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An Overview of the Harmful Additives and Contaminants Possibly Present in Baby Cosmetic Products

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Abstract

Baby cosmetics and personal care range of products is an essential part of daily needs of all the infants now days. These products are available in a wide variety to fulfil all the skin care and hygienic requirements of the young ones. However, it should be kept in mind that the chemicals used as additives in these products might be harmful to the immature skin and immunity of an infant. This article presents a review of the possible contaminants and intentionally added additives which are known to cause harm to human system. Our intention is to spread awareness among scientific community as well as the end users i.e. the parents of infants about these chemicals so that they can judge these products for their safety and quality on their own.

Keywords: Baby cosmetics; Skin care products; Toxicity; Cosmetic additives; Parenting essentials

Introduction

Parental care is an incredibly challenging as well as an essential part of human behavior. Raising a child is the biggest responsibility which requires lot of efforts by both parents. Parenting means to promote and support the physical, emotional, social, and intellectual development of a baby from infancy to adulthood. It refers to all the aspects of raising a child, aside from the biological relationship. This explains why the parents want to be prepared for their baby's needs from his/her arrival only. Moreover, the modern parenting has slowly become technology driven as parents read a lot on internet before doing anything for their kids especially during their young childhood. They look for products which are good for baby's health and hygiene as well as are comfortable and easy to use [1].

Along with the other aspects like feeding and vaccinating, bathing and skin care is also an important part of infant grooming because good hygiene plays a big role in baby's health. It has been shown that poor hygiene affects immune system, general health and skin quality in infants [2-4]. It is a known fact that as the infant's skin is very delicate and soft, there is a high risk of skin breakdown due to allergies, extravasation, infections and even skin cancers. Therefore, it becomes necessary to

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preserve its health and integrity. This can be done by choosing the right skin care products [5,6]. According to few paediatric publications, babies should be bathed using pH neutral cleansers. The emollients or the preparations that soften the skin should be free of fragrances, dyes or preservatives. The nappy area should be kept moisturized and clean [7,8].

Keeping all this in mind, the manufacturers of baby cosmetic products try to make mild preparations which can moisturize and nourish the baby's skin in a better way. This is the reason why this range of products is gaining extreme popularity in the market. The global market is flooded with a wide range of baby cosmetic products like night cream, diaper rash cream, mosquito repellent, massage oil, sunscreen lotion etc., in response to high demand for them. However, in spite of high market demand, the production of these products is not an easy task. The major hurdle in the development of baby products industry is the high manufacturing cost, lesser availability of raw materials and the stringent rules for the commercialization of these products leading to very high end price. Due to this, there is a quest in the manufacturing companies to bring the price of these products within the range of all the economic groups of the society. However, these efforts should be balanced and should not bring a downfall in the quality and safety of the baby cosmetic products.

Baby cosmetic products are marketed as best in quality which makes the consumers purchase them in prices much higher than the normal range of products. The television and print advertisements of these products claim that they are having the goodness of milk, cream and honey. Many new marketing strategies are being introduced in the market making this newly grown industry flourish very fast [9]. These products have soothing aromas and soft textures. Additionally, manufacturers claim that their products have accurate compositions. They also contain proper foaming and cleansing agents which help in keeping baby's skin cool and fresh and maintain skin's moisture equilibrium. Most of the products also have antimicrobial and antiseptic agents which prevent skin infection in babies. However, the chemical nature of these products is neutral. A study indicates improved skin health and decrease in skin diseases with the use of commercial skin care products [8].

In spite of so many advantages, it has been reported that many of the baby products contain traces of harmful chemicals which are possibly introduced during the manufacturing, sterilization or packaging stages. Many additives like preservatives, flavouring agents, colouring agents and aromatic agents etc. which are added to these products to increase their shelf life and to enhance their flavour and appearance, are harmful and are known to cause serious health concerns in babies [10].

To control the health hazards caused by cosmetics, the Government of India has formed an act called the Drug and Cosmetic act which includes certain manufacturing norms to regulate the production, marketing and sales of baby cosmetic products in India. Among the international agencies, The Food and Drug Administration (FDA or USFDA) is responsible for protecting and promoting public health through the control of cosmetic products. The specialized rules for processing, packaging and labelling of baby cosmetic products given in these acts are having many lacunae therefore in spite of stringent laws being made and bans being enforced against various harmful additives by the national and international federal agencies, many products introduced into the market by well-known manufacturers have been found to contain non-permissible limits of these additives [11]. As a general FDA regulation, the ingredients and their quantity in the composition should be clearly indicated on the packaging. It is therefore very important to know about the possible harmful chemicals present in these products so that they can be judged for their safety and quality.

