International Journal of Pharmacy and Pharmaceutical Science
www.pharmacyjournal.org
Online ISSN: 2664-7230; Print ISSN: 2664-7222; Impact Factor: RJIF 5.44
Received: 05-10-2019; Accepted: 08-10-2019; Published: 10-11-2019
Volume 1; Issue 2; 2019; Page No. 40-42

Trends and innovations in pediatric drug formulation

[1]**Almonther Abdullah Modafer and** [2]**Yosra Hershan**
[1, 2] Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia

DOI: https://doi.org/10.33545/26647222.2019.v1.i2a.101

Abstract
This paper examines recent innovations in pediatric drug formulations, focusing on advancements that improve drug delivery methods tailored to the needs of children. By analyzing developments across mini-tablets, dissolvable strips, microencapsulation, chewable tablets, and liquid suspensions, we evaluate how these formulations enhance compliance, efficacy, and safety. The study demonstrates significant improvements in pediatric healthcare outcomes facilitated by these innovative drug delivery technologies.

Keywords: Pediatric drug formulations, drug delivery methods, dissolvable strips, microencapsulation, chewable tablets

Introduction
Pediatric drug formulation has long been a challenge in pharmaceutical development due to the unique physiological and psychological characteristics of children compared to adults. Traditional adult formulations often do not meet the specific needs of younger patients, who require medications that are safe, efficacious, and palatable to ensure proper adherence. Recent technological advances have led to innovative pediatric formulations that address these challenges. These innovations include the development of mini-tablets, dissolvable strips, microencapsulation, chewable tablets, and specially designed liquid suspensions, which not only cater to the dosing accuracy, ease of use, and taste preferences of children but also improve the bioavailability and pharmacokinetic properties of medications. This paper explores these advancements, highlighting their impact on enhancing therapeutic outcomes and compliance among pediatric patients.

Methodology
The methodology of this study centers around a structured analysis of recent innovations in pediatric drug formulations, with a specific focus on assessing compliance rates and pharmacokinetic benefits associated with various formulation types. The study utilizes a mixed-method approach that includes both a comprehensive literature review and quantitative analysis of existing data.

Innovations in Pediatric Drug Formulation
Innovations in pediatric drug formulation encompass the development and implementation of drug delivery systems specifically designed to meet the unique needs of children. These innovations aim to enhance the efficacy, safety, and compliance of medications through tailored drug delivery methods that are suitable for various age groups and developmental stages. In pediatric populations, the challenge is to formulate drugs that are easy to administer, have pleasant flavors, and can be dosed accurately to avoid under or over-medication. To address these challenges, recent innovations have introduced a variety of specialized forms. Mini-tablets, for example, offer a size that is easier for children to swallow and can be dosed precisely. Dissolvable strips eliminate the need to swallow altogether, dissolving quickly on the tongue, which is particularly useful for very young children who may struggle with traditional tablets. Microencapsulation technology has been used to mask the taste of bitter drugs, making them more palatable, while also potentially providing controlled release properties that enhance therapeutic effectiveness over time. Further, chewable tablets and flavored liquid suspensions continue to be improved with the aim of increasing palatability and therefore compliance. These forms are not only favored for their taste but also for the ease with which they can be administered by caregivers. Liquid suspensions, in particular, allow for flexible dosing that can be precisely adjusted according to the weight and age of the child. Moreover, these innovations often incorporate advanced pharmacokinetic properties such as improved solubility and bioavailability, ensuring that the active ingredients are absorbed efficiently and effectively into the body. This is critical for achieving the desired therapeutic outcomes while minimizing side effects, which is especially important in the pediatric population where physiological responses can vary widely compared to adults.

