamination in comparison to whitecoats. Also, we found that the type of department and type provider specialty concerning bacterial contamination has a no different effect when compared to others. in our results, the administrative staff carries the same results as healthcare workers regarding bacterial contamination highlighting that they can share in the risk of bacterial transmission.

Previous Next

Keywords

Traditional dress; Nosocomial; Infection; Thop; Abaya; Whitecoat

Abbreviations

ICU, Intensive Care Unit; CCU, Coronary Care Unit; ER, Emergency Room; Lab, Laboratory; OPD, Outpatient Department; OR, Operation Room

1. Introduction

It is a known fact that up to 60% of the hospital staff dress uniforms are colonized with pathogenic and drug-resistant bacteria which can be transferred to the patients causing infections (Wiener-Welletal., 2011). Clean dresses in the hospital dressing rooms showed contamination with *Staphylococcus aureus* and *Clostridium* species. Ward dresses are more contaminated with microorganisms than dresses in operating theaters (Hambraeusetal., 1978). The type of dress textiles also accounts for bacterial contamination. It is seen that the non-woven fabric is better than cotton garments in reducing microbial contamination (Mitchelletal., 1978). Microorganisms have also been cultured from white coats worn by health professionals which act as vectors of disease, disseminating new infections (Saloojee,2001). Wearing plastic aprons over the dress uniforms would significantly reduce the probability of transmitting nosocomial infections (Callaghan, 1998).

In Saudi Arabia, nosocomial infections are widespread, accounting for 4-5% of hospital admissions causing economic burden, health care problems, mortality, and morbidity (Abdel-Fattah,2008). The commonest organisms noted are *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella Species* (sp), *Candida* sp, *Proteus* sp, enterococci, *Enterobacter* sp, and *Acinetobacter* sp in general hospital-based infections (Abussaud,1991). It is seen that the MRSA (Methicillin resistant staphyloccus aureus) burden among physician working in the intensive care unit is less when antimicrobial impregnated scrubs were worn compared to routine scrub suits (Conwayand Lipner,2020).However, no studies have been done regarding traditional dress representing a source of nosocomial infectionThop is a long gown traditional dress worn by males and Abaya is a female dress that is used in Arab countries. Shemagh and Ghutra are the head coverings of cloth in males along with the head ring, Scarf (head cover), and Niqab (face cover) in females.

The bacterial contamination of dresses of health care workers is well known and has been supported with evidence in most of the cases (Wiener-Welletal., 2011, Kuehn,2014). Microbiology analysis of swabs taken from physician white coats from various sites like cuffs and pocket mouths ranges from 60-91% (Wiener-Welletal., 2011, Treakleetal., 2009). According to the Society for healthcare epidemiology of America, it has been found that white coats, uniforms, and ties are often colonized with harmful pathogens (Kuehn,2014). Hospital dressings are made up of various materials cotton, polyester, and mixed. Long sleeve aprons transmit more infections than short sleeve aprons and therefore this should be considered when improving the good practice rules of hospital hygiene (Gouraudetal., 2014). Control of nosocomial infections can be achieved by frequent hand hygiene and avoiding contaminated surfaces (Visalachyetal., 2016).

(PPE)Personal Protective Equipment is used widely in healthcare Centres to minimize the passage of microbes to patients and Health care workers (Youngetal., 2021). There are no documented studies in the past regarding the rate of bacterial contamination in traditional dresses Thop, shemagh/ghutra/scarf/niqab in comparison with aprons of health care workers. Therefore, there is a need to investigate this and eventually develop guidelines regarding this crucial matter in gulf countries. According to researcher knowledge, no studies have been done regarding traditional dress concerning bacterial contamination or as a source of nosocomial infection. Hence there is advising or recommending appropriate hospital dressing code in the interest of both patients and community safety.The aim of this research is to

1- To study the rate of bacterial contamination in traditional dress in comparison with Whitecoat of health care workers.

2- To explore any statistical correlation between bacterial contamination and department type.

3- To explore any statistical correlation between bacterial contamination and provider specialty

4- To compare the level of bacterial contamination of dress in professional workers with textile material.

1.1. Research hypothesis

1- There is no statistical difference between a traditional dress and a non-traditional dress regarding the rate of bacterial contamination.

2- There is no statistical difference between department type and the rate of bacterial contamination.

