

## Types of Attractive Dosage Forms for Primary School Students and Associated Factors in Baghdad/ Iraq

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### Abstract:

The lack of age-appropriate and child - friendly formulation of medication for children poses a major challenge to pediatric therapeutic practice, adherence, and health care delivery worldwide, however, formulation acceptability and preferences facilitate medication

adherence in children, and they are important factors in achieving the intended treatment outcomes in which this study looks ahead. The present study aims to determine the various medication trends of children through their parents and caregivers, child preference of certain dosage form (chewable gel) in comparison with another solid dosage forms and its popularity among Iraqi primary school, furthermore the study highlights different variables influence student preference for chewable gel. A total of 230 Iraqi primary school students were randomly selected and interviewed with the presence of their parents. It was observed that (51.3%) of the parents/caregivers reported that the liquid dosage form is the most dosage form that commonly used, (72%) of consumers revealed that the capsules and tablets are not easy to swallow, furthermore, this study revealed that (68.6%) of school students preferred to take medication as chewable gel over than other oral solid dosage forms, and this preference varied significantly with several socioeconomic and other factors.

**Key words:** Oral Dosage Form, Chewable Gel, children

### أنواع الصيغ الدوائية المرغوبة من قبل طلاب المدرسة الابتدائية والعوامل المرتبطة بها في بغداد / العراق

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### الخلاصة:

يشكل الافتقار إلى إيجاد صيغ دوائية مرغوبة من قبل الأطفال بمراحلهم العمرية المختلفة إلى نشوء تحدي كبير في طريقة أخذ واتباع العلاج بالطريقة الصحيحة ليعطي الغرض المطلوب ، ومع ذلك فإن تقبل الصيغة الدوائية وتفضيلها تسهل الالتزام لأخذ الدواء واتباع العلاج لدى الأطفال ، إذ تعتبر من العوامل المهمة في تحقيق نتائج العلاج المرجوة والتي تتطلع إليها هذه الدراسة. تهدف الدراسة الحالية إلى تحديد اتجاهات الأدوية المختلفة للأطفال من خلال آبائهم ومقدمي الرعاية لهم، وتفضيل الأطفال لصيغة دوائية معينة (هلام قابل للمضغ) مقارنة بصيغ الدوائية الصلبة الشائعة الأخرى و شعبيتها بين أطفال المدارس الابتدائية في العراق ، علاوة على ذلك ، تسلط الدراسة الضوء على العوامل التي أدت إلى تفضيل الطالب لمضغ الهلام مقارنة بالصيغ الدوائية الأخرى .

وقد تم اختيار مجموعه مكونة من 230 طالبًا في المدارس الابتدائية في العراق بشكل عشوائي وإجراء مقابلات معهم بحضور والديهم ومقدمي الرعاية . وقد تم توزيع الاستبيان المعد لهذه الدراسة وعند جمع النتائج ودراستها احصائيا لوحظ أن (51.3%) من الآباء / مقدمي الرعاية لهم أفادوا بأن الصيغ الدوائية السائلة هي الأكثر استخدامًا ، بينما (72%) من

المستهلكين صرحوا أن الكبسولات والحبوب ليس من السهل ابتلاعها ، علاوة على ذلك ، هذه الدراسة كشفت أن (68.6%) من طلاب المدارس فضلوا تناول الأدوية على صيغة هلام قابل للمضغ أكثر من الصيغ الدوائية الفموية الصلبة الأخرى. وهذا التفضيل جاء نتيجة دراسة العديد من العوامل الاجتماعية والاقتصادية ومدى تأثيرها على تفضيل هذه الصيغة الدوائية

**الكلمات المفتاحية:** شكل جرعات فموية ، جل قابل للمضغ ، أطفال.

## Introduction

The proper design and formulation of a dosage form require consideration of the physical, chemical, and biological characteristics of all drug substances and pharmaceutical ingredients to be used in formulating the product. Compatibility between drug and the rest pharmaceutical materials is essential for producing a drug product that is stable, efficacious, palatable, stress-free to administer, and well-tolerated [1]. Drug formulations used in pediatric pharmacotherapy should be rehabilitated to children's needs to suit their age, size, physiologic condition, and treatment requirements. Such pediatric medicines are crucial for achieving safe and precise dose administration, decreasing the risk of medication errors, expanding medication adherence, and improving therapeutic outcomes in children [2].