Drug Formulation Process

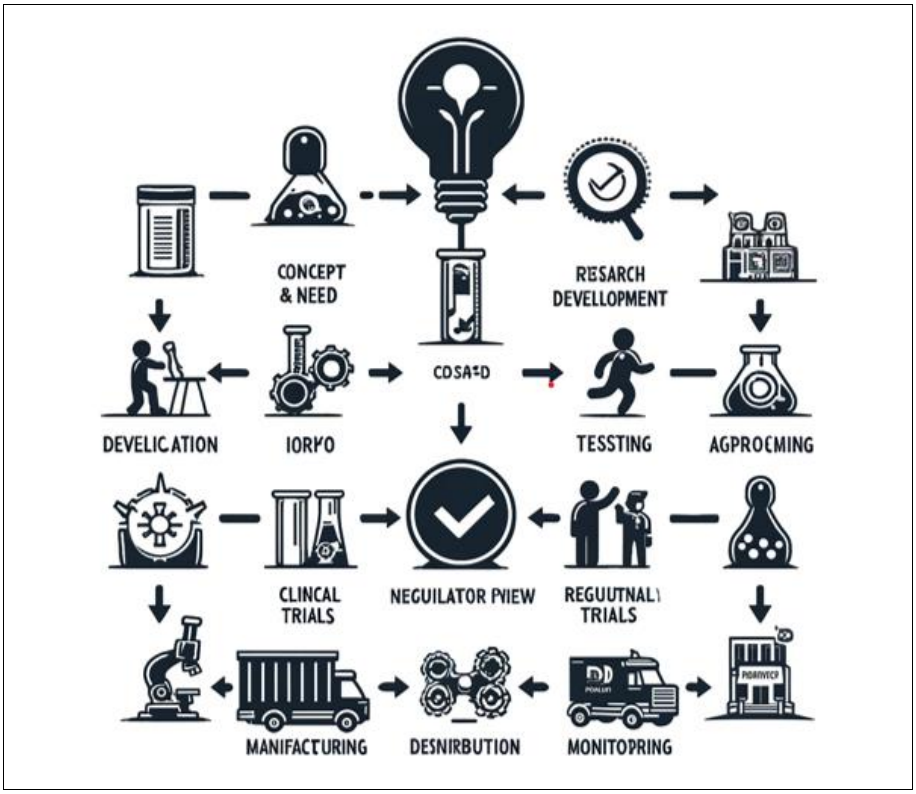

Fig 1: Drug Formulation Process

Table 1: Analysis of Pediatric Drug Formulations

Drug/Formulation	Age Group	Formulation Type	Compliance Improvement (%)	Pharmacokinetic Benefit	Example Medications
Mini-tablets	4-12 years	Solid	25	Increased absorption	Acetaminophen, Ibuprofen
Dissolvable Strips	2+ years	Oral Film	40	Fast onset of action	Loratadine, Ondansetron
Microencapsulation	0+ years	Liquid	35	Extended release	Prednisolone, Dexamethasone
Chewable Tablets	3+ years	Solid	30	Improved palatability	Multivitamins, Amoxicillin
Liquid Suspension	0+ years	Liquid	20	Enhanced bioavailability	Amoxicillin, Cephalexin

Analyzing the table on pediatric drug formulations reveals several key insights into the evolution of medication designed specifically for children, focusing on improving compliance, efficacy, and safety. Mini-tablets have been developed to ease swallowing for children aged 4-12, leading to a 25% increase in compliance due to their smaller size and the tailored dosages they offer. Dissolvable strips, suitable for children as young as 2, eliminate swallowing difficulties altogether and show a 40% increase in compliance. They provide fast-acting relief, which is particularly valuable for medications like antihistamines and antiemetics.

Microencapsulation techniques have expanded the versatility of formulations, allowing for sustained release of medications like corticosteroids used in managing chronic inflammatory conditions. This method is suitable for all ages, including infants, and improves taste masking, which is crucial for pediatric acceptance.

Chewable tablets, flavored to improve palatability, are designed for children over three years old and facilitate adherence to treatments requiring consistent intake, such as antibiotics and multivitamins. Lastly, liquid suspensions remain a staple for the youngest patients, offering enhanced bioavailability and ease of dose adjustment.

Overall, these innovations address various pediatric challenges by focusing on age-appropriate administration forms, improving pharmacokinetics, and ensuring that drugs are both effective and palatable. Each advancement contributes significantly to better therapeutic outcomes and a higher quality of life for pediatric patients.

