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Beware! Our home is Wonderland of Pathogenic Bacteria

Tyagi S., Tyagi P.K.*, Mishra M. and Khan N.
Department of Biotechnology, MIET, Meerut, INDIA

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Abstract

The number of bacteria isolates from living rooms in 55 (bacterial growth was observed in 39 plates out of 40 plates only 1 plate were devoid of bacteria) in rural areas and 41 (bacterial growth was observed in 37 plates out of 40 plates 3 plate are devoid of bacteria) in urban areas was recorded. The present investigation clearly indicates that the living rooms of rural areas are more contaminated (with the major fractions of 4 genera such as Proteus spp., Salmonella spp., Shigella spp., Klebsiella spp.) in comparison to urban areas (3 genera: Acinetobacter spp., Klebsiella spp. and Proteus spp.). All in all, the rural living rooms are more contaminated with pathogenic virulent bacteria as compare to urban living rooms. On the other hand, we can say that our home is wonderland of phatogenic bacteria share with our habitat. The results of this study will help the awareness of residing populations in rural and urban areas to make an educated decisions and precautions in developing a proper routine of cleaning regime in their households/kitchens. The data of this research might contribute to designing and manipulating sanitation guidelines/ cleaning that will help to implement best sanitation and hygienic conditions in within households/kitchens and further opportunities in research may be conducting in the area of food born diseases.

Keywords: Bacterial contamination, bacterial strain, living rooms, sanitation, hygiene.

Introduction

In present context, there has been increasing concern about indoor air quality in houses and its surrounding areas. The households can sometimes become a source of microbial contamination, where microbes proliferate. Inadequate ventilation and high moisture levels resulting from water damage episodes or excess humidity often cause the proliferation of microbes on visible surfaces or hidden inside structures. In such a context, a good diagnosis of the degree of microbial contamination in homes becomes more important. Unfortunately, assessment tools are few and insufficient. Air sampling, still frequently used, but we also used surface sampling. Surface samples are useful to document the nature of microbial contamination but insufficient to obtain a global diagnosis[1]. Microorganism such as bacteria and fungi are ubiquitous in the environment and we are continuously interacting with them. Human activities can influence the level and diversity of microorganism associated with a particular environment. The household is one such environment where we live interact, and spend more time apart our workplace so chance of bacterial contamination very higher in households. Domestic kitchen environment are potentially spread bacteria. The primary sources of these bacteria are kitchens in which the food spoilage and stored dust bean contain for many days and directly entered vegetables, some infected with higher pathogens. After getting favorable condition these bacteria spread out to living rooms and its surrounded areas[2]. In living rooms such as carpet, curtains, toilet doors, table top, dressing tables and ceiling fans etc. are the best places in which the bacterial growth are more conditionable and when the favorable conditions start (seasonal variation) these bacteria infected the individuals[3]. To avoid bacterial contamination the proper ventilation and sanitation in kitchens and living rooms are required. Kitchens sponges renewable should be dried after use or immersed in boiling water for 5 to 10 minutes. Furthermore, hygienic measures and precaution in the kitchens should be well maintained to reduce harmful bacteria levels[4].

In the present work the bacterial contamination revealed the status living rooms. In India very few literatures have been identified of bacterial contamination in the air samples as well as surface samples of living room in rural and urban areas and their comparison. This study therefore aimed to investigate, identify, and comparison of the bacterial contamination in air samples as well as surface samples living rooms.

Material and Methods

Study area: In this present work the study area was Meerut district of Uttar Pradesh, in which, the villages of rural areas are namely Jainpur, Rithani, Maharolly, Rijhani and colony of urban areas are namely Maliyana, Madhopuram, Modipuram, Shastrinagar were selected as random for sample collections.

Collection of samples: We were randomly selected 80 samples of open air or surface samples from 80 homes, 40 of each rural & urban area of Meerut district of Utter Pradesh from July to August 2010.

Methodology: All 80 samples were aseptically collected in already clean prepared culture plates of Nutrient Agar (NA). The samples were taking in NA plate media from the open air and surface samples such as wooden spoons, toothbrushes, bath towels, pillows and duvets, hairbrush, mattresses, kitchen sponges/cloths, carpets, tabletop, curtains, dressing tables and ceiling fans etc. from living rooms. Samples incubated for 24 hours at 28-30°C and best growth samples were selected for proceeds to pure culture by sub culturing of 2-3 times in NA media. NA broths were used of different isolates for further morphological, physiological and biochemical tasting.

