ABSTRACT

The majority of individuals use an infant pacifier (IP) at some point during their early childhood. The debate as to the pros and cons of IP use is ongoing. Anecdotal evidence would indicate that sanitization of used IP vary widely. The goal of the present study was to evaluate the level of bacterial contamination of used IP. Ten used de-identified IP were collected from infants at a well-baby clinic. Bacteria were cultured from both the nipple and the shield areas. The level of contamination was determined by using a serial dilution procedure (expressed in colony forming units/ml = CFU/g). Seven unused IP served as controls. The bacterial isolates were speceied using standard laboratory procedures. The results showed marked variations in the level of contamination, with half of the IP being lightly contaminated and the other half heavily contaminated. The most heavily contaminated IP yielded two species of gram negative bacilli. The second most contaminated IP was populated with gram positive cocci. These results show that the sanitary condition of used IP vary widely and may negatively affect the systemic health of the user.

INTRODUCTION

Archaeological evidence suggests that IP have been used since the Neolithic period. Modern IP were developed at the turn of the 20th Century. It has been estimated that in western countries, 75% - 85% of infants use IP for some period during their infancy/childhood. Sexton and Natale reviewed the positive benefits of IP use and found an analogous effect, a shortening of the hospital stay, and a possible prevention of sudden infant death syndrome. They also compared the benefits of IP use to problems, such as complications of breastfeeding, a negative impact on dental health, and microbial contaminations that might lead to infection. While no direct connections between infectious diseases and IP use were demonstrated, there was a positive correlation between IP use and increased incidence of colic and otitis media. The purposes of the present study were to isolate, quantitate, and identify the bacteria from used IP.

METHODS

IP: Ten used, de-identified IP were collected from well-babies at a pediatric clinic. Each IP was placed in a sterile plastic zip-lock bag and immediately transported to the Forensic Pathology/Microbiology Laboratory, OSU-CHS for processing. Seven new IP were used as controls. Microbial sampling: Each IP was given a unique specimen number, photographed, and weighed. The nipple and shield sections were aseptically separated. Colony forming units (CFU/g) Determinations: Portions of either the nipple or the shield were minced into small pieces (~0.5cm³). One gram (1.0 g) of the resultant material was placed in 10 mL of sterile water and vortexed for 1 minute. The CFU were determined by the method of Miles & Misra. Each sample was diluted through a series of 1:10 dilutions; plated in triplicate on a blood agar plate; and incubated at 37°C and read at 24 and 48 hours. (Fig. 1).

Identification of microorganisms: Pure cultures of each colonial type appearing on any plate were made using standard laboratory procedures. The final identification of all microorganisms was based on cellular morphology, gram staining, and biochemical testing. BioMerieux Vitek systems were used to confirm identification of the microorganisms wherever possible.

RESULTS

The bacterial loads of 10 used IP were expressed in CFU/g. Five of the used IP were lightly contaminated, while the other 5 IP were heavily contaminated with levels reaching 10² CFU/g. Forty different species of bacteria were isolated from the 10 IP. These included: 17 gram positive cocci; 8 gram positive bacilli; 14 gram negative bacilli; and 1 gram negative cocci. Five of the IP were positive for Staphylococcus aureus. As an example of the microbial diversity, IP-003 had both gram negative bacilli and gram positive cocci, while IP-004 was contaminated only with gram positive cocci (Table 2). All controls had <10¹ CFU/g.

DISCUSSION/CONCLUSIONS

The results of the present study demonstrated that used IP are contaminated with a wide variety of bacteria. Many of these bacteria, including S. aureus (50%), are associated with clinical infectious disease. Rovers et al. found that used IP are associated with a higher risk of acute otitis media. Sexton and Natale have implicated IP in several gastrointestinal conditions such as colic (40% of children). Other clinicians have found colic in 15 - 30% of infants in the first 3 months of life and have related this to alterations in the intestinal microbiota as a possible etiology for colic. Unsanitary IP may be the source of the microorganisms and/or their metabolic products. All bacteria have “signature” molecules, either cellular structural components or toxins, with pathogen-associated molecular patterns (PAMPs). These patterns are recognized by the human innate immune system. The response of the host’s immune system to PAMPs is based on their binding to the host’s Toll-like receptors (TLRs). Gram negative bacteria, including lipopolysaccharides (LPS), powerful modulators of the humen immune system through interaction with the host’s Toll-like receptor-4 (TLR-4). Different species and strains within these species produce LPS with diverse chemical structures that affect the immune system in various ways. Erridge et al. proposed a mechanism whereby LPS in saliva can get into the human circulation system and results in low grade systemic inflammation. This low grade systemic inflammation may potentiate the risk of developing atherosclerosis and metabolic syndrome with related obesity and type II diabetes. Similar inappropriate interactions between species of LPS and TLR-4 may lead to allergies, asthma, and autoimmune diseases. For example, IP-003 was very heavily contaminated with gram negative bacteria containing LPS. By sucking on the pacifier, the infant was exposed to high concentrations of LPS that may ultimately result in obesity and diabetes below. This is a new area of study that needs to be investigated further to determine the potential of sanitary pacifiers to cause non-infectious systemic disease processes.

REFERENCES

2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3057865/