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STUDY TO EXPLORE THE WASTAGE OF SEMI-SOLID FORMULATIONS FROM TUBE PACKAGING

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ABSTRACT

Objective: To collect the data, which will assist to analysis the waste of medicament from the collapsible tube and loss of effectiveness of the formulation meant for treatment can be minimize.

Methods: After the used of consumers, the semisolid collapsible tube of medicament was collected. The material left in packaging (unused) is scrap off with the help of spatula and the unused or wastage material is quantified by simple weighing technique.

Results: According to the results obtained, the data interpretation showed that, 5 % to 18 % of wastage was observed in the tube having packing size of 10gm-50gm of medicament, while 5% -10 % of wastages were observed in the tube having size of 50gm-100gm of medicament. In case of large packing with 100gm to 150gm tube and 150 gm to 200 gm the wastage was found to be 2% -10% And 2% - 8%, comparatively less than the smaller packing.

Conclusion: By analysing the data it is concluded that there was more wastage of medicaments in metal packaging tubes than the plastic packaging tube. Also the small size of packaging shows more wastages when compared to the large packaging size tube. The packaging size and materials could a reason and because of this, the consumers are unable to fully utilize the medication due to the current packaging, leading to economic losses. So it is concluded that to avoid the wastage of medicament and its efficacy, there is a need for the modified pharmaceutical packaging, especially for semisolid preparations, to reduce wastage and improve economic efficiency.

INTRODUCTION

A Pharmaceutical Package container is an article or device which contains the Pharmaceutical Product and the container may or may not in direct contact with the product. The container which is designed for pharmaceutical purpose must be stable.[1]

Ideal Qualities of a Pharmaceutical Packages:

1. It should have sufficient mechanical strength so as to withstand handling, filling, closing and transportation.
2. It should not react with the contents stored in it.
3. It should be of such shape that can be elegant and also the contents can be easily drawn from it.
4. It should not leach alkali in the contents.
5. The container should not support mould growth.
6. The container must bear the heat when it is to be sterilized.
7. The contents of container should not be absorbed by the container.
8. The material used for making the container should be neutral or inert.
9. Any part of the container or closure should not react with each other.
10. Closure should be of non-toxic nature and chemically stable with container contents.
11. It should provide desired degree of protection from environmental hazards. [2, 3]

Types of Packages:

Primary Package: Primary package are those packages which are in direct contact with the pharmaceutical formulation. The main aim of primary package is to protect the formulation from environmental, chemical, mechanical and/or other hazards.

Secondary Package: The package external to Primary package is known as secondary package. This package provides additional protection during warehousing and also provide information about drug product. e.g. Leaflets.

Tertiary Package: It is used for warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into the container. [4]

Packaging materials and closures:

Glass: For a large number of pharmaceuticals, including medicinal products for oral and local administration, glass containers are usually the first choice (e.g. bottles for tablets, injection syringes for unit- or multi dose administration.

Plastics: Some containers are now being made of plastics; the main use is for bags for parenteral solutions. Plastic containers have several advantages compared with glass containers unbreakable**,** Collapsible**,** light

Metal: Metal containers are used solely for medicinal products for non- parenteral administration. They include tubes, packs made from foil or blisters, cans, and aerosol and gas cylinders. Aluminium and stainless steel are the metals of choice for both primary and secondary packaging for medicinal products. They have certain advantages and provide excellent tamper-evident containers. Metal is strong, impermeable to gases and shatter proof, it is the ideal packaging material for pressurized containers.

Closures: Closures used for the purpose of covering drug containers after the filling process should be as inert as possible. Closures, as primary packaging components, are of critical importance and must be carefully selected. [5]

Dosage Forms:

- Solid
- Liquid
- Semi-Solid

Semi-Solid Dosage Form: Pharmaceutical semisolid preparations may be defined as topical products intended for application on the skin or accessible mucous membranes to provide localized and sometimes systemic effects at the site of application. In general, semisolid dosage forms are complex formulations having complex structural elements.