The manufacturing of baby cosmetic products includes formulation followed by their processing and packaging before their introduction into the market. The processing of baby cosmetic products involves grinding and homogenization, dispersion in oil based or water based mediums, pigment addition, flavor and aroma enhancement and texture management etc. This is usually achieved by addition of many chemical additives.

Additives used in the skin care products increase their viscosity and also serve as stabilizers, dispersants, lubricants, binders, penetration enhancers, emulsifying agents, and suspending agents. Phthalates are an important class of additives that can serve all these functions [12]. However, according to a study conducted in the year 2008 the use of infant lotion, infant powder, and infant shampoo was associated with increased infant urine concentrations of phthalate metabolites. The younger infants were found to be more affected. The study clearly states that "Young infants are more vulnerable to the potential adverse effects of phthalates given their increased dosage per unit body surface area, metabolic capabilities, and developing endocrine and reproductive systems" They are known endocrine disruptors and are directly linked to breast cancer [13].

Preservatives constitute a major class of chemical additives. Preservatives commonly added to baby cosmetics include BHT (Butyl hydroxytoulene) and BHA (Butyl hydroxyanisole). BHT is an antioxidant and has been linked to cancer, asthma and behavioural issues in children. Some manufacturers have voluntarily removed BHT from their products and have replaced it by another antioxidant BHA. BHA is also a carcinogen but when taken in high doses [14,15]. With regards to skin care, however, it has been assessed that dermal application of BHT and BHA provides a very limited and gradual penetration of the skin and it does not become absorbed in to the bloodstream and thus does not expose the body to any of the BHT's potential harmful side effects [16]. Parabens are another very popular class of preservatives used in foods as well as skin care products due to their bactericidal as well as fungicidal properties. Parabens are active against a wide range of microorganisms. However, they have been linked with dermatitis and allergies. Parabens are potential endocrine disruptors and are known to cause breast cancer [17-19].

Formaldehyde is used in many baby wash products like shampoos, liquid soaps etc. It helps prevent microbes from growing in water-based products [20]. It is a probable human carcinogen and is associated with gene damage, mutations and developmental problems [21]. Some baby products contain formaldehyde releasing preservatives in place of formaldehyde itself. The formaldehyde releasing preservatives include dimethylol urea, DMDM hydantoin, polyoxymethylene urea, sodium hydroxymethyl glycinate, and diazolidinyl urea. They lead to the infant exposure to formaldehyde [22]. Formaldehyde releasing preservatives are the most dangerous class of preservatives as far as carcinogenicity is concerned. They are banned from cosmetics, toiletries as well as food products in Japan, Europe and Sweden [23].

Other than these, preservatives like Isothiazolinones, Phenoxyethanols and some organic acids like benzoic acid/sodium benzoate, sorbic acid/potassium sorbate, levulinic acid, anisic acid etc. are also used in cosmetic products. To keep the babies safe from these chemicals, it is advisable that manufacturers should use natural preservatives like salt, sugar, oil, lemon, vinegar, cloves, herbs, rosemary extract, citric acid etc., for increasing the shelf life of baby products [24]. As compared to other preservatives, BHA, BHT and isothiazolinones have been found to be safer for use in baby cosmetics other than mild skin allergies that they might cause [25].

Colorants which are another class of frequently used additives in baby cosmetic products are Caramel, Unicert Red K 7008-J, Chlorophyllin and Unicert Red K 7054-J out of which last two have been found considerably cytotoxic in a study [26]. Other than these, colorants like Quinoline Yellow and Acid Orange are also used in baby cosmetic products. Both of them are known to cause DNA damage *in vitro*.

Emulsifiers as additives play a very important role in baby cosmetic products. They are used to make oil in water solutions. Most commonly used emulsifiers for these products are lecithin, glyceryl stearate, cetearyl alcohol, polysorbate, stearic acid and myristic acid etc. Out of these myristic acid is known to be comedogenic i.e., it causes skin allergies however it did not induce any mutagenic response in either bacterial or mammalian systems *in vitro*. Polyethylene glycols (PEG's) used as thickeners in different cream based baby products are a topic of concern as the manufacturing process might contaminate them with ethylene oxide (a gas used as raw material in manufacturing of PEG) or 1, 4-dioxane (used as stabilizer for storage and transfer in aluminum containers), both which are carcinogenic compounds [27].