3- There is no statistical difference between provider specialty type and the rate of bacterial contamination.

4- There is no statistical difference between the dress textile type and the rate of bacterial contamination.

2. Material and methods

The Study type is Descriptive Analytic – Cross-Sectional Study,at King Abdullah Medical City,Staff is around 3000 in January 2020 and the estimated number to reach the prevalence

within 5 % allowable error and considering a 95 % confidence level are 341 participants. but in our study, we included 139 participants with multiple swabs taken from each participant,Random sampling technique was used.The inclusion criteria: Doctors, nurses, Laboratory (lab) Technicians, and Administrative staff in all specialties working in our hospital wearing traditional dresses and white coats with full sleeves and who are willing to participate anonymously in the study.The exclusion criteria was persons with short sleeves (Physicians/nurses) and Scrub suits.All variables are clearly described and relate logically to the research objective(s),Dependent variable were the level of bacterial contamination and the independent variable were the type of dress,types of Department,type of provider speciality,and the type of textile .Data analysis was presented as mean± SD, or as median and range according to the type of distribution of each variable. Chi-square test was used to test for the association and/or difference between two categorical variables and p-value <0.05 was chosen as a cut-off level for statistical significance. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version 25 software.The following data collection method was used.A cross-sectional study was undertaken at our institute with the study population being doctors, nurses, laboratory technicians, and administrative staff. All subjects who enrolled in the study were given a serial code number for identification and to keep their confidentiality maintained. Sterile swabs will be taken at the end of the working day and will be obtained from standardized 2×2 cm area from the following sites: In males, right, left, and back of the head cover (either shemagh or ghutra depending on what the person was wearing), from the chest, back portion, right and left sleeve (traditional or whitecoat) and also from the head ring. In females: right, left and lower part of the headcover (either niqab or scarf) and back of it and front and back of mouthpiece; right sleeve, left sleeve, back and chest from the dress (whitecoat or Abaya).

With each specimen collected a data collection sheet is filled by the collector and they gather the following information: age, gender, department of practice, job type, textile type, how many days the dress is worn, and the specimen collection site and code.

Collected specimens were transported to the microbiology laboratory in the Cary-Blair transport medium, where plating was done on blood agar and MacConkey agar plates (Visalachyetal., 2016). The plates were incubated overnight at 37 *C under atmospheric conditions. Culture plates were examined the next day for bacterial growth. Isolates were processed for identification and susceptibility testing by the standard protocol using automated Microscan walkaway 96 plus (Siemens) and Vitek 2 compact, Biomerieux systems, and the results were reported. The colony count was enumerated by visual inspection of the plates and duly recorded as the number of colonies per plate.Data analysis

was presented as mean± SD, or as median and range according to the type of distribution of each variable

3. Results

A total of 139 participants were enrolled in the study with the total swabs' samples from the different source sites being 742. Seventy-nine (56.8%) were males and 60 (43.2%) were females. The average duration of the dresses worn was 1 day in 80% of the participants. Among the participants Doctors were 67(48.2%), laboratory staff and others 4 (2.8%), nurses 27(19.4%), pharmacists 3 (2.2%), physiotherapist 12 (8.6%), administrative staff 26 (18.7%) (Fig. 1). Traditional dress swab samples were 316 (42.58%), samples were collected from the following sites: Thop 65 (20.56%), Shimagh 28 (8.86%), headscarves females 57 (18.03%), Niqab 122 (38.60%), Head ring 13(4.11%), Ghutra 18(5.69%), Abaya (female dress) 13 (4.11%). Non-traditional dresses were in the form of white coats 426 (57.41%) (Fig. 2).

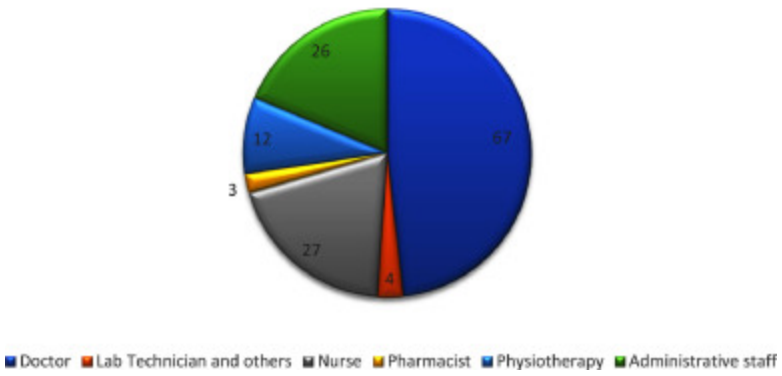

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Fig. 1. Showing the Diversity of professionals enrolled in the study, the largest specialty is doctors followed by nurses and administrative staff.

