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DESIGN AND RESEARCH FOR A FASHIONABLE PROTOTYPE FOR PATIENTS WITH FECAL INCONTINENCE.

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DOI: 10.63442/CTRP1991

**KEYWORDS | FASHION DESIGN, TRANSDISCIPLINARY DESIGN, FECAL INCONTINENCE,
ADOLESCENCE**

ABSTRACT | The negative impact of Fecal Incontinence (FI) on the quality of life of adolescents and their families and healthcare systems is well established. Moreover, it has been observed that FI leads to a decline in the psychological well-being of affected adolescents. Fashion Design can positively impact society by integrating creative design and social innovation. However, particularly in the intimate fashion field, the adolescent segment is an unexplored area of scientific research.

This paper addresses the theme's importance, focusing on the research design for developing an innovative and fashionable prototype for FI as part of an ongoing Ph.D. work. The current research proposes a mixed methodology through a case study, using Portuguese adolescents diagnosed with FI aged 8 to 14 as a sample.

This paper aims to contribute to the literature review of incontinence-related design products research and describe a sample of existing products on the European market. Finally, it states the importance of a transdisciplinary dialogue in creating products to enhance the quality of life for those diagnosed with FI.

1. Introduction

Fashion designs assume a purpose by creating aesthetically pleasing products capable of triggering emotions and sensations (Lerpiniere, 2013).

The importance of studying the evolution of intimate fashion design, especially in the children's segment, cannot be overstated. It can unlock new knowledge in fashion design and open new research areas on the emotional experience that aesthetics can bring to fashion products at younger ages. The research on the aesthetic preferences of children and adolescents for their intimate apparel needs to be deepened. According to a recent study by Rocha et al. (2020), age is an essential factor influencing our aesthetic preferences and development. Despite other variables that can also affect our aesthetic preferences, it was found that different stages of aesthetic development are achieved at different ages. Thompson (1991) highlights the fundamental role that childhood and adolescence have in individual construction, where emotional and conscious beings are developed. For those reasons, a deeper theoretical reflection on the symbolism the experience assumes in the relationship with intimate apparel at young ages, mainly adolescence, is essential to further research. Additionally, a study that contributes to developing a prototype capable of addressing the problems arising from incontinence, particularly fecal, can have far-reaching benefits for the user, the caregiver, and the healthcare system. By conducting such research, we can create products that will improve the quality of life for those who use them and positively impact society.

Incontinence can be categorized as urinary or fecal. This paper presents the design of an ongoing Ph.D. research that proposes a higher incidence of fecal incontinence, as it is a growing problem. Child fecal incontinence can be challenging for children and adolescents between the ages of 4 and 17 (Ferreira-Maia et al., 2016; Robin et al., 2018; Rajindrajith et al., 2021). The involuntary loss of stool can cause embarrassment and discomfort. The initial treatment usually involves drug therapy, which may include laxatives, along with a fiber-rich diet. Additionally, establishing a daily routine to re-educate the anal sphincter muscles can help manage the condition (Rajindrajith et al., 2021).

FI belongs to the group of gastrointestinal disorders. According to a recent study by Rajindrajith et al. (2021), fecal incontinence can be classified into two categories: fecal incontinence (FI) and Organic Incontinence (OI). The first category has a higher prevalence, especially among males. The study also suggests that constipation is one of the primary reasons for fecal incontinence. Another study conducted by Scarpato et al. (2018) in school settings (sample of 13,750 children and adolescents) in European Mediterranean countries showed a prevalence of gastrointestinal disorders of 20.7% in children between 4 and 10 years old and 26.6% in adolescents between 11 and 18 years old, among these cases 11.7% and 13.1% respectively were related to constipation. Levy et al. (2017) conducted a systematic literature review and found that the prevalence of constipation varies across different regions worldwide. In North and South America, the prevalence of constipation in children and adolescents ranges between 10% and 23%. In Europe, the prevalence is lower, between 0.7% and 12%, only in the group of children. In Asia, the prevalence ranges between 0.05% and 29.6%.