Other than these, another chemical additive benzophenone found in sunscreen lotions and other cream based products is used to absorb ultraviolet light before it can burn baby's skin. Benzophenone is associated with cellular damage, endocrine disruption, organ system toxicity and cancer [28]. Sodium Laureth (or Lauryl) Sulfate which is added as to shampoos, soaps, toothpastes and body wash etc. as foaming agent is also a matter of concern as it might get contaminated with a carcinogen 1, 4 dioxane (used for sterilization of the product) during the manufacturing process [29].

It is always advisable by the pediatricians that the baby product should be neutral in nature. Therefore, it becomes important to add pH regulators like Triethanolamine to the baby skin care products. Triethanolamine also works as emulsifier and foaming agent. Small doses of triethanolamine are approved by the FDA for use in cosmetics and personal care products intended for "discontinuous use," meaning that it should be washed off briefly after application. However, the concentration should be less than 5%. Its regular exposure can cause liver, bladder and testicular cancer [30]. Chemical called talc is commonly used ingredient in baby powder and diaper rash creams. It is known to cause ovarian cancer. It can also cause severe skin allergies and irritation in the eyes [31].

As these products are made for infants, the most important part of their formulation is imparting a soothing aroma to them. Phthalates are commonly used for this purpose. They are suspected carcinogens and hormone disruptors. Diethyl phthalate (DEP) is the most toxic phthalate [32]. Mineral oil is another toxic ingredient used in oil based baby products. It has also been shown to cause cancer in humans. Moreover, mineral oil might appear to have a moisturizing effect, but it actually seals the skin pores and prevents the skin from breathing [33].

In addition to the above-mentioned chemicals, these products have also been found to contain toxic heavy metals like lead, cadmium, nickel, chromium, and mercury. A study conducted in Nigeria tested many commonly used personal care products (not all of them were specifically for infants) and they found that about 61% of the products contained detectable levels of nickel, lead and cadmium which are much above the limit suggested by the regulatory authorities. It was also found that creamy white coloured cosmetics contained higher levels of metal contaminants than the other colours [34].

Other than processing, the packaging of cosmetic products is also done using very attractive colours and graphics to influence the buying decision of the consumers. These products are packaged in jars, tubes, sachets, bottles and dispensers etc. The packaging materials commonly used are glass, plastic and metal. The packing might also contain BPA or other surface coatings and plasticizers etc., which might migrate into the product and cause harm.

The 'no suck back' metal tubes used in many cream based products are made of aluminium (60%), lead (25%) and tin (15%) all of which have been shown to migrate into the contents of the tube [35,36]. Few recent studies have found the presence of many heavy metals like lead, arsenic, antimony, cobalt, chromium etc. in products meant for daily use [37,38]. The active packaging with quality sensors and preservative delivery devices is being used in the packaging of cosmetic products [39]. It is important to be noted that there are no specific packaging norms for infant cosmetic products.

These reports compel the users to think if there is any need for specialized products for infants? If yes then what are the criteria and guidelines for their composition and suitability to babies? If no, then why these products are in the market? Products sold in the name of baby products are expensive as compared to the traditional products. Aggressive promotion in the print and electronic media has resulted in parents buying these products at high prices.

The products which are used on daily basis by the infants should be manufactured with utmost care under stringent conditions. Parents are compelled to trust the big names in the baby product business because of their impressive advertising. Therefore, it is very necessary that strict laws should be made for production as well as advertising of baby products which should be based on the toxicity profiling of different ingredients, additives, manufacturing processes and packaging methods. Moreover, the permissible limits of the possibly harmful additives should be lower for the baby products as compared to the products for adult use. Also, more studies should be done specifically on baby products and the results should be published more frequently in both scientific and nonscientific publications [40].

Conclusion

The baby cosmetic products are gaining a lot of popularity these days. The regulations for manufacturing and marketing of these products are not specific and stringent leading to many instances where harmful chemicals above permissible were found in products from well-known and reputed manufacturers. It would be beneficial if more research groups work on the toxicological analysis of and safety assessment of these products. Also, the permissible limits of additives known to cause toxicity should be lower for infant products as compared to similar products for adult use.

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