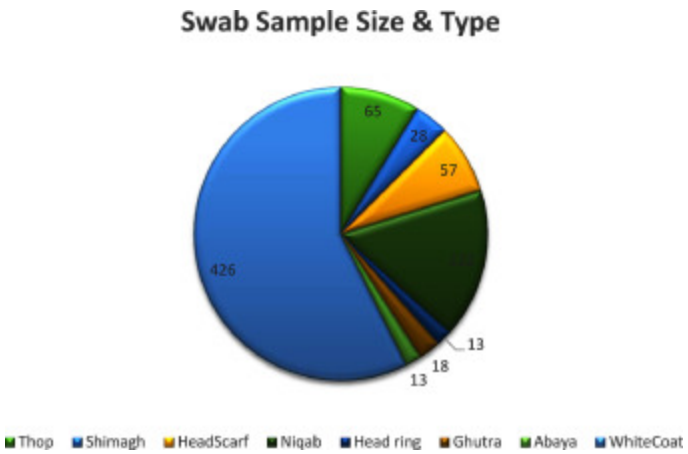

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Fig. 2. Showing the swab sample taken from different sites of dress, half is whitecoat and the other half is traditional dress subdivided into 7 categories.

Regarding the bacterial growth in the area of work, it was seen that the dresses of participants working in the laboratory were contaminated 50% when compared to radiology department colleagues, the contamination rates were 18.8% (Table 1). It was seen that when the bacterial growth was compared among the staff according to the job specialty type, dresses of physiotherapist 32.1% are contaminated and Administrative staff dress found to be contaminated by 27.3% but nurses were found to be more hygienic with 16.0% along with pharmacists with 11.1% when compared to the above 2 groups mentioned (Fig. 3). The relationship between growth and source of the sample showed that traditional dresses showed more growth (29.7%) whereas nontraditional (white coat) growth showed (22.5%) (Fig. 4). More bacterial growth was seen in Niqab (36.1%) and Abaya (30.8%), but the least growth was seen in Shimagh, Ghutra, and Head ring (Fig. 5).

Table 1. Shows the bacterial growth in relation to the department, with the highest percentage seen in the laboratory by 50.0% and Office by 28.0%.

Area	Growth	Number	Percentage
Lab	NO	2	50.0
	Yes	2	50.0
	Total	4	100
CCU	No	11	84.6
	Yes	2	15.4

Area	Growth	Number	Percentage
	Total	13	100
ER	No	3	75
	Yes	1	25
	total	4	100
ICU	No	36	80.0
	Yes	9	20.0
	total	45	100
Office	No	116	72.0
	Yes	45	28.0
	total	161	100
OPD	No	120	74.5
	Yes	41	25.5
	total	161	100
OR	No	16	80.0
	Yes	4	20.0
	total	20	100
Radiology	No	13	81.3
	Yes	3	18.8
	total	16	100
Ward	No	220	74.1
	Yes	77	25.9
	total	297	100

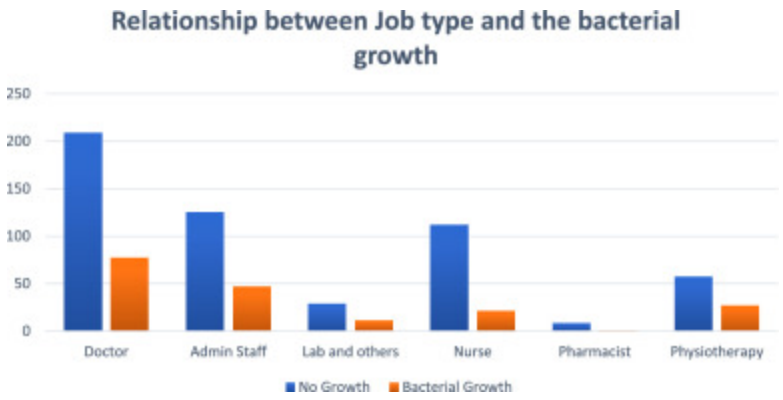

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Fig. 3. Showing the relationship between job type and bacterial growth.

