# Iron deficiency Anemia (IDA) during the Pregnancy

***By***

*Sneha Arora*

*Dissertation submitted for the partial fulfillment of the*

*MBA Pharmaceutical Management*

*Academic year, 2018-2020*

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This certificate is awarded to

**SNEHA ARORA**

In recognition of having successfully completed her Dissertation in the department of Product Management Team (PMT)

And has successfully completed her project on

**"Iron Deficiency Anaemia (IDA) during Pregnancy"**

Duration: 17.02.2020 to 05.06.2020

La Renon Healthcare Private Limited, Ahmedabad

She came across as a committed, sincere and diligent person who has a strong drive and zeal for learning

We wish her all the best for future endeavors

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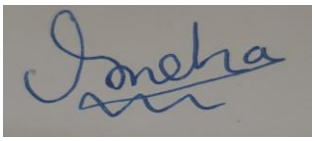
## CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Iron Deficiency Anemia (IDA) during Pregnancy** and submitted by **Sneha Arora Enrollment No: IIHMR-U/02/2018-20/0152** under the Supervision of **Dr. Sandeep narula** for award of MBA in Pharmaceutical Management in Health and Hospitals of the University carried out during the period from **17th feb 2020 to 5th June 2020** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.



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## ABSTRACT

**Background:** Iron deficiency anemia (IDA) represents scarcity of iron; with the high prevalence of IDA is high among pregnant women's

**Objective:** To study the IDA during pregnancy & IDA market in India along with the potential of Lactoferrin.

**Methodology:** Secondary data analysis- Journals, research papers, articles, reports, library materials websites, market data sheets.

**Introduction-** Iron is pivotal for various biologic functions, it plays vital role in, energy production, DNA synthesis, respiration and cell development. According to WHO and NFHS survey Prevalence of IDA dring pregnancy is 50 to 53 % .According to WHO, anemia in pregnancy occurs when the hemoglobin is < 11 g/dL. Throughout pregnancy, IDA has adverse affect on mother and fetal health, like increased in risk of preterm delivery, growth of fetus may retarded , decreased in birth weight, and is linked to increased fetal death. IDA treatment includes oral and parentral iron therapy which have adverse effects. The current treatment modalities available such as oral ferrous sulphate and parenteral iron are fraught with many adverse drug reactions which lead to poor patient compliance and hence poor response to therapy. Lactoferrin is an effective, patient friendly treatment of iron deficiency anaemia . Lactoferrin, a glycopeptide found in colostrum, belonging to transferrin family, is involved in absorption of iron from dietary sources. Hence, supplementing lactoferrin should increase iron absorption. Its efficacy in increasing iron parameters in pregnant women. Lactoferrin found as a suitable treatment for IDA with no side effects.

**Results**- Total market of Haemetinics in 2019 was 21.562 billons and with the growth CAGR of 10.1% from 2018. Emcure was found as leading company in haematinics with the MAT value july 19 624.1 cr. , Growth rate of 17.5% and market share of 28.9%.
Combination of Iron cynocobalamine and folic acid was found as leading molecule of market with the MAT value of July 19- 153.7 cr. And market share of 28.5 %

**Closure**- As prevalence of IDA during pregnancy is increasing, and huge market of haematinics in India there is a wider scope to explore the other therapies for the management of IDA during the pregnancy in India. Iron supplementation is required during the whole duration of pregnancy, so the effective treatment with no side effects in lesser cost should be focused.

Lactoferrin can be seen as desired therapy for IDA, efficacy and safety of lactoferrin consider utmost during the pregnancy.

**Affirmation:**

My earnest gratitude to each one of the individuals who have been the main thrust behind the fruitful Completion of my Internship and Dissertation. Right off the bat, I might want to say thanks to **Dr. Pankaj Gupta-Director** and **Dr. Saurabh Banerjee – "Dean, Academics & Student Affairs"-IIHMR University** for the help during the course.