Sample analysis: All samples were analyzed by conventional techniques as described by Buchanan and Gibbons[5] and Carter and Cole[6]. After collection of samples, culture plates were incubated in BOD incubator at 28-30°C for 24 hours. After 24-48 h of incubation, the colonies that appeared visually dissimilar were chosen, counted and subculture to fresh nutrient agar and incubated at 37 °C for 24 h.

Identification of microbes: Identification of microorganisms did not commence until it was evident that a pure culture had been obtained. The most common growth media for microorganisms are nutrient broths (liquid nutrient medium) or LB medium (Lysogeny Broth). Basal media, Selective media and Differential media or indicator media such as Nutrient Agar, Eosin Methylene Blue, Blood agar, Macconky agar, Xylose Lysine Desoxyscholate etc. was used to cultivate and purify the colonies identifiable. A culture characteristic such as the shape, color, size texture and hemolytic reactions was carefully examined via macroscopically. Colonies are gram stained and individual bacterial cells were observed under the microscope. The bacteria were speciated using these isolated colonies[7]. Further detailed identification of entire organisms was done using the different taxonomical methods.

Results and Discussion

A total of 80 samples from 80 homes (40 each samples of rural and urban living rooms respectively) were collected and analyzed for bacterial contamination and their comparisons. Sample obtained from in rural and urban living rooms near wooden spoons, toothbrushes, bath towels, pillows and duvets, hairbrush, mattresses, kitchen sponges/cloths, carpets, tabletop, curtains, dressing tables and ceiling fans etc. On the basis of primary characterization, the samples were subjected to morphological and biochemical analysis to confirm the identify bacteria. The presence of bacteria was discerned in 78 samples of air of living rooms in rural and urban areas out of 80 samples. Only 2 samples (one in rural and one in urban areas) of air of living rooms were found to be bereft of bacteria. The total number of bacteria isolates from the air of living rooms in rural and urban areas was 55 and 41 respectively; with 52 bacterial strains. The number of bacteria isolates from living rooms in 55 (bacterial growth was observed in 39 plates out of 40 plates only 1 plate were devoid of bacteria) in rural areas and 41 (bacterial growth was observed in 37 plates out of 40 plates 3 plate are devoid of bacteria) in urban areas was recorded. So we can say that the positive bacterial growth 97.5% (Maximum growth) of rural areas was observed in comparison to 92.5% (Minimum growth) urban areas (table 1). The morphological identification of the bacteria isolated from air of living rooms based on agar slant culture characteristic and preliminary characterization, in which the morphological characteristics such as shape, size, color, texture, and hemolytic growth patterns are help to identify the bacteria (table 2, figure 1). Some preliminary characters of 52 bacterial strains such as motility, 22 motile and 30 non motile, gram staining, 29 gram positive and 23 gram negative, growth in anaerobic broth media, only 41, growth in oxidative fermentation, only 48, acid production by glucose, only 37, and shape, 16 round and 36 rod were observed. These all preliminary characters of 52 bacterial strains are also help to identify the bacterial genus (figure 2). The biochemical characterization of all 52 bacterial strains in living rooms based on 12 different tests for both gram positive and gram negative bacterial strain, in which 29 gram positive and 23 gram negative for catalase test, 9 gram positive and 43 gram negative for oxidase test, 7 gram positive and 45 gram negative for H_2S production test, 44 gram positive and 08 gram negative for nitrate reduction test, 10 gram positive and 42 gram negative for indole production test, 29 gram positive and 23 gram negative for MR reaction test, 16 gram positive and 36 gram negative for VP reaction test, 15 gram positive and 17 gram negative for citrate utilization test, 14 gram positive and 38 gram negative for urease test, 18 gram positive and 34 gram negative for lactose fermentation, 31 gram positive and 21 gram negative for sucrose fermentation and 39 gram positive and 13 gram negative for dextrose fermentation were observed (figure 3).

The total numbers of bacterial genus identified 9 in both in rural and urban living rooms were recorded. In rural areas the bacterial growth on the basis of colonies formation /plate as a such manner *E. coli* for 80% of isolates (32 colony types from 40 plates), followed by *Proteus spp.* and *Salmonella spp.* (60%), *Micrococcus spp.* (55%), *Klebsiella spp.* (50%), *Bacillus spp.* (50%), *Staphylococcus spp.* (30%), *Shigella spp.* (22.5%), *Alcaligenes spp.* (15%) were observed. In urban areas, *Staphylococcus spp.* accounted for 60% of isolates (24 colony types from 40 plates), followed by *Klebsiella spp.* (45%), *Proteus spp.* (40%), *Paenibacillus spp.,* (40%), *Micrococcus spp.* (37.5%), *E. coli* (30%), *Acinetobacter* (20%), *Lactobacillus spp.* (17.5%), *Pseudomonas spp.* (10%) were observed (figure 4 and 5).