Fecal incontinence is a common problem among children and is one of the main reasons for referral to gastrointestinal consultations (Ferreira-Maia et al., 2016). Inan et al. (2007) state that fecal incontinence is common in childhood and should be considered a common problem. According to Levy et al. (2017), constipation (most often resulting in FI) has an estimated average prevalence of about 15% of the child population. There is a consensus that this pathology affects the quality of life of children and families, impacts healthcare systems, and contributes to a decrease in the psychological well-being of these children (Joinson et al., 2006; Rajindrajith et al., 2013; Rajindrajith et al., 2021).

The ongoing research presented in this paper sets out the main objective of developing and testing a fashionable prototype that can enhance the quality of life of adolescents diagnosed with FI.

2.A Review of Incontinence Products

Despite the significant evolution of products for incontinence, from a design point of view over the last decades, there are no aesthetically attractive solutions, especially in the children's segment. Although an undergarment does not solve the incontinence problem, particularly fecal, a tailored fashion design product can solve or mitigate several initial problems, mainly using smart and functional textiles.

Three significant issues related to fecal incontinence are identified in an initial analysis: storage, odor, and tactility. Involuntary stool loss results from the loss of anal sphincter movement, and children and adolescents are often unaware that they are defecating, which makes stool storage problematic (Levy et al., 2017).

It is essential to understand how to reduce the time the child's skin is in contact with feces while following the daily hygiene routine suggested in therapy.

Moreover, the unpleasant odor of feces leads to stigmatization and exclusion (Joinson et al., 2006; Rajindrajith et al., 2013). Many of these children lose their sensitivity to fecal odors and cannot identify them after some time. When designing a new solution, neutralizing the odor released and accumulated in intimate fashion clothing should be considered. McNichol et al. (2018) state that frequent skin exposure to feces can cause 'incontinence-associated dermatitis.'

An initial literature review on research into textiles applied to developing products for incontinence reveals different lines of research. Still, most of them are aimed at monitoring and alarming urinary incontinence. Liu et al. (2012) have presented a novel solution for incontinence monitoring, incorporating conductive yarns on a seamless textile structure with an alarm system. The authors also state that smart and functional wearable textile product research requires collaboration across multiple disciplines, including aesthetic design, biomedical engineering, science, and technology, reinforcing the need for transdisciplinary dialogue in developing this type of product. Also, in a study published in 2020, Gaubert et al. focused on improving enuresis alarm systems. They aimed to make the systems more comfortable for children and increase their acceptance. They achieved this by replacing the rigid alarm with a flexible one. The new system includes a humidity sensor and wire that are fully integrated into a textile structure.

2.1 Existing Products

An analysis was conducted on the existing products that primarily address incontinence, which can be urinary, fecal, or both. The main objective was to understand the current product offerings better.

Table 1 showcases a sample of existing products available on the European Market. The products are compared by gender (female, male, or unisex), age group (child or adult), type (pants, boxers, diapers with flaps, diapers-pants, pads), response to physical and sensory problems arising from incontinence such as storage and odor, and product life cycle (disposable or reusable). The survey also includes washable and reusable products for urinary incontinence that can inspire designing a product that addresses fecal incontinence.

Table 1. Sample of existing products on the European Market.

Product	Gender	Segment	Typology	Answer	Life Cycle
Happyjam, Dodot	Male and Female options	8y to 12y (27-55kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
Underjams, Pampers	Male and Female options	Size S/M (17-29kg) Size L/XL (26-39kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
DryNites, Pampers	Male and Female options	4y to 7y (17-30kg) 8y to 15y (27-57kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
McKesson	Unisex	Adult + Senior	Daily Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
Protective Underwear, Tena Men	Male	Adult	Diaper-Pant	Odor control, enuresis, humidity control, and an elastic waistband are needed for better fitting.	
Active Fit, Tena Men	Male	Adult	Pad	Odor Control, Enuresis, Thin (4mm), Ergonomic, Humidity Control.	
Training Pants, Bambino Mio	Unisex	12m to 24m (11-13kg) 2y to 3y (13-15kg) +3y (+15kg)	Pantie	Enuresis, Water-resistant and inner par, Comfortable and stretchy waistband for active toddlers	
Confitex for Men	Male	Adult	Boxer Short	Ultra Absorbency, Discreet design, close to regular boxer short form, Comfortable and breathable textiles.	
Organics for Men, LeakWear	Male	Adult	Boxer Short	Ultra Absorbency, Discreet design, close to regular boxer short form, Comfortable and breathable textiles.	
Incontinence Boxer Short, Impetus	Male	Adult	Boxer Short	Ultra absorbency, discreet design, close to regular boxer short form, comfortable and breathable textiles, and odor control.	