They are often composed of two phases (oil and water), one of which is a continuous (external) phase and the other a dispersed (internal) phase. The active ingredient is often dissolved in one or both phases, thus creating a three-phase system.

Semisolids are characterized by a three-dimensional structure that is sufficient to impart solid- like character to the undisturbed system but that is easily broken down and realigned under an applied force. [6,7]

Ideal Properties:

Physical Properties

- Smooth texture
- Elegant in appearance
- Non dehydrating
- Non gritty
- Non greasy and non-staining
- Non hygroscopic

Physiological Properties

- Non irritating
- Do not alter membrane / skin functioning
- Miscible with skin secretion
- Have low sensitization index

Application Properties

- Easily applicable with efficient drug release
- High aqueous washability [8]

Container used for the Semisolid Preparation

Collapsible Metal and Plastic Tubes: Its narrow orifice prevents serious contamination of unused parts of contents. Wastage is reduced, since the patient is less likely to remove an excessive amount. When part of the preparation is expelled, it is not replaced, as in other containers, by equivalent volume of air; consequently, microbial contamination and oxidative or hydrolytic degradation of the remaining contents are reduced. Nozzle type applicators can be fitted to facilitate administration into body cavities such as nose or vagina. Most collapsible tubes are made of aluminium, although tin, lead, tin coated lead and plastics are also used. Aluminium tubes have good resistance to corrosion because the surface of film of oxide.

Fig. 1 Metal Tubes

Fig. 2 Plastic Tubes

Glass Plastic Pots: Suitable alternatives are wide mouthed squat, cylindrical pots made from glass or suitable plastics having a plastic (or occasionally metal) screw (or, sometimes in case of plastics, slip over cap). Glass pots may either be colourless and either clear or amber colour or opal white. Glass is inert, hygienic and provides stability considerations allow transparency, the content can be seen. Unless returned by patient for reuse, they are more expensive than plastics.

MATERIAL AND METHOD:

Collection of Used Tubes: After consumer use,

Emptied or are near empty the collapsible tubes were collected. Ensure that the tubes are clean and free from external contaminants.

Measurement:

Spatula were used carefully to scrape the inside of the tube to collect any residual semi- solid formulation.

Weighing:

Collected material were placed into a pre-weighed container.
An analytical balance was used to measure the weight of the container with the residual product.

Fig. 3 Weighing of Scrapped Material

Fig. 4 measuring of scrapped material

Brand Name	Company	Packaging Material		Total Content	Content Remain After Complete Evacuation	Percent Wastage (%)
		Metal	Plastic			
Moov (Cream)	Paras Pharmaceutical Ltd.	-	Plastic	5g	0.3520 ±0.009	7.04±0.062
Neosporin	Burrough Welcome Ltd. (India)	Metal	-	5g	0.5502±0.008	11.04±0.032
Quadriderm	Zyg Pharma Ltd.	Metal	-	5g	0.4390±0.008	8.78±0.043
Sensur	Gracewell Glenmark Pharmaceutical Ltd.	Metal	-	5g	0.5012±0.007	10.02±0.045
Begay	Chirayu Pharmaceutical	Metal	-	7g	0.8580 ±0.007	12.25±0.065
Lexus Petroleum Jelly	Zen Beauty Tech	-	Plastic	10g	1.8400±0.007	18.40±0.071