It is notable fact that the more pathogenic bacterial genus 4 was found only in the living rooms of rural areas such as *Proteus spp., Salmonella spp., Shigella spp., Klebsiella spp.* and non-pathogenic genus 5 such as *Staphylococcus spp., Bacillus spp., E. coli, Micrococcus spp.,* and *Alcaligenes spp* (figure 6). On the other hand, the 3 genus of pathogenic bacteria was observed in the living rooms of urban areas such as *Acinetobacter spp., Klebsiella spp.,* and *Proteus spp.* and 6 non-pathogenic bacteria

genus *Pseudomonas spp., Paenibacillus spp., Micrococcus spp., E. coli, Lactobacillus spp. Staphylococcus spp* (figure 7). The present results shows that the bacteria isolated from air of living rooms in rural areas are more virulent and show higher pathogenic activity as compared to the bacteria isolated from air of the living rooms in urban areas with lower pathogenic activity. On the other hand, we can say that our home is wonderland of phatogenic bacteria share with our habitat. The results of this study will help the awareness of residing populations in rural and urban areas to make an educated decisions and precautions in developing a proper routine of cleaning regime in their households/kitchens. The data of this research might contribute to designing and manipulating sanitation guidelines/ cleaning that will help to implement best sanitation and hygienic conditions in within households/kitchens and further opportunities in research may be conducting in the area of food born diseases.

Table-1
Bacterial contamination analysis in the air of 80 living rooms in rural (40) and urban (40) households of Meerut district of Utter Pradesh

Type of samples	Source of Samples	Total no. of samples processed	No. of samples devoid of bacteria	Total no. of bacteria isolated	Number of genus isolated	Bacteria identified
Living rooms of rural households	Jainpur	10	Nil	16	7	[1]
	Rithani	10	Nil	13	7	[2]
	Maharolly	10	1	12	5	[3]
	Rijhani	10	Nil	14	7	[4]
Living rooms of urban households	Maliyana,	10	Nil	12	7	[5]
	Madhopuram,	10	1	12	7	[6]
	Modipuram,	10	Nil	10	5	[7]
	Shastrinagar	10	2	07	7	[8]

Living rooms of Rural households: [1] *Staphylococcus spp., Proteus spp., E.coli, Shigella spp, Klebsiella spp., Alcaligenes spp., Bacillus spp.* [2] *Bacillus spp., Klebsiella spp., Salmonella spp., Micrococcus spp., Proteus spp., E.coli, Staphylococcus spp.* [3] *E.coli, Micrococcus spp., Salmonella spp., proteus spp., Shigella spp.* [4] *Klebsiella spp., Micrococcus spp., Shigella spp., E.coli, Bacillus spp., Salmonella spp., Proteus spp.* **Living rooms of Urban households:** [5] *Streptococcus spp., Staphylococcus spp.*-2 strains*, Acinetobacter spp.*-2 strains, *Bacillus spp.*-2 strains.[6]*Micrococcus spp.*-2 strains, *Paenibacillus spp.*-2 strains, *E.coli, Lactobacillus spp.*-2 strains.[7] *Bacillus spp*-2 strains, *Streptococcus spp.*-2 strains, *Pseudomonas spp.*[8] *Staphylococcus spp.*-2 strains, *Micrococcus spp.*-2 strains, *E.coli, Paenibacillus spp.*-2 strains.

Table-2
Morphological identification of the bacteria based on agar slant culture characteristics of living rooms of rural and urban households samples

Morphological Characteristics based on Agar Slant Culture	Probable Bacteria
Abundant, opaque, white waxy growth	*Bacillus spp.*
Soft, smooth, yellow growth	*Micrococcus spp.*
White, Moist, glistening	*Escherichia coli*
Thin, even, grayish growth	*Salmonella spp.*
Slimy, White, translucent, raised growth	*Klebsiella spp.*
Irregular, white, rough surface	*Alcaligenes spp.*
Thin, blue-gray, spreading growth	*Proteus spp.*
Rough surface growth, paper like	*Acinetobacter spp.*
Abundant, Opaque, Golden growth	*Staphylococcus spp.*
Whitish, grayish, slightly Transparent, Glistening appearance	*Paenibacillus spp.*
Thin, even, grayish growth	*Shigella spp.*
White, irregular, big circular	*Lactobacillus spp*
Abundant thin, white growth, media turning green	*Pseudomonas spp.*