To ensure adequate treatment of children of all ages, diverse routes of administration, dosage forms, and strengths are regularly desirable for the same active substance. Such routes of administrations are oral for liquid and solid preparations, rectal, parenteral, transdermal, nasal and pulmonary routes. The vast majority of formulations are for oral administration. Oral solid drug delivery systems have been the formulation of choice for the pharmaceutical industry due to the pros of well-established expertise platforms permitting long-term stability, simplification of the supply chain, and conserving low manufacturing cost. Nevertheless, conventional solid forms may not be suitable for patients with swallowing difficulties, particularly the children population besides to poor flexibility of dose [3].

To ease swallowing, consumers or caregivers tend to break, chew or crush the hard tablets of the active pharmaceutical ingredient (API) which may lead to altering the rate or extent of drug dissolution and absorption, as a result, the risk of inaccurate dosing and off-tasting of some (API) that may be enhanced and in turn hospitalization, health care costs, and death would be increased [4].

Liquid formulations for oral administration such as solutions, suspensions, syrups, elixirs, and emulsions. These formulations are suitable for children who cannot swallow oral solid forms. The appositeness of a liquid formulation is achieved through the volume of the dose which considers as an essential key role not only for the palatability of the formulation but also the ability to measure the dose accurately, besides to stability issues [5]. Therefore, there is a scope for more pediatric-friendly dosage forms that offer ease of administration methods, majorly the oral route. Convenient administration methods and more palatable and elegant dosage forms for pediatric patients are gaining momentous importance in the design of novel dosage forms [6]. Throughout decades medicated chewable gel has gained growing recognition as a drug delivery system, especially for the pediatric population. Chewable gel (jelly) has a transparent, translucent, non-greasy appearance and texture, chewable gel are semisolid preparations of definite shape and size, meant for oral administration, this dosage form has several merits that make it fitted satisfactory with the need and desire of pediatric population [7]. The purpose of this study is to identify the dosage forms that commonly are used by caregivers or parents to medicate their children. Furthermore, child preference of certain dosage forms (chewable gel) in

comparison with another solid dosage forms, to highlight the manufacturers about such formulations which provide high potentials for the development of a more acceptable dosage form that may enhance medication adherence and patient acceptability.

## Methodology

### Study strategy

The study was conducted in the "Noor Al-Shams "governmental primary school in Baghdad /Iraq. The strategy involved students of age (9-12 years), integrated 116 males and 114 females, the study duration was from October 2018 to April 2019, a cross-sectional study was conducted, all types of question trials in the study depend on pre-piloted questionnaires from previous studies [8,9]. Data of a total of 230 students were collected with the aid of parents or caregivers during teacher-parent meetings days [8]. The design of the present study founded on a random sampling technique that was questionnaire-based. The research obtained approval from Mustansiriyah University /College of pharmacy and Karkh directorate education II. The questionnaire was prepared in the Arabic language and consisted of three sections. The first section was related to basic demographic information of parents /caregivers and students like gender, age, monthly income, and educational level. To simplify investigation, the parents /caregivers were divided into three age groups (18-29, 30-44 and 45+), and the educational level was assessed into three levels: low (primary and secondary school), average (high school and institute) and high (college and postgraduate) qualifications. The second section related to conditions for which parents usually preferred to medicate their children, purchasing medicines owning by medical expert's consultation or family for treating illness, moreover, their interest in reading the patient information leaflet before starting medication, the dosage forms that

parents /caregivers commonly used or prescribed by medical experts to medicate their children (capsule, tablet, syrup, suppository, chewable oral gel, and injection), furthermore the preferences of children for the medication sweet taste, and the ease of swallowing solid dosage forms (tablet/capsule).

The last section was related to student's preference and favorite for chewable gel in comparison with other dosage forms (tablet/capsule), besides to commitment of participant for taking medication within the prescribed interval, and the possible methods to take the medication (swallowing the whole or grinding/splitting the tablet and emptying the capsule content). The parents/caregivers recorded their children's responses whenever the questions were headed to them. Verbal consents were taken by participants before the interview, by explaining to them the objective of the study. During the interview, each question was properly explained to the participants in the language which he/she could understand easily. For each participant data was collected on an individual questionnaire.

### Statistical analysis

Statistical analysis of data was performed using SAS (Statistical Analysis System - version 9.1). The percentages were compared by using the Chi-square test.  $P < 0.05$  is considered statistically significant [10].