Promise Anticavity	Balsara Home Products Ltd.	-	Plastic	10g	1.5340±0.007	15.34±0.063
Sensur	Gracewell Glenmark Pharmaceutical Ltd.	Metal	-	10g	0.6012±0.008	5.12±0.081
Ring Guard	Paras Pharmaceutical Ltd.	-	Plastic	12g	1.9840±0.0072	15.01±0.068
Aderferin Tm	Gladerma Pvt. India Ltd.	-	Plastic	15g	1.7320±0.0050	11.54±0.07
Betadine	Win Medicare Pvt. Ltd.	Metal	-	15g	1.1050±0.0054	7.36±0.063
Candid-B	Glenmark Pharmaceuticals Ltd.	Metal	-	15g	1.5870±0.0045	10.58±0.07
Itch Guard	Gladerma India Pvt.Ltd.	-	Plastic	15g	1.2200±0.0087	08.06±0.067
Efaderm	Glenmark Pvt India Ltd	-	Plastic	20g	2.4320±0.0074	12.16±0.069
Pepsodent Whitening	Hindustan Ltd Lever	-	Plastic	20g	2.1020±0.0087	10.51±0.056
Tantum Gel	Eider Pharmaceutical Ltd.	Metal	-	20g	0.9340±0.0082	14.67±0.061
Eczecure Cream	Sarda Homoeo Lab	Metal	-	21g	0.9430±0.0083	14.76±0.0062
Mupirocin Ointment 2%	Padagis Pvt Ltd	Metal	-	22g	0.9540±0.0097	14.96±0.0073
Acne Star Gel	Pharma Force Lab Unit Ii	-	Plastic	22g	1.9840±0.0072	15.01±0.068
Fair & Lovely	Hindustan Unilever Ltd	-	Plastic	25g	0.9560±0.0084	14.96±0.0085
Skin Shine Cream	Cadila Pharmaceutical Ltd.	-	Plastic	30g	0.8659±0.0093	13.95±0.0083
Soframycin	Sanofi	Metal	--	30g	0.6689±0.0082	13.56±0.0074
Everyuth Natural	Zydus Wellness Products Ltd.	-	Plastic	50g	0.5698±0.0074	11.42±0.0062

Table: 1 Percent Wastage of 10-50 gm Size Packaging

Dermadew Baby Cream	Hegde And Hegde Pharmaceutical Llp	-	Plastic	80g	0.8420±0.003	2.30±0.02
Oral-B	Procter & Gamble	-	Plastic	85g	0.8520±0.002	1.30±0.02
Ujjal Cream	Herbs N Drugs	Metal	-	90g	3.1486±0.006	3.10±0.02
Johnson Baby Cream	Johnson & Johnson Pvt. Ltd.	-	Plastic	100g	3.1290±0.005	3.12±0.02

Table: 2 Percent Wastage of 50-100 gm Size Packaging

Bectodine	Medilio Enterprise Private Limited	Metal	-	125g	1.7220±0.004	2.26±0.03
Palmer's	Reliance Retail Limited	-	Plastic	125g	1.8569±0.005	2.56±0.04
Joy Ubtan	Rsh Global Pvt.Ltd	-	Plastic	150g	3.8450±0.003	2.56±0.03

Table: 3 Percent Wastage of 100-150 gm Size Packaging

Dabur Dant Rakshak	Dabur India Ltd.	-	Plastic	175g	4.5020±0.004	2.57±0.02
Pepsodent Regular	Hindustan Lever Ltd.	-	Plastic	200g	3.6514±0.002	2.20±0.2

Table: 4 Percent Wastage of 150-200 gm Size Packaging Mean ± SD (N=3)

RESULT AND DISCUSSION:

According to the results obtained, the data interpretation showed that, 5 % to 18 % of wastage was observed in the tube having packing size of 10gm-50gm of medicament, while 5% -10 % of wastages were observed in the tube having size of 50gm-100gm of medicament. In case of large packing with 100gm to 150gm tube and 150 gm to 200 gm the wastage was found to be 2% -10% And 2% - 8%, comparatively less than the smaller packing.