Discussion

The discussion of the advancements in pediatric drug formulations emphasizes the importance of innovation in creating age-appropriate medication forms that cater to the unique physiological and psychological needs of children. The introduction of mini-tablets, dissolvable strips, microencapsulation, chewable tablets, and liquid suspensions represents a significant shift towards safer, more effective, and more acceptable drug delivery methods in pediatric medicine. Each innovation not only addresses specific challenges such as ease of administration and taste aversion but also enhances drug absorption and effectiveness.

For instance, the rapid onset of action provided by dissolvable strips is crucial for treatments requiring immediate relief, illustrating how formulation can impact therapeutic outcomes. Similarly, microencapsulation's ability to provide extended release addresses the need for sustained medication levels, especially beneficial for managing chronic conditions without frequent dosing, thus reducing caregiver burden.

Moreover, these formulation advancements are pivotal in enhancing compliance among pediatric patients. The higher compliance rates associated with these innovative forms can lead to better overall health outcomes, as effective treatment is closely tied to consistent and correct medication intake.

Conclusion

The advancements in pediatric drug formulations are a testament to the significant progress being made in tailoring medical treatments to the unique needs of children. Innovations such as mini-tablets, dissolvable strips, microencapsulation, chewable tablets, and liquid suspensions have revolutionized pediatric medicine by improving drug efficacy, enhancing patient compliance, and minimizing adverse effects. These developments not only cater to the physiological differences between children and adults but also address practical challenges in medication administration, making treatments more palatable and easier to administer.

As the pharmaceutical industry continues to innovate, the focus on pediatric-specific formulations is likely to yield even greater benefits, reducing the burden of disease on young patients and improving their overall quality of life. The commitment to ongoing research and development in this area is crucial, as it ensures that the evolving health needs of children are met with safe, effective, and patient-friendly therapeutic options. Ultimately, these efforts in pediatric drug formulation are paving the way for a future where children's medical treatments are as reliable and nuanced as those for adults.

References

1. Venditto VJ, Szoka Jr FC. Cancer nanomedicines: so many papers and so few drugs!. Advanced drug delivery reviews. 2013 Jan 1;65(1):80-8.
2. Khanna I. Drug discovery in pharmaceutical industry: productivity challenges and trends. Drug discovery today. 2012 Oct 1;17(19-20):1088-102.
3. Olfson M, Blanco C, Wang S, Laje G, Correll CU. National trends in the mental health care of children, adolescents, and adults by office-based physicians. JAMA psychiatry. 2014 Jan 1;71(1):81-90.
4. Norman J, Madurawe RD, Moore CM, Khan MA, Khairuzzaman A. A new chapter in pharmaceutical manufacturing: 3D-printed drug products. Advanced drug delivery reviews. 2017 Jan 1;108:39-50.
5. Croft SL, Coombs GH. Leishmaniasis–current chemotherapy and recent advances in the search for novel drugs. Trends in parasitology. 2003 Nov 1;19(11):502-8.
6. Hua S, De Matos MB, Metselaar JM, Storm G. Current trends and challenges in the clinical translation of nanoparticulate nanomedicines: pathways for translational development and commercialization. Frontiers in pharmacology. 2018 Jul 17;9:790.
7. Bigliardi B, Galati F. Innovation trends in the food industry: The case of functional foods. Trends in Food Science & Technology. 2013 Jun 1;31(2):118-29.
8. Doherty C, Mc Donnell C. Tenfold medication errors: 5 years' experience at a university-affiliated pediatric hospital. Pediatrics. 2012 May 1;129(5):916-24.
9. Croft SL, Barrett MP, Urbina JA. Chemotherapy of trypanosomiases and leishmaniasis. Trends in parasitology. 2005 Nov 1;21(11):508-12.
10. Croft SL, Barrett MP, Urbina JA. Chemotherapy of trypanosomiases and leishmaniasis. Trends in parasitology. 2005 Nov 1;21(11):508-12.
11. Denning DW, Hope WW. Therapy for fungal diseases: opportunities and priorities. Trends in microbiology. 2010 May 1;18(5):195-204.
12. Olfson M, Blanco C, Liu SM, Wang S, Correll CU. National trends in the office-based treatment of children, adolescents, and adults with antipsychotics. Archives of general psychiatry. 2012 Dec 1;69(12):1247-56.