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Last however doubtlessly in all seriousness to thank my family and my Friends for being what their identity is. Without their help and consolation I would have not accomplished all that I have up until now. I trust I have satisfied their hopes.

**TABULATION:**

**List of Table**



**List of figures:**

**List of Abbreviations**

**IDA- Iron deficiency anemia**

**Hb – Hemoglobin**

**IBD- Inflammatory bowel disease**

**HMWID - High-molecular-weight iron dextran**

**"NTBI" – Non transferrin(Protein) bound iron**

**Fpn – Ferroportin**

**"Tf" – Transferrinn**

**TfRs - Transferrin receptors**

**IFA – iron folic acid**

**Lf – Lactoferrin**

**BLf – Bowine Lactoferrin**

**TSI- Transferrin saturation Index**

**AI – Anemia of Inflamation**

**IL-6 - Interleukin**

**IDA**

**Initiation:**

IDA a customary anemia includes inadequate amount red blood cells. Red blood cell is a carrier of oxygen for body.
It occurs due to amount of iron supply is lesser than the physiological need of iron to produce hemoglobin (Hg). , Hg is a major component of oxygenation of tissue, cellular function, and development of cells of body. Level of Hemoglobin (Hg) indicates the amount which is circulating of Hgb is proteins found in body it attached with RBC and make iron usable for body.

One of the main reasons of IDA is insufficient amount of iron intake or due to issues related with absorption of iron. Human body conserves iron by diverse ways, recycling after disintegration of RBC & therefore detention of iron when excretion mechanism does not occur.

Excessive amount of Fe in body lead to a toxic effects, due to its limited absorption, one to two mg per day, & daily requirement of Fe approximate twenty five(25 mg) daily dispense by recycling through macrophages these phagocytose ageing catabiosis process of RBC. Further 2 mechanisms directed through hepcidin, helping in balance healthy range of iron in body, two mechanism of hepcidin maintain normal range of total iron of body and helps to avoid conditions like deficiency and excess of iron.

Iron-deficiency anemia can be falls for grievous condition when number of RBC are low.

**Iron- Deficiency Anemia (IDA)**

Amount of Fe is about 15 mg/day of dietary iron, 1 mg iron is absorbed by an adult, and it is approximate to this amount, looses by daily cell desquamation through the intestine and skin. When iron depletion occur, absorption of iron increases because hepcidin suppressesin such condition , by hepcidin iron Metabolism is regulated; however, absorption seldom elevate ,less than 6 mg/day so supplementation needed to fulfill the requirement.

**Stages - iron deficiency**

Stages can be determined by different laboratory tests

**Stage 1,** is marked as lessen iron store in bone marrow ;but the level of Hb and serum iron in body maintained , but fall in serum ferritin level seen , less than 20 ng per mL (44.9 pmol/L), but increased rate of iron absorption found in this stage which causes rise in binding capacity of iron (transferrin).

**stage 2**, Impairment of erythropoiesis , and level of transferrin elevated, decline in serum iron level ; decreased saturation of transferrin .Impairment of Erythropoiesis occur during test of serum iron descend greater than < 50 mcg/dL & level of saturated of transferring greater than < 16%. Rise in level of serum-transferrinn receptor up to 8.5 mg per liter.

**Stage- 3**, Decrease in circulating RBC parameters and started decrease in oxygen carring capacity.

**stage 4**, size of RBC become smaller than normal and number of properly function RBC decreased.

**stage 5**, physiological symptoms starts appearing, impact on body tissues due to deficiency reflects symptoms.

**Functional iron deficiency**

Functional IDA is a condition of insufficient or improper movement of iron from the storage cells but iron demand increases, level of ferritin <100 ng/dl, treated with erythropoiesis stimulating agent.