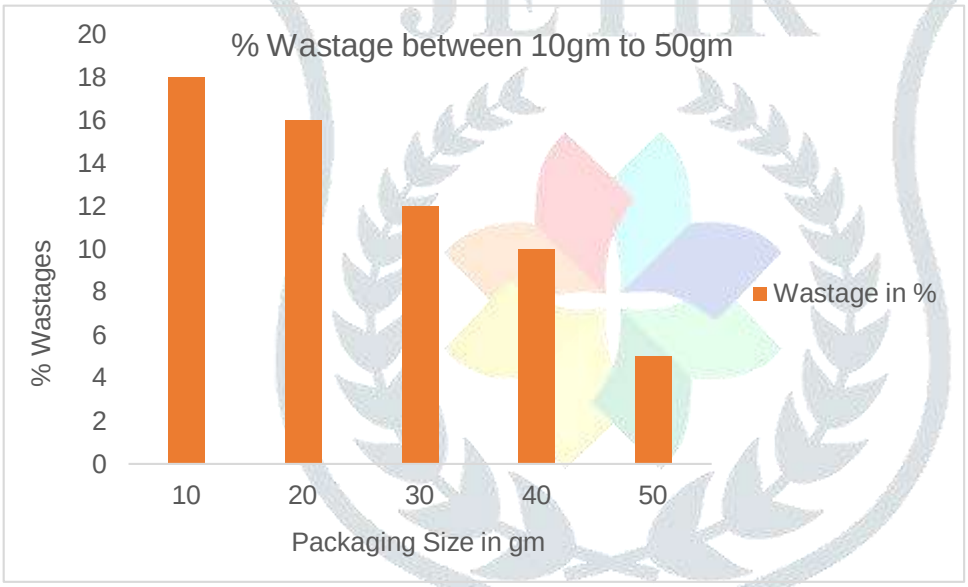

fig:5 Percent Wastage of 10-50 gm Size Packaging

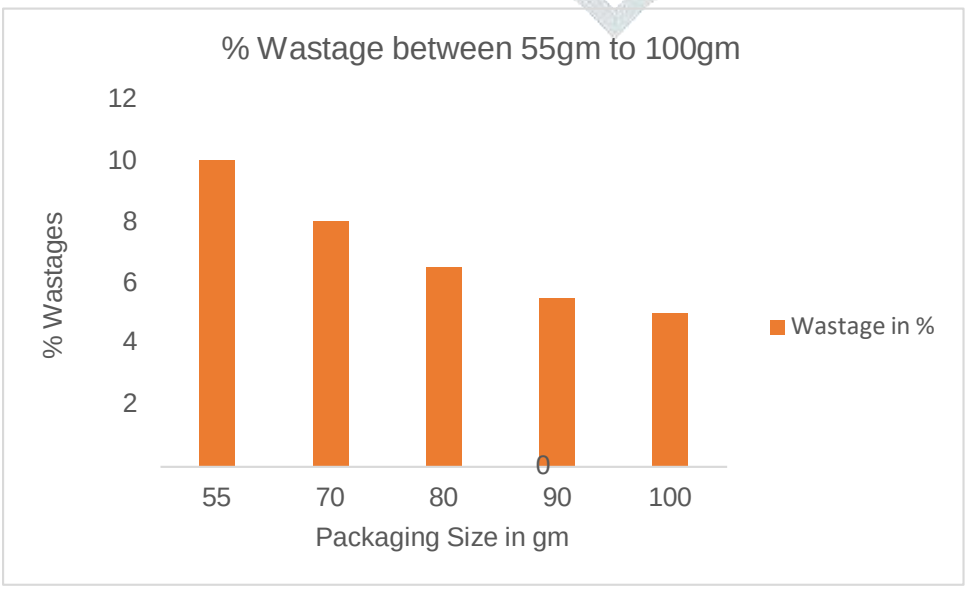

fig:6 Percent Wastage of 50-100 gm Size Packaging

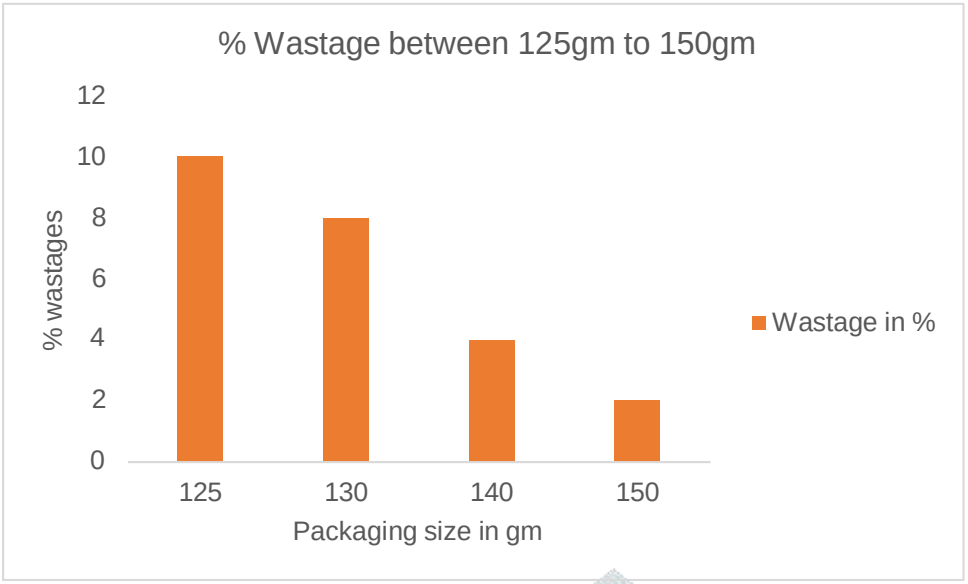

fig:7 Percent Wastage of 100-150 gm Size Packaging

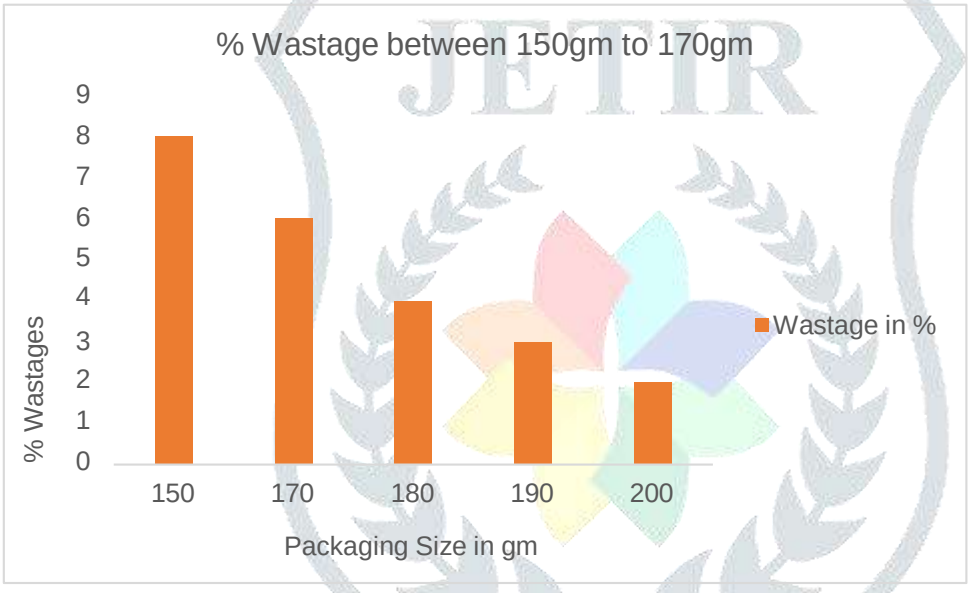

fig:8 Percent Wastage of 150-200 gm Size Packaging

CONCLUSION:

The study of wastage from semi-solid formulations tube packaging highlights the need for ongoing research and development in both formulation science and packaging technology. By addressing the factors that contribute to product wastage, manufacturers can improve product efficiency, enhance consumer satisfaction, and reduce environmental impact associated with discarded products. Future studies should continue to explore innovative solutions to minimize wastage and optimize the performance of semi-solid formulations in various applications.

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