Since feces in fecal incontinence can have a range of densities, from pasty to liquid, menstrual underwear was also considered a product that could contribute to innovation and design in this area. Small clots often accompany liquid menstruation on the surface of regular menstrual pads. Therefore, technology transfer from non-disposable products to menstruation into fecal incontinence products could partially solve the storage problem.

Menstrual pants are one of the most advanced products in intimate apparel, and they have an absorbent function. Impetus Group, for example, has developed the Period EcoPanty, which is absorbent, hypoallergenic, thin-layered, anti-odor, and reusable.

3. Methodology of the Ongoing Research

The ongoing research is exploratory and adopts a methodological approach that recognizes the various terminologies used in the fashion industry. The term "intimate fashion clothing" refers to underwear, undergarments, and intimate clothing.

The research employs a mixed-method approach to collect and analyze quantitative and qualitative data in different phases, as described below:

1. The first phase will be a case study using a qualitative methodology that will allow a more profound knowledge of FI medical disorder:
 - Semi-open interviews with a focus group of specialists, mainly from pediatrics, a pediatric gastroenterologist, a child psychiatrist, and parents/caregivers. To validate our data collection, a pediatrician will lead this expert group;
 - In-depth semi-open interviews will be conducted using an exploratory and phenomenological approach to understanding the main problems arising from fecal incontinence. These interviews will be conducted with a non-probabilistic sample by convenience, consisting of patients diagnosed with fecal incontinence aged between 8 and 14 whom two health institutions are following in Oporto. The Interpretative Phenomenological Analysis (IPA) will be adopted to interpret the interviews.
2. (Once the problems arising from FI are acknowledged, a study will be conducted on Portuguese adolescents aged between 8 and 14. The study assesses their aesthetic preferences and perception of aesthetics, comfort, and well-being. The surveys will be applied to a probabilistic sample of adolescents without the disorder. The sample will be selected from a randomized selection of schools in the metropolitan area of Oporto. This sampling method integrates the two stages of Piaget's child development (1964): concrete (8 to 11 years) and formal operative (12 to 14 years). The prototype can be developed more accurately by cross-referencing the perceptions and needs of adolescents with and without the disorder.
3. Prototype development;
4. To validate the prototype, it will be tested in a focus group with adolescents between 8 and 14 years old and a control group with children without the disorder.

This study involves minors who must voluntarily agree to participate. To ensure the study is conducted ethically, it will be reviewed and approved by the Ethics Committee of the University of Beira Interior and the Ethics Committees of partner hospitals. It is important to note that all minors who participate in the study must obtain prior consent from their parents or legal guardians. Additionally, all data collected will be protected by the Data Protection Act, which aims to preserve the anonymity and privacy of the participants.

4. Conclusions

Understanding the emotional relation with intimate fashion clothing in adolescence will allow this knowledge to design more visually pleasing fashion items that align with modern ergonomics theories and promote the user's comfort and well-being. Particularly in the case of FI disorder, the application of new knowledge from this research can be helpful to the creation of innovative intimate fashion products that improve intimate hygiene in adolescents. This research aims to develop a lower environmental and economic impact product. Additionally, it is expected that the research will generate interest in the field of children's intimate fashion clothing and pave the way for further studies in related areas such as the history of children's intimate fashion clothing, ergonomics, and children's anthropometrics, and the role of design in children's fashion products. Finally, as the research is conducted, it will be pertinent to realize the importance of transdisciplinary dialogue in product development, such as the one proposed.

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P/REFERENCES OF DESIGN

This contribution was presented at Cumulus Budapest 2024: P/References of Design conference, hosted by the Moholy-Nagy University of Art and Design Budapest, Hungary between May 15-17, 2024.

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ISBN Volume 1: 978-952-7549-02-5 (PDF)

ISBN Volume 2: 978-952-7549-03-2 (PDF)

DOI Volume 1: <https://doi.org/10.63442/IZUP8898>

DOI Volume 2: <https://doi.org/10.63442/TADX4016>

Conference Organisers

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