**Causes of Iron Deficiency**

- **Deficiency Diminished Uptake**
- Malabsorption
- Celiac disease
- Duodenal resection/gastric bypass surgery
- Inflammatory bowel disease (ileal-jejunal disease and/or anemia of chronic disease)
- Helicobacter pylori gastritis
- Autoimmune gastritis

- **Dietary causes**

- Malnutrition
- High intake of phytates, polyphenols

- **Increased Demand**

- Pregnancy, lactation

- Childhood

    - Erythropoiesis-stimulating agents (in chronic renal disorder , chemotherapy-induced anemia)
    - Enhanced Loss Gynecologic causes

    - Meno(metro)rrhagia (myoma, endometriosis, bleeding disorders)

    - Uterine cancer

    - Gastrointestinal causes

    - Malignancy

- **Upper gastrointestinal blood loss**

    - – Gastric/duodenal ulcer

    - – Variceal bleeding

    - – Esophagitis, erosive gastritis

    - – Mallory-Weiss syndrome

- – Angiodysplasia, vascular ectasia
- – Dieulafoy lesions
- – Rare: Meckel diverticula, Cameron lesions

➢ **Lower gastrointestinal blood loss**

- – Diverticulosis/diverticulitis
- – Hemorrhoids, anal fissures, rectal ulcers
- – Angiodysplasia
- – Inflammatory bowel disease
- – Infectious colitis

➢ **Other causes**

- Surgery, trauma, childbirth, blood donation
- Prolonged nonsteroidal anti-inflammatory drug drug use
- Parasitic infection (eg, hookworm, tapeworm)

➢ **Rare Causes**

- Idiopathic pulmonary hemosiderosis

- Hereditary hemorrhagic telangiectasia
- Coagulation disorders, platelet dysfunction
- Congenital iron deficiency (iron-refractory iron deficiency anemia

**Epidemiology**

Approx 25% individuals all over the world have anemia. ID, the foremost cause, is liable for approx "50% "of all anemia's. Rate of IDA is much more in developing countries in compare to countries like US ,In US, prevalence of IDA,in women of us, speed was approx,10% because losses by menstruation, while 9% of youngster's ages 12 to 36 months are iron-deficient and one-third of these children develop anemia. While the speed of deficiency of iron anemia is low within the US, who belongs from family having low-income are in danger.

**Prevalence of IDA in pregnancy**

According the data of, WHO prevalence of Iron deficiency in India is 53.0% in 2015–2016 While according to the report of NFHS survey (2015-16) , 50% of women's found as anemic in India.

**ID and IDA in Pregnancy**

According to WHO, anaemia in pregnancy occurs when the Hb is
< 11 g/dL or the hematocrit found < 33%, regadles gestation

**IDA**

In India70% mother(maternal) deaths caused by anemia, from this percentage twenty percent (20%) have direct because of anemia & fifty percent(50%) have relation with anemia.

India is majorly shares the percentage, fifty percent (50%) is contributed to worldwide maternal due to anemia.

During pregnancy, iron requirements aren't uniform. within the different trimester During initial trimester iron per day reqirements decrease because menstruation stops which leads iron saving of roughly 0.56 mg of iron per day, or 160 mg for the pregnancy. Losses of iron from the skin , gut and urinnation are approximately 14 µg/kg/day (about 230 mg for the pregnancy). additionally , erythropoietic activity also reduced during this time.

During the second trimester of pregnancy , blood volume increases upto( 45%) , plasma volume rise approx fifty percent( 50%) ; and also rise in red cell mass by thirty five percent (35% )in iron-replete women. It is nearly (450 mg) of iron, with the weight of 55 kg woman. Demand is increased during the gestation, long-term demands are substantially less as, aside from fetal requirements; the iron is redistributed instead of lost.

Fetal demands for iron are utmost during the third trimester , iron content required for a 3 kg fetus has been estimated at( 270 mg). Parturition presents loss of iron , it is different for each person .During delivery about (150mg) maternal iron losses.

Lactation lead to (0.3 mg/day) iron loss.

Therefore, the mother must be ready to mobilize almost 1200 mg of iron during pregnancy, although her net obligations are approximately 600 mg.