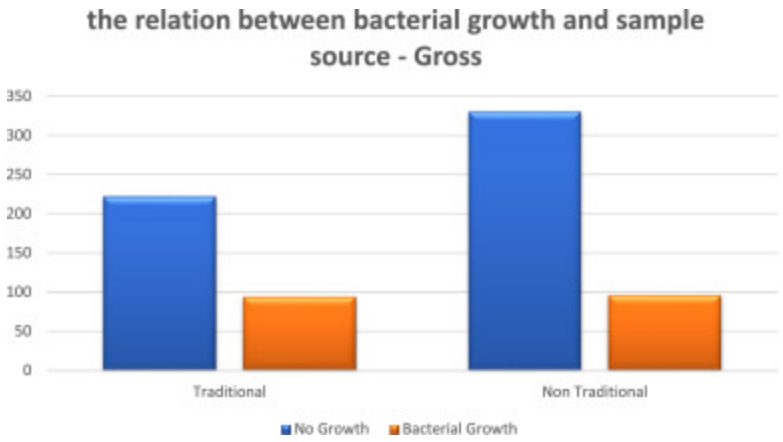

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Fig. 4. The relation between bacterial growth and sample source – Gross, showing that traditional dress is accounted for 29.7% and non-traditional is 22.5%.

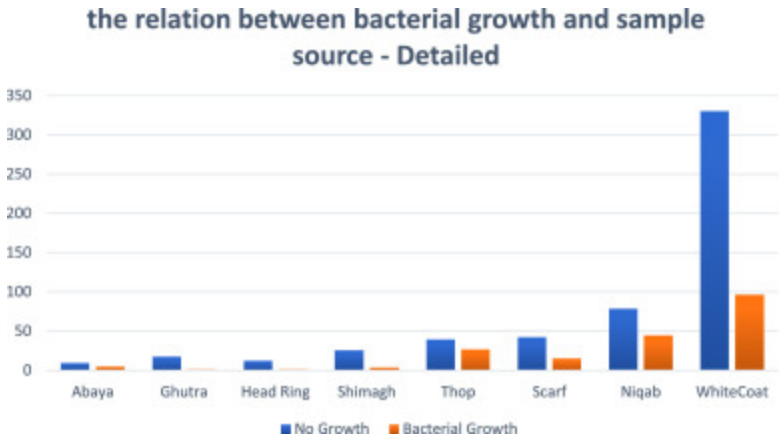

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Fig. 5. The relation between bacterial growth and swab sample source – detailed.

Textile Considering the type of material worn it was seen that the mixed material shows the most growth at 35.7% of total samples, whereas the polyester showed more than 50% fewer contamination chances than the mixed material (Fig.6).

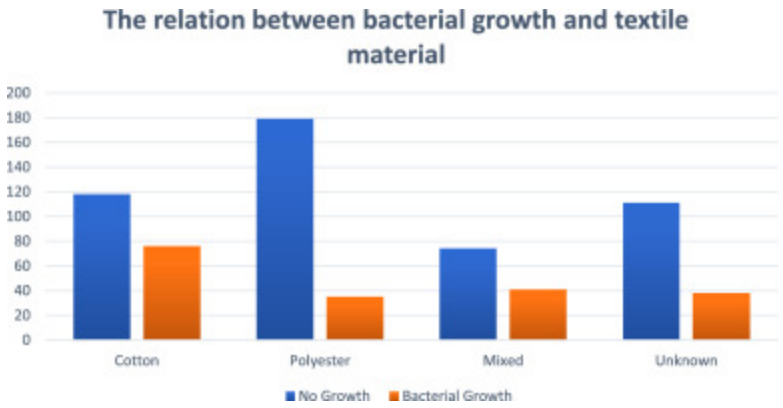

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Fig. 6. Shows the relation between bacterial growth and dress textile material, the mixed type is the most contaminated type of textile by 35.7% followed by cotton with 28.8%.