## Results

The study was conducted on students for primary school between the ages of 9-12 years; where 53% were male and 47% were females, the information was gained from parents/caregivers, the majority of caregivers were females (76.5%) while the rest were males (23.4%) of three different age groups, educational level, monthly income, the characteristics were listed in table 1.

**Table (1): Demographic characteristics of participants**

Characteristics	n (%) (N=230)
Gender <sup>a</sup>	
Male	(116)50.2 %
Female	(114)49.5 %
Age group in years <sup>a</sup>	
9-10	(120)52.1%
10-11	(74)32.1%
11-12	(36)15.6%
Gender <sup>b</sup>	
Male	(120)22%
Female	(179)78%
Age group in years <sup>b</sup>	
18-29	(12)5.21%
30-44	(167)70.43 %
45+	(56)24.34%
Educational level <sup>b</sup>	
Low	(8)3.4%
Average	(34)14.7%
High	(188)81.7%
Monthly income <sup>b</sup>	
Low	(10)4.3%
Average	(104)45.2%
High	(110)50.4%

Note: n (%) refers to the number and percentage of participants, N refers to the total number of participants, <sup>a</sup> letter donated for students, <sup>b</sup> letter donated for parents and caregivers, educational level classified into: low (primary and secondary school), average (high school and institute), high (college and postgraduate). monthly income level in Iraqi dinar classified into: low (100,000-500,000) ID; average (500,000-1,000,000); high (1,000,000-3,000,000), columns occasionally do not sum exactly to 100% because of rounding.

The parents/caregivers that participated in the study were majority of (30-44) years age group (70.43%) with high monthly income (50.4%) and educational level (81.7%), they believed in the physician as first medical and health adviser rather than the pharmacist (13.9%), family members and friends (0.86%). The data documented in table 2 refers that the majority of participants (95.6%) significantly read the patient information leaflet before starting medication, while only (4.3%) claimed that

they were not interested in reading. In general, more than half of parents/caregivers significantly used liquid dosage form (51.3%) (syrup, suspension) as a pharmaceutical dosage form, followed by a capsule (17.39%), chewable gel (15.6%), tablet (10.3%) and equally (2.6%) of both injection and suppositories. furthermore, the study revealed that most consumers (91%) preferred the sweet taste of medicament.

**Table (2): Variable characteristics of participants**

Characteristics	n (%) (N=230)	P-value
Seeking medical advice		
Physician	(188)81.7%	<0.0001 <sup>□</sup>
Pharmacist	(32)13.9%	
Family member	(10)0.86%	
Reading the leaflet	(220)95.6%	<0.0001 <sup>□</sup>
Not interested	(10)4.3%	
Dosage forms used by parents/caregivers		
Liquid dosage form (syrup/suspension)	(118)51.3%	<0.0001 <sup>□</sup>
Capsule	(40)17.3%	
Chewable gel	(36)15.6%	
Tablet	(24)10.3%	
Suppository	(6)2.6%	
Injection	(6)2.6%	
prefer sweet taste	(210)91.3%	<0.0001 <sup>□</sup>
Not prefer	(20)8.6%	

note: n (%) refers to the number and percentage of participants, N refers to total number of participants, <sup>□</sup> symbol refers to significant P -value, a significant difference was detected by Chi-square test, columns occasionally do not sum exactly to 100% because of rounding.

The study emphasizes on the acceptability of young population consumers for relatively less familiar dosage form which is a chewable gel (jelly), as this dosage form is majorly known as a supplement in the Iraqi pharmacies, the questionnaire was headed toward the difficulty of swallowing the solid dosage forms (capsule or tablets), it was founded that the 51.3% of consumers suffer from the difficulty of swallowing such dosage form, while 48.6% were not experiencing discomfort/dysphagia. Consequently, in general, (68.6%)158 of the consumers prefer to take the medication in chewable gel form rather than other dosage forms (capsule or tablet) (31.3%), Although the

chewable gel was preferred over the solid dosage forms, significant differences were found among consumers concerning variable characteristics as shown in table 3, as there was significant variation regarding age group 9-10 years (55.6%), ease of swallowing of solid dosage forms (capsule or tablet) as (72.1%) refer not easy, and (75.9%) were commitment to take the medication after finishing the prescribed interval, also high educational (88.6%) and monthly income level (50.4%) have a significant impact in preferring this dosage form. While gender and splitting /grinding the tablet and emptying capsule content have no significant influence of preferring the chewable gel.