**Table 1:**

**Quantity Requirement for iron**

| **Gross iron demands** | |
|---|---|
| **Obligatory Iron Loss (0.8mg × 290 days)** | **230 mg** |
| **Increase in red cell mass** | **450 mg** |
| **Newborn baby (birth weight 3.5 kg)** | **270 mg** |
| **Placenta and umbilical cord** | **90 mg** |
| **Blood loss at delivery** | **200 mg** |

| | |
|---|---|
| **Gross iron demands** | |
| **Total gross** | **1240 mg** |
| **Net Iron demands** | |
| **Absence of menstruation in pregnancy** | **− 160 mg** |
| **Post partum decrease in red cell mass** | **− 450 mg** |
| **Total net iron demands** | **630 mg** |

**Pathophysiology**

Iron is involved in ,active metabolic and storage pools, amount of iron in whole body is approx (3.5 g men) and (2.5 g for women), the reason may have relation with body size of women, dearth of stored iron due to iron loss during menses.

The distribution of body iron is

•" Hb": 1.5 gram female

•" Ferritin": 1 gram for male, 0.6 gram female

• "Hemosiderin level": 300 milli grams

• "Myoglobin level": 200 milli grams

• “Tissues enzymes”: 160 milli grams

• “Transport-iron compartment”: 3.5 milli grams

**iron -absorption**

Absorption of dietary Fe takes place in the large intestine of body. Iron absorption, mainly dictate through sort of molecules of Fe. As well as the other food consumed, food containing heme iron leads to increase in iron absorption. Ferric state of dietary non-heame iron consumed by food , required to convert into “ferrous state” & secreted in gastric fluid. Absorbing of Non-heme Fe, lessen due to consumption of foods & antibiotics like “tetracycline”. Also Cenolate catalyzes nonheme iron absorption.

**Transpotation of iron and usage**

Firstly iron transfer to transferring from the mucosal cells of intestine. Protien which helps in iron transfer synthesized within liver. Protein named transferrin wors as transporter,it conveyed Fe by cells of intestine to target receptors which is located at various sites like in mature RBC, on located cells of placental,& cells of liver . Non protein part of hemoglobin , Fe is transported by tranferin in mature RBC. It sends Fe factor IX. Tf half-life of plasma 8 days shot out additional use expanded in combination of transferrin with iron lack however in incessant infection, it diminishes.

**Capacity and reusing of Iron:**

Iron in two pool:

• "Ferritin"

• "Hemosiderin"

ferritin situated in hepatocytes, bone marrow, and spleen in RBCs; and in serum.

Iron put away in ferritin is promptly accessible for anyone necessity. Circling (serum) ferritin level equals the components of the body stores (1 mg/mL = 8 mg of iron inside the

capacity pool).

The second warehouse some portion of iron is in "hemosiderin", which is moderately insoluble and is put away principally in Kupffer cells and in macrophages.

Since iron retention is so limited, the body reuses and moderates iron. Transferrin gets a handle on and reuses realistic iron from maturing RBCs experiencing "phagocytosis "by mononuclear phagocytes. This component administer about 97.1% of the every day iron required "about 25.2 mg of iron"