94 out of 222 swab samples (29.7%) showed positive for the presence of microorganisms in traditional dresses. The most common sites of contamination in traditional dresses are shown in (Fig.7). The most common organism noted in the dresses was *Staphylococcus epidermidis*, with (6.3%) of total samples yielding the organism, followed by *Staphylococcus*

hominis, *Micrococcus*, and *related species* (5.5%), *Staphylococcus capitis* (5.3%), *staphylococcus aureus* (1%). Traditional dress in male and females are highlighted in (Fig.8).

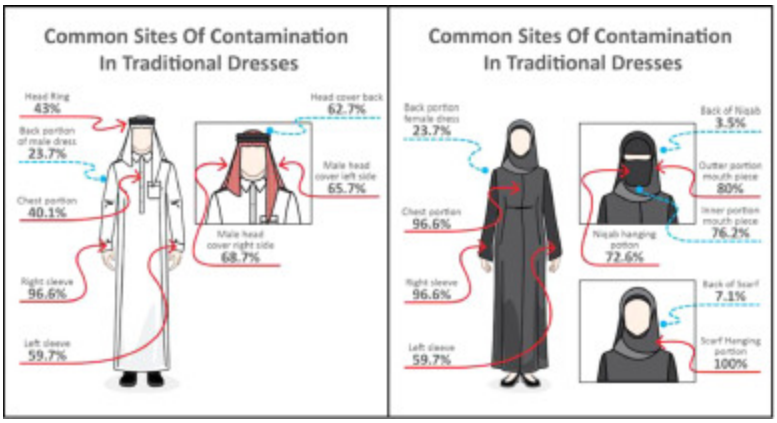

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Fig. 7. Showing the common sites of contamination in traditional dress for both males and females in positive culture swab results.

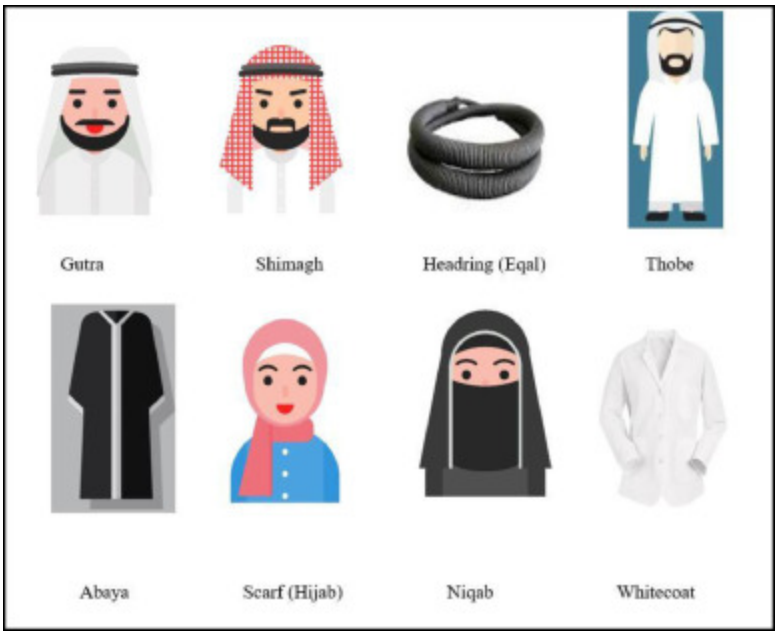

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Fig. 8. Showing the different types of traditional clothes and whitecoat.

3.1. Inferential analysis

Chi-square test was used to test for the association and/or difference between two categorical variables and p-value <0.05 was chosen as a cut-off level for statistical significance.

Table2 shows that type of dress was significantly associated with bacterial contamination as 29.7% of participants who wear traditional dress compared to 22.5% of those wearing the nontraditional dress (Whitecoat) had bacterial contamination. This difference was statistically significant, p=0.026. Concerning the type of traditional dress, the highest rate of bacterial contamination was observed with Thop (40%), followed by Niqab (36.1%) whereas the lowest rate was observed with Ghoutrah (5.6%) and Head ring (7.7%), p=0.004. Regarding the source textile material, the mixed type had the highest rate of bacterial contamination (35.7%) whereas polyester had the lowest rate (16.4%), p=0.001. Concerning specialty, physiotherapists had the highest rate of bacterial contamination (32.1%) while pharmacists had the lowest rate (11.1%). However, the association between specialty and bacterial contamination was not statistically significant. The department type of the participants was not significantly associated with bacterial contamination.