**Table (3): Variables influence the preference of chewable gelatin**

Characteristics	n (%) (N= 158)	P-value
Gender		0.34
Male	76(66.6%)	
Female	84(72.4%)	
Age group		<0.0001 <sup>□</sup>
9-10 years	88(55.6%)	
10-11 years	48(30.3%)	
11-12 years	22(13.9%)	
Ease of swallowing capsule or tablet		<0.0001 <sup>□</sup>
Yes	44(27.8%)	
No	114(72.1%)	
Commitment to take the medication After finishing the prescribed interval	120(75.9%)	<0.0001 <sup>□</sup>
	38(24%)	
Splitting /grinding tablet, emptying capsule content	90(56.9%)	0.08
No	68(43.03%)	
Educational level		<0.0001 <sup>□</sup>
Low	8(5.06%)	
Average	10(6.3%)	
High	140(88.6%)	
Monthly income		<0.0001 <sup>□</sup>
Low	6(3.7%)	
Average	70(44.3%)	
High	82(51.8%)	

note : n (%) refers to number and percentage of participants, N refers to total number of participants prefer chewable gel, <sup>□</sup> symbol refers to significant P- value, a significant difference was detected by Chi-square test, educational level classified into: low (primary and secondary school), average (high school and institute), high (college and postgraduate ), monthly income level in Iraqi dinar classified into :low (100,000-500,000)ID; average (500,000-1,000,000); high (1,000,000-3,000,000) , columns occasionally do not sum exactly to 100% because of rounding.

## Discussion

Although the pharmacist plays a role especially in Iraqi community as a dependable medical adviser as previous study referred in Iraq <sup>[11]</sup> nonetheless, it appears that highly educated parents /caregivers with high monthly income are significantly ( $p < 0.001$ ) more reliable on physicians in their source for medical advice.

The finding from our study supports the hypothesis that the highly educated participant have increasing interest for reading the leaflet, the majority of

participants who were highly educated significantly ( $p < 0.001$ ) read the leaflet to be aware and mindful of diverse information related to the prescribed medication such as the method of administration and possible adverse effects especially for prolong term therapy, the previous study refers that patients of a lower socioeconomic status requested more verbal information on their treatment <sup>[12]</sup>.

Drugs given orally include liquid dosage forms (syrups, suspension) as well as solid dosage forms including tablets, capsules, granules, chewable tablets, orodispersible



tablets, and controlled-release tablets [13]. Ordinarily, the oral route of administration is the preferred route for patients of all ages for reasons of convenience and stability. Children necessitate dosage forms adapted to their ability and need for variable dose with age. [14,15] The statistical analysis of the study revealed that consumers significantly ( $P < 0.001$ ) consume liquid dosage form (syrups/suspensions) over other proposed dosage forms (tablet, capsule, chewable gel, suppository and injection, the reason beyond using (syrups, suspension) a liquid dosage forms majorly related to the ease of swallowing and palatability [16].

Most students in the study significantly ( $P < 0.001$ ) nominated that a drug's taste is one of the influencing barriers to take and complete the treatment. According to other studies, the preference for sweet taste remains high through childhood and then switches to neutral during late adolescence. Sweet tasting of medication especially in solution forms in the oral cavity noticeably decreases pain in children, probably via the involvement of the endogenous opioid system. Consequently, it is expected that many oral formulations for children are sweetened [17].

Oral drug delivery consuming solid dosage forms for instance tablets and capsules is the most prevalent and common route of administration because of its convenience and economical way to deliver medications into the body [18], however previous studies referred that there is a certain challenge in swallowing capsules and tablets among children [19,20], therefore, the questioner proposed the consumption of chewable gel among school students and compare it with other solid dosage forms (capsule and tablet), our study finding refers that chewable gel is less commonly used or prescribed by medical experts than liquid dosage forms and capsules, possibly due to this dosage form is majorly known as dietary supplements such as multivitamins and omega -3 and recently melatonin in Iraqi

pharmacies, the statistics shows that the students significantly ( $P < 0.001$ ) prefer medication to be in the form of chewable gel, that means this dosage form gains popularity and growing acceptance among school student as a child-friendly dosage form, this is may be related to simplicity in administrations which is more convenient for such population, nevertheless, the questionnaire findings refers that the youngest age group in the study (9-10 years) significantly ( $p < 0.0001$ ) prefer chewable gelatin, they found it is easier to swallow and more appealing and natural to chew than other solid dosage form [21].