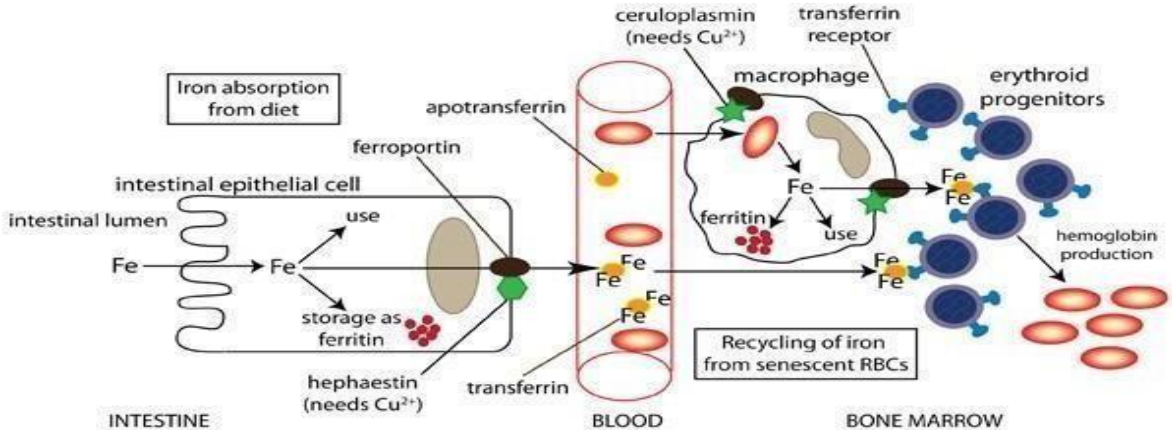



**Figure: 1**

**Iron requests increment during Pregnancy**

During pregnancy, physiologic iron requests increment considerably for "fetoplacental advancement" and "maternal adjustment".

Gauge maternal body iron misfortunes in nine months as follows:

1. More "230 mg" - present pregnancy due on monthly cycle

2. "360 mg" Iron improvement of the placenta and baby

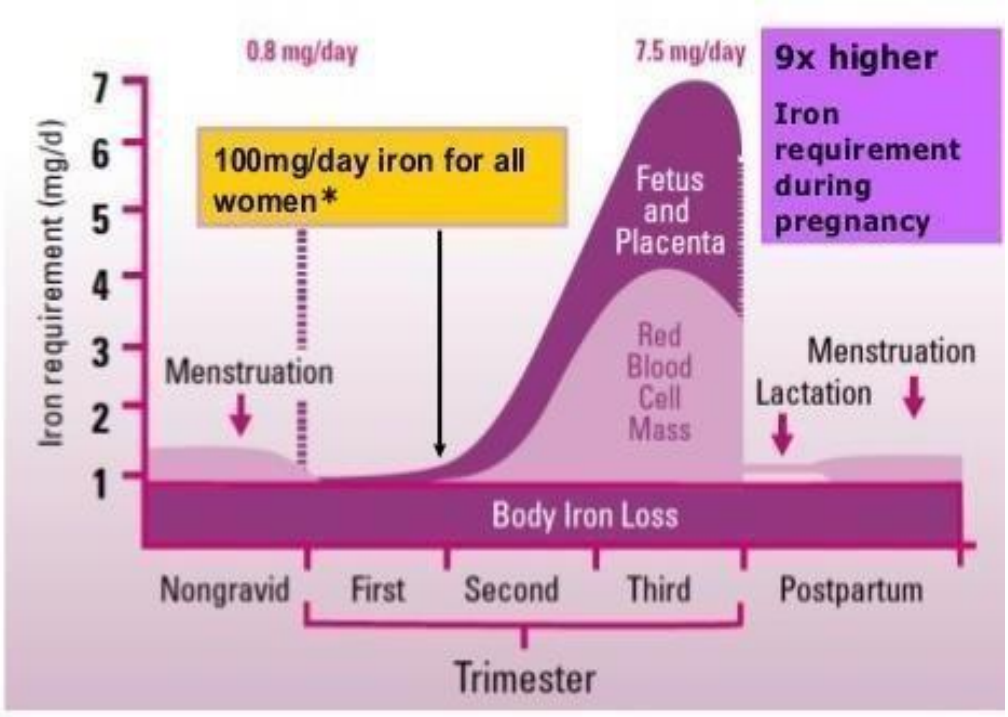
3. "452 mg" Iron for "maternal Red Blood Cell".

4. 1 g of iron for the maternal iron equalization and fetoplacental advancement.

**Digestion of iron - Pregnancy**

"Hepcidin" sway exchange of Fe from mother plasma to embryo. as fixations decrased iron can undoubtedly entered in body liquid and plasma on high rate. High pace of hepcidin causes, caught like enterocytes, macrophages, and "hepatocytes" . 1 to 8 mg outside iron day by day required. Outside Iron expected to adjust physical development, iron is important for build up the baby and placenta and mother