Table-3
Morphological identification based on agar slant culture characteristics and number of colonies of the bacteria isolated from the air of living rooms in rural and urban households

Bacterial genus	Colonies formation /plate	No. of colonies in (%)/40 samples	Nature of bacteria NP or P/ Rural or Urban
E. coli	32	(80%)	NP/Rural
Proteus spp.	24	(60%)	P /Rural
Salmonella spp.	24	(60%)	P /Rural
Micrococcus spp.	22	(55%)	NP/Rural
Klebsiella spp.	20	(50%)	P /Rural
Bacillus spp.	20	(50%)	NP/Rural
Staphylococcus spp.	12	(30%)	NP/Rural
Shigella spp.	09	(22.5%)	P /Rural
Alcaligenes spp.	06	(15%)	NP/Rural
Staphylococcus spp.	24	(60%)	NP/Urban
Klebsiella spp.	18	(45%)	P/ Urban
Bacillus spp.	18	(45%)	NP/Urban
Proteus spp.	16	(40%)	P /Urban
Paenibacillus spp.	16	(40%)	NP/Urban
Micrococcus spp.	15	(37.5%)	NP/Urban
E. coli	12	(30%)	NP/Urban
Acinetobacter spp.	08	(20%)	P /Urban
Lactobacillus spp.	07	(17.5%)	NP/Urban
Pseudomonas spp.	04	(10%)	NP/Urban

*P-Pathogenic bacterial genus, NP-Non pathogenic bacterial genes.

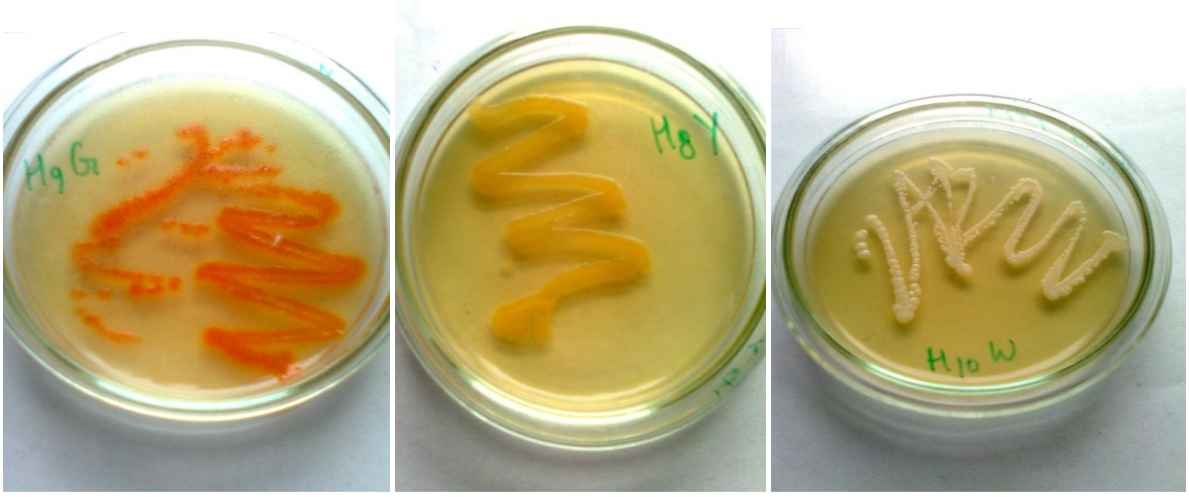

Figure-1
Growth pattern of pure cultures of unknown bacterial samples on nutrient agar medium