Besides, those who preferred chewable gel were significantly ( $< 0.0001$ ) commitment to take the medication after finishing the prescribed interval, this is related in addition to previous merits of chewable gel, the good mouth feeling property, the pleasing taste, and smooth texture no need to water, It can be easily accepted by children because of its aesthetic, eye-catching appearance besides to ease of handling may result in changing the perception of medication and impart a positive impact toward medical adherence and consumer acceptability [22,23].

The shortage of appropriate formulation for children is progressively acknowledged by regulatory and scientific committees, given the prevalence of unlicensed and off-label medicine use, undocumented manipulation of dosage forms and patient reported difficulty of administration and rates of non-adherence [20], the practice of splitting / grinding pills and emptying capsule content was common among all parents/caregivers surveyed; this could have many drawbacks in dose accuracy, which risks toxicity, reduced efficacy, and drug resistance. Palatability, also, can be reduced by breaking or crushing pills, particularly if the pill's format, matrix, and capsules tasteless shell are designed to mask bitter active ingredients [9, 24].

Education does not act on health in separation from other deterrents, the

monthly income also is a crucial deterrent that interrelates in many important ways with education as impacts on health. The outcome from this study revealed that the highly educated and monthly income parents \ caregivers' children significantly ( $<0.0001$ ) preferer the chewable gel as a dosage form this is maybe related to the fact that highly educated parents /caregivers are more involved in promoting and sustaining the healthy routines and positive choices, supporting and nurturing human development, parents' or caregivers' interest in using this dosage form is highly founded in the previous study, to boost their children 's general health and improve cognitive development [25].

### Conclusions:

Our outcomes shed the light on significant formulation's associated challenges encountered by parents/caregivers and children. Furthermore, the study declared that there is a certain need for medical chewable gel as a dosage form given to school students since it gains popularity among school students in agreement with the statistics of the questioner and that provides a positive impact toward medical adherence which is a certain concern for both care providers and medical professionals.

### Recommendations:

- Opening Innovative Business opportunity toward product differentiation, product promotion, and patent extension of medicated chewable gel.
- Encourage medical industry quarter in Iraq toward pediatric formulations manufacturing that may give a positive impact fort medical adherence by providing this dosage form available for the Iraqi market
- Highlight the pharmaceutical scientific research (ministry of higher education and scientific research) to take the lead for further studies directed for pediatric

formulations especially the medicated chewable gel.

- A consensus agreement and collaboration between academia and pharmaceutical industry must be established in order to enhance and encourage the safe and effective pediatric formulation production.

### References:

- 1- Allen L.V. Jr. Dosage form design and development. Clin Ther. November 2008. Vol. 30(11). Pp:2102-2111.
- 2- Ivanovska V.; Carin M.A. Rademaker C.M.A; Dijk L.V., and Mantel-Teeuwisse A.K. Pediatric Drug Formulations: A Review of Challenges and Progress, Pediatric. August 2014. Vol.134 (2) Pp: 361-372.
- 3- Lopez F.L.; Ernest T.B; Tuleu C.and Gul M.O. Formulation approaches to pediatric oral drug delivery: benefits and limitations of current platforms. Expert Opin. Drug Deliv, July 2015.Vol. 12(11) Pp: 1727–1740
- 4- Morten J. D., Magnus N. H. and Kurt I. D. Soft, chewable gelatin-based pharmaceutical oral formulations: a technical approach. Pharm Dev Technol. Jun 2018.Vol 23(5) Pp: 504-511
- 5- Rose, K. (Munich) van den Anker, J.N. Guide to Paediatric Drug Development and Clinical Research. (Washington, D.C) Basel, Karger, 2010, pp 1–20
- 6- Nunn T, Williams J. Formulation of medicines for children. Br J Clin Pharmacol. Jun 2005; Vol (59) :674-676)
- 7- Ruheena T., Sirisha M. Soft chewable drug delivery system: Oral medicated jelly and soft chew. Journal of Drug Delivery & Therapeutics. July 2018; Vol 8 (4) Pp: 65-72
- 8- Ibrahim I.R. • Ibrahim M.I. M • Al-Haddad M.S. The influence of consumers' preferences and perceptions of oral solid dosage forms