Table 2. Factors associated with bacterial contamination among the participants (n=742).

	bacterial growth on swab sample		**Chi-square test p-value***
	No growth N=552 N (%)	**growth detected N=190 N (%)**	
Type of DepartmentWard (n=297)OPD (n=161)Office (n=161)OR (n=20)CCU (n=13)ICU (n=45)Lab (n=4)ER (n=4)Radiology (n=16)	220 (74.1)120 (74.5)116 (72.0)16 (80.0)11 (84.6)36 (80.0)2 (50.0)3 (75.0)13 (81.2)	77 (25.9)41 (25.5)45 (28.0)4 (20.0)2 (15.4)9 (20.0)2 (50.0)1 (25.0)3 (18.8)	0.864
Type of Specialty (n=724)Doctor (n=286)Administrative staff (n=172)Nurse (n=133)Physiotherapy (n=84)Pharmacist (n=9)Lab and others (n=40)	209 (73.1)125 (72.7)112 (84.2)57 (67.9)8 (88.9)29 (72.5)	77 (26.9)47 (27.3)21 (15.8)27 (32.1)1 (11.1)11 (27.5)	0.069
Type of dressNon-Traditional (white coat) (n=426)Traditional dress (n=316)	330 (77.5)222 (70.3)	96 (22.5)94 (29.7)	0.026
Specific type of traditional dress (n=316)Ghoutrah (n=18)Head ring	17 (94.4)12 (92.3)25 (89.3)39 (60.0)9	1 (5.6)1 (7.7)3 (10.7)26 (40.0)4	0.004

	bacterial growth on swab sample		Chi-square test p-value*
	No growth N=552 N (%)	growth detected N=190 N (%)	
(n=13)Shomag (n=28)Thop (n=65)Abaya (n=13)Niqab (n=122)Scarf (n=57)	(69.2)78 (63.9)42 (73.7)	(30.8)44 (36.1)15 (26.3)	
Type of textile materialCotton (n=264)Polyester (n=214)Mixed (n=115)Unknown (n=149)	118 (71.2)179 (83.6)74 (64.3)111 (74.5)	76 (28.8)35 (16.4)41 (35.7)38 (25.5)	0.001

4. Discussion

In this study, out of a total of 742 swab samples, traditional dress samples were 316 (43%). Nontraditional dresses were in the form of white coats 426 (57%). The traditional dresses of health care workers were slightly more contaminated in the form of more bacterial growth (29.7%) when compared to the white coats (22.5%) worn by health care workers in the same hospital. out of the 29.7% positive cultures in traditional dresses, The female traditional dress showed more bacterial growth in Niqab (36.1%), the possible reason could be as it is constantly in contact with the mouth and it is a known fact that the oral cavity harbors more bacteria in the form of commensals and pathogenic organisms. In comparing thop and abaya, the abaya (30.8%) had less bacterial growth when compared to thop (40.0%), the thop is more exposed to the surrounding atmosphere inside the hospital when compared to abaya as it is changed after arriving to the hospital and worn back just before leaving, and is changed with white coats of females in almost all cases. The headscarves of females showed more bacterial contamination when compared to male head scarves shemagh and ghutra. In comparison to the level of contamination in professional workers and administrative staff, the health care staff working as physiotherapists had more bacterial contamination (32.1%) than the administrative staff (27.3%) working in the office. Although The relation between bacterial contamination and type of provider specialty and the department is statistically shown to be statistically insignificant but having an administrative staff that is in less contact with patients unlike other healthcare providers within range, bacterial contamination percentage is worth to be highlighted.

Regarding the types and sensitivity rates of isolated microorganisms, the most common organism noted in the traditional dresses was *Staphylococcus epidermidis* with 6.3% of total samples yielding this organism followed by *Staphylococcus aureus* (1%). Staphylococcus

epidermidis is a known commensal on the skin as well as an opportunistic pathogen capable of causing disease in immunocompromised or debilitated patients. This could be problematic if the health care staff wearing contaminated dresses come into direct contact with patients without wearing proper personal protective gear like gloves and overalls. Staphylococcus aureus is known to be more pathogenic in most clinical settings. Majority of the organisms were sensitive to levofloxacin (18.4%), sulfamethaxazole-trimethorpim(18.3%), tetracyclines(18.1), erythromycin(18.4), ciprofloxacin(13.5%) and Amoxycloxacin(13.3%).