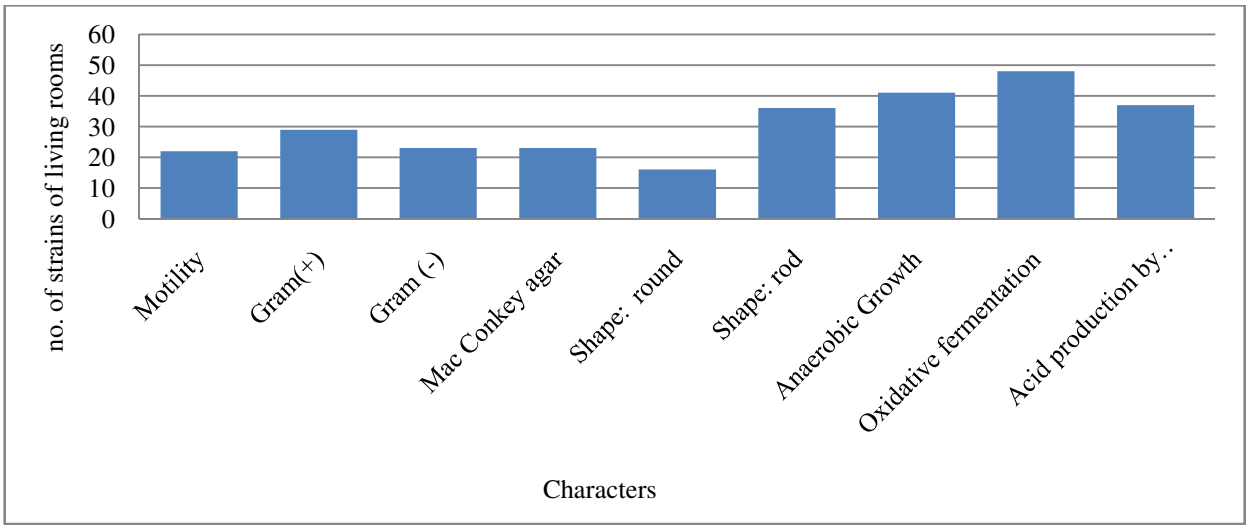

Figure-2
Showing preliminary characterization of based on following parameters of living rooms samples

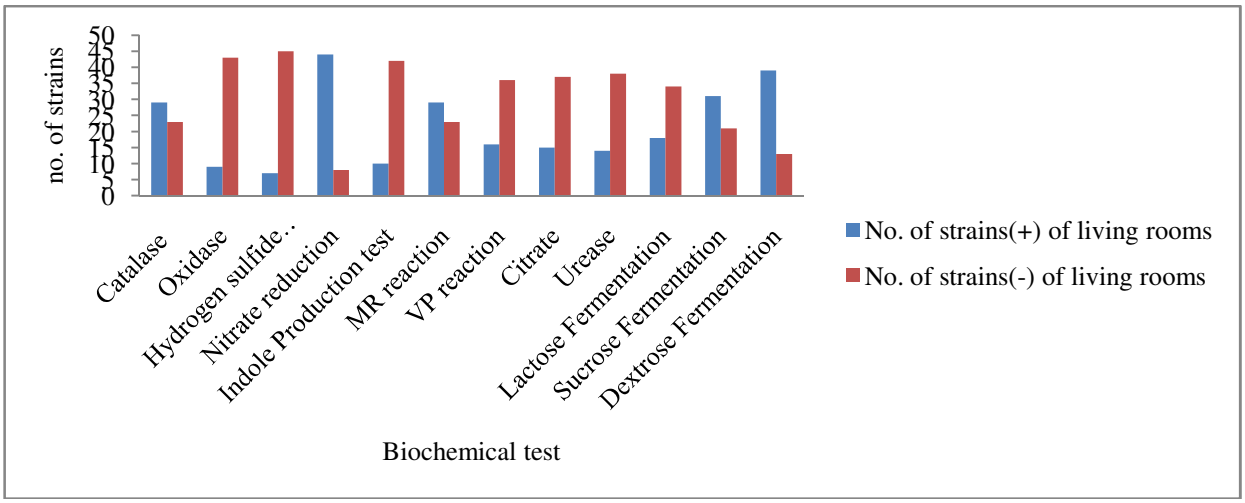

Figure-3
Showing biochemical characterization based on 12 different biochemical tests of living rooms strains