- on their treatment. *Int J Clin Pharm.* June 2012; Vol (34)5: 728-732
- 9- Adams L.V., Craig S.R., Mmbaga E.J., Naburi H., Lahey T., Nutt C.T., Kisenge R., Noel G.J., Spielberg S.P., Children's Medicines in Tanzania: A National Survey of Administration Practices and Preferences. *PLOS ONE.* March 2013; Vol 8 (3): Pp1-7
  - 10- SAS.2010.SAS/STAT Users Guide for Personal Computer. Release 9.1.SAS Institute, Inc., Cary, N.C., USA.
  - 11- Ibrahim I.R., Al Tukmagi H.F., Wayyes A. Attitudes of Iraqi society towards the role of community pharmacists. *INNOVATIONS in pharmacy.* Jan 2013; Vol. 4(2): Pp:1-10
  - 12- Vinker S., Eliyahu V., Yaphe J. The Effect of Drug Information Leaflets on Patient Behavior. *The Israel Medical Association journal: IMAJ.* May 2007; Vol.9 (1) Pp:383-386
  - 13- Abdulkhale N.M., Ali W.K Elkordy A.A. Effect of coating method on release of Glimepiride from porosity osmotic pump tablets (POPTs). *Al-Mustansiriyah Journal for Pharmaceutical Sciences.* May 2020; Vol.20(2): Pp37-42
  - 14- Mowafaq, M. G. Development and evaluation of orodispersible tablet of Propranolol Hydrochloride by sublimation technique. *AJPS.* 2013, Vol. 14(2) Pp:65- 72
  - 15- Sabri, L.A.; Sulayman H.T and Ameen D.W. Formulation of Tinidazole as an oral suspension dosage form. *AJPS.* 2013; Vol. 13(1): Pp:82-83
  - 16- Van D.A; Riet N.; Schobben A.F.A.; Vromans H.; Egberts T.C.G; Rademaker C.M.A; Safe and effective pharmacotherapy in infants and preschool children: importance of formulation aspects. *Arch Dis Child.* March 201; Vol 101(7) Pp: 662–669.
  - 17- Alyami H.; Dahmash E.; Fahad Alyami F.; Dahmash D.; Chi Huynh C.; Terry D.; Mohammed A.R. Dosage form preference consultation study in children and young adults: paving the way for patient centred and patient informed dosage form development. *European Journal of Hospital Pharmacy.* October 2017; Vol 24(6) Pp: 332-337.
  - 18- Esther T. L., Steadman K. J, Mak M., Cichero J.A.Y., Nissen.L.M. Prevalence of swallowing difficulties and medication modification in customers of community pharmacists. *Journal of Pharmacy Practice and Research.* March 2015; Vol.45(1) Pp:18-23
  - 19- El Edelbi R., Eksborg S., Lindemalm S. In situ coating makes it easier for children to swallow and tolerate tablets and capsules. *Acta Pædiatrica.* June.2015. Vol. 104(9) Pp: 956–961
  - 20- Ranmal S.R., O'Brien F., Lopez F., Ruiz F., Orlu M., Tuleu C., Walsh J., Liu F. Methodologies for assessing the acceptability of oral formulations among children and older adults: a systematic review. *Drug Discov Today.* Apr 2018; Vol. 23(4) Pp:830-847
  - 21- Mistry P., Batchelor H., Evidence of acceptability of oral pediatric medicine a review. *Pharm Pharmacol.* April, 2017; Vol. 69(4) Pp:361-376.
  - 22- Kadhim Z.M., K. Ali W. Utilization of Natural Polymer in the Preparation of Oral Jelly of Granisetron. *Al Mustansiriyah Journal of Pharmaceutical Sciences.* May .2019; Vol. 19(2):1-8
  - 23- Olaanea A. A and Bahari A.Z.B.S. Advantages of Jelly over Liquid Formulations for Pediatrics. *J Formul Sci Bioavailab.* February 2017; Vol.1(1) Pp:1-2
  - 24- . Sarojini S., Anusha K., Maneesha Ch., Mufaquam M. A., Deepika B., Reddy Y.K., and Kanduko N.R.). Oral medicated jellies -a review. *World Journal of Pharmaceutical Research* 2018; Vol. 7(6) Pp: 352-365

- 25- Ali A., Shadeed A., Fitian H.& Zyoud S.H.The difficulties experienced during the preparation and administration of oral drugs by parents at home: a cross-sectional study from Palestine. BMC Pediatrics. May 2020; Vol.20 (198):1-8
- 26- Elliott I.C. Assessing Vitamins, Minerals and Supplements Marketed to Children in Canada.Int. J. Environ. Res. Public Health. Nov. 2019; Vol. 16 (22):1-11