**3D-Printed Chewable Gummies: A Customizable Approach to Formulate Propranolol in the Paediatric Population**

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**Background:** The lack of age-appropriate medications for the paediatric population, which comprises over 30 % of the global, remains a significant healthcare challenge. Due to the high costs and complexities of research, most available drugs are formulated for adults, leading to the off-label use of medications in children thus, increasing the risk of side effects and decreasing the treatment efficacy. This is the case of propranolol hydrochloride. A medication frequently used in children for arrythmias and other cardiac disorders. Furthermore, dosage flexibility, palatability, and ease of ingestion needs are frequently not satisfied by conventional drug manufacturing; all of which are critical for therapeutical adherence in paediatric patients.

**Methods:** The present study addresses these issues by developing chewable dosage forms, also called gummies, using a semisolid extrusion-based 3D printer, specifically the pressure-assisted micro syringe technology. A preformulated hydrogel, based on sodium alginate and iota-carrageenan, was optimized through rheological analyses to achieve the ideal properties for high-resolution 3D printing. Fourier Transform Infrared Spectroscopy (FTIR) was employed to evaluate the material's compatibility and drug distribution within the final dosage form while Tensile Profile Analysis (TPA) used to assess texture of the gummies, thus palatability and stability after packaging over time.

**Results:** The optimal formulation contained 7 % w/w of iota-carrageenan and 3 % w/w of sodium alginate. A total amount of 40 mg of propranolol hydrochloride was loaded per dosage form. FTIR spectroscopy confirmed the even distribution of the drug within the gummies, and texture analysis showed satisfying chewability when compared to commercially available gummy products. In addition, tests carried out in accordance with the European Pharmacopoeia requirements showed mass and content uniformity, ensuring the solid oral dosage form's quality.

**Conclusions:** This study demonstrates how 3D printing can be used to produce child-friendly, customized dosage forms with good mechanical properties and improved medication with the aim to increase compliance among patients.