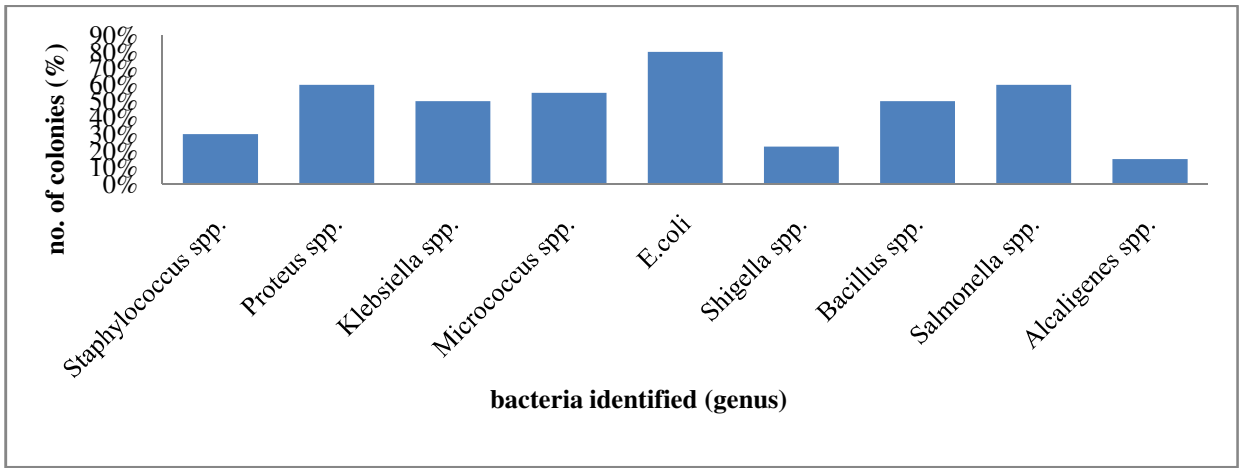

Figure-4
Number of colonies (in %) and bacteria identified (genus) of air /surface samples of living rooms in rural areas

Studies of the bacterial contamination in rural and urban areas of Indian subcontinent[8,9] and domestic environment[10,11] indicate that microorganisms such as bacteria/germs including some potentially pathogenic species, are commonly found in all areas of the households/kitchens. The results of this observation indicate that wet sites, such as kitchens, sink areas, pours wooden spoons, old kitchen sponges, dishcloths, cleaning utensils and households, old toothbrushes, multiple user bath towels, old pillows and duvets, multiple user hairbrushes, old mattresses, toilets and nappy buckets are most commonly associated with heavy bacteria/germs contamination and the occurrence of potentially harmful species. The present results partly agree with the previous observation in which the bacteriological quality of air of kitchens in rural households was found to be more pathogenic and virulent as compared to that of kitchen in urban households [4, 8, 9]. Our home is wonderland of phatogenic bacteria share with us and these opportunistic pathogens may be harmful, especially in immune compromised host. In this setting, there is a constant risk of contamination and transfer to willing host. Hence, better quality of air can be achieved by manipulating sanitation and hygiene within houses, kitchens and surrounding areas. Published web reports/case studies indicated that the daily uses items/modern life style uses items of households/kitchens are responsible for proliferation of microbes and germs such as Wooden spoons, Toothbrushes, Bath towels, Pillows and Duvets, Hairbrush, Mattresses, Kitchen sponges and Clearing cloth.

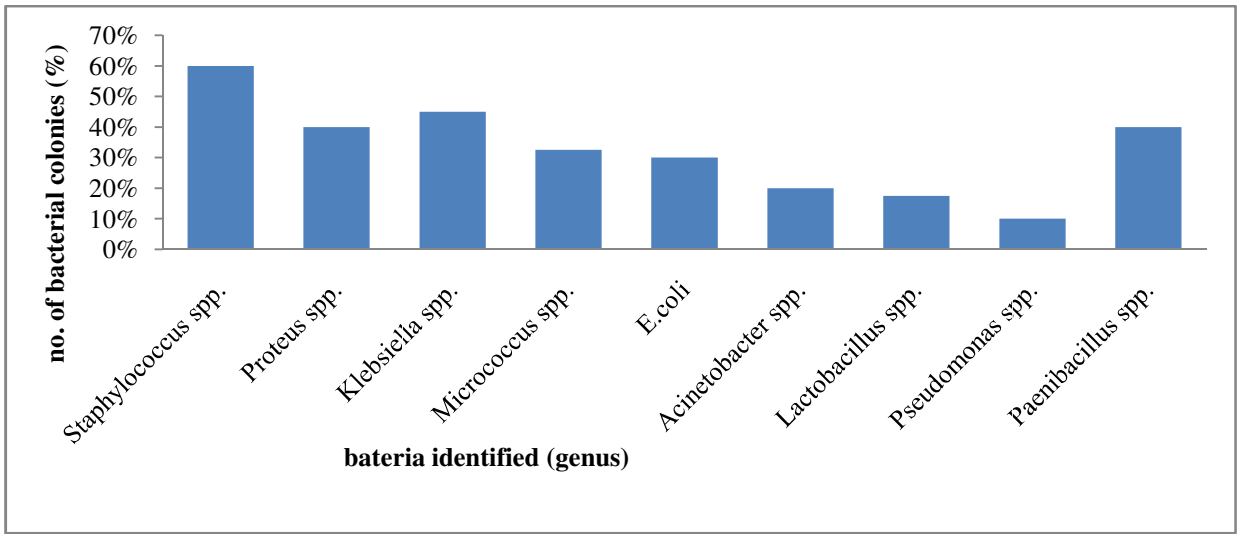

Figure-5
Number of colonies (in %) and bacteria identified (genus) of air /surface samples of living rooms in urban areas