In our study, the mixed material shows more growth of organism with 35.7% of total samples being positive, Whereas the polyester showed more than 50% fewer growth chances when compared to mixed textile type. And as these results turned to be statistically significant in our study, It is being proved beyond doubt that cotton transmits less infection and contamination compared to other materials (Mitchelletal., 2015; Takashima,2004), these results could be attributed to the fact that the data of the type of material was collected on oral questioning by the participants and not by examining the textile material.

Bare below the elbow (BBE) policy was implemented in the United Kingdom (UK) and it has been linked as the whitecoat carries a risk that plays a role in transmitting infection along with any long sleeve shirt (Tseetal., 2015). (Goyaletal., 2019) did a systematic review that showed that healthcare workers' professional dress carries a potential source of transmitting bacteria in hospital settings. A study showed that the practice of hand hygiene is the main factor that dropped the rate of infection (Bearmanetal., 2014, Tseetal., 2015). Besides other studies conducted feel that physicians stopped wearing whitecoat has an impact on physicians and patient satisfaction (Petrillietal., 2018, Dancerand Duerden,2014, Nash,2014). Although we addressed bacterial contamination in our study as it's the majority of nosocomial infection that has an impact on hospital prolonged stay and eventually higher cost, another emerging disease is linked with contact cross-infection Corona Virus Disease 2019 (COVID-19) that flow the same way of disease spread in the hospital-based environment.

4.1. Research contribution

This paper addresses the gap in the literature about wearing traditional dress in the healthcare setting. It will help to build a base toward evidence-based medicine in developing hospital policies.

4.2. Strength and limitation

There are no previous studies on the traditional dress in hospital settings, this study is the first of its kind that focuses on the role of traditional dress in regards to bacterial contamination. a larger sample would be more reflecting especially that some traditional dress types in our study were low in number. A larger multicenter study is proposed to implement action on policymaking. In our study, we tested bacterial contamination as it's the leading causing organisms for nosocomial infection and prolonged hospital stay and consequently higher cost and another emerging disease that is worth studying is COVID-19 in which swabs for virus contamination can be tested but the limited resources as this research were supported by hospital administration with a very limited budget to provide the swabs and the medium for bacterial culture and no other research fund or support in which it was reflected on the sample number in the study.

4.3. Implication and recommendation

we recommend further larger multicenter studies across the kingdom of Saudi Arabia and Gulf Countries with a concentration on Thob, Abaya & Niqab as our results showed to be the most contaminated traditional dress type. We also recommend having more detailed studies on the textile material type worn by healthcare workers. We also emphasize the importance of practicing proper hand hygiene and its role in preventing nosocomial infections.

5. Conclusion

The traditional dress showed to be higher in the rate of bacterial contamination in comparison to nontraditional (whitecoats). Also, we found that the type of department and type provider specialty concerning bacterial contamination has a no different effect when compared to others. In our results, the administrative staff carries the same results as healthcare workers regarding bacterial contamination highlighting that they can share in the risk of bacterial transmission. However, we require much larger and multicenter studies before any generalization could be made. The fact of contamination of traditional dress can draw attention towards the possible role of these dresses in transmitting infections. This information should help in developing dress code policies in health care institutions and precautions for both patients and community safety.

Authors' contributions

Dr OAS, OAM, WMK, SAR, MAK were involved in Design, Writing, and implementing the Study. Data collection, Revieiw of literature by RAF, MKA, TA, MEH, SEB, WSJ and EAT, SNS,

BS in microbiological aspects of the study, HAJ in editing the study

Declaration of Competing Interest

Ethics approval and Written approval obtained from the Institutional Review Board (IRB) approval was obtained from the King Abdullah Medical City research Center, Makkah, Saudi Arabia, A specialist quaternary care hospital. The participants provided the written informed consent of willingness to participate in the study voluntarily and the ethics committee approved the procedure. The Data was collected and recorded in the Data collection form manually and later transferred to a Computer excel sheet and then analyzed using SPSS software

Institutional Review board Letter -enclosed, IRB No Enclosed letter 15-177.Makkah, SaudiArabia

The authors has no conflict of interest to declare.

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Taken from all contributing authors

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Appendix. Supplementary materials

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