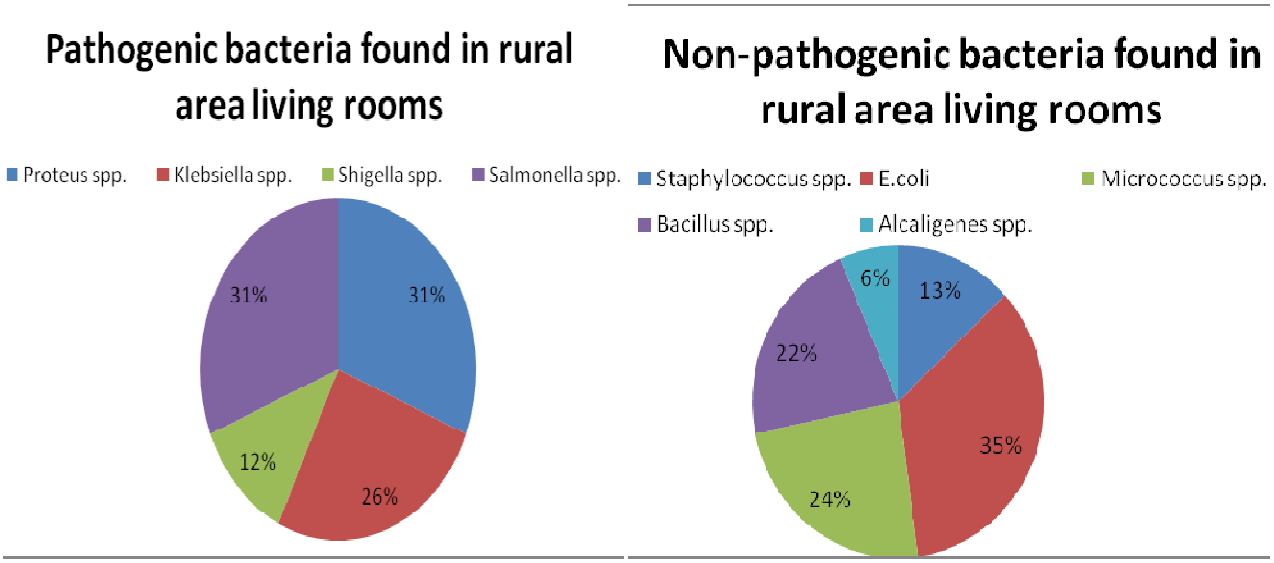

Figure-6
Showing pathogenic and non- pathogenic bacteria found in rural area living rooms

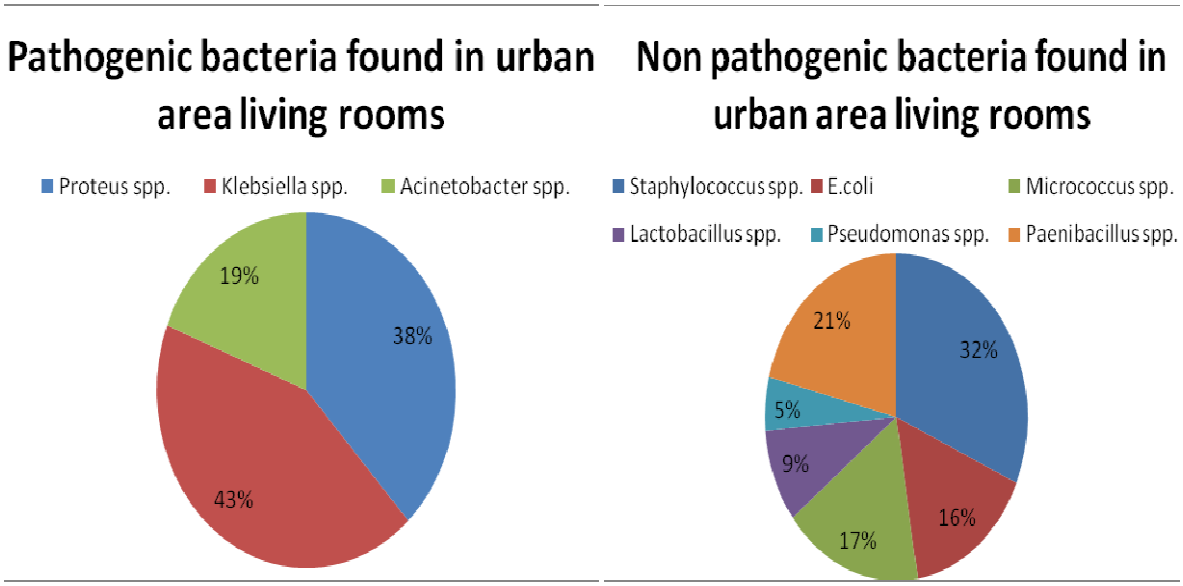

Figure-7
Showing pathogenic and non- pathogenic bacteria found in urban area living rooms

Wooden spoons are made up porous woods are more suitable to carrying bacteria and germs as compare to plastic are other metals spoons. Daily brushes on teeth is recommended practices suggested by dentists but the published reports indicates that the major health problems such as heart disease, stroke, arthritis and chronic infections could be strongly linked toothbrushes under the topic of "unhygienic toothbrushes"[12]. Bath towels are favorable conditions provider of bacteria and germs to one person to another person from skin to towel and reveres, due to their moist fibers environment. Another linked ring to increase this bacterial contaminations chain is pillows/ duvets. Unwelcome guests such as dust mites live in pillows/duvets and regularly increase the weight approx double within three years. Scientist of University of Worcester analyzed ten duvets and found twenty thousand live house dust mites along with some bacteria/germs[12]. According to Dr Andrew Wright, dermatologist of Bradford Hospitals NHS foundation trust found that hair brush are also helpful for proliferation of microbes and germs i.e. impetigo disease a bacterial skin infection spread from one person to another person by using hairbrush on sharing basses. Sponges and cleaning cloth are also powerful tools to spread out bacterial contamination in households and kitchen. They are provided all nutrients and good conditions for required bacteria to cultivation. On the basis of this ideal enviourment old uses sponges and cleaning cloth are the best houses of bacteria/germs[12].

Here, with the help of scientific expert's comments from different websites, scientific reports, scientific articles and our findings, we conclude how clean daily uses household/kitchens items. Don't put wooden spoons in the dishwasher, especially not on a regular basis, as they may crack and therefore provide a haven for bacteria/germs. Wooden spoons soak in disinfectant for about half an hour and then wash with boiling soapy water. After five years, but earlier if the wood cracks, or if any part becomes soft or dark, as this could mean the wood is rotting and retaining bacteria may be change. Published results of Manchester University suggested that the 3 month old toothbrush contained about ten million germs, including a high percentage of potentially fatal bacteria such as *Staphylococci, Streptococcus, Proteus spp., Salmonella spp., Shigella spp.* and *Klebsiella spp.*[12]. We can't see the build-up of germs, but we can see the distorted and broken bristles that will harbour the bacteria. So we must change regularly the toothbrushes in three month intervals. Daily uses bath towels need to be washed twice a week at high temperature or more to wipe out, bacteria/germs that can be transferred from skin to the towel. In case of pillows and duvets, which is the best home of dust mites and bacteria/germs and responsible for spreading fever, eczema or asthma, particularly since face is touching the pillow. Dust mite waste also leaves people more susceptible to rhinitis (stuffy nose) and sinusitis. So washing the pillow is compulsory in 6-8 months intervals at 80^0C for at least 20 minutes. Asthma or allergies suffering persons may use hypoallergenic pillows, which are usually made from foam.

Conclusion

The present investigation clearly indicates that the living rooms of rural areas are more contaminated in comparison to urban areas. The scientific expert's comments from different websites, scientific reports, scientific articles and our present findings, for bacterial contamination in households such as living rooms/kitchens indicates that unhygienic enviourment, improper ventilations and daily uses items such as Wooden spoons, Toothbrushes, Bath towels, Pillows and Duvets, Hairbrush, Mattresses, Kitchen sponges and Clearing cloth play a significant role in the spread of microbes and germs in the

home. On the other hand, we can say that our home is wonderland of phatogenic bacteria share with our habitat. The results of this study will help the awareness of residing populations in rural and urban areas to make an educated decisions and precautions in developing a proper routine of cleaning regime in their households/kitchens. The data of this research might contribute to designing and manipulating sanitation guidelines/ cleaning that will help to implement best sanitation and hygienic conditions in within households/kitchens and further opportunities in research may be conducting in the area of food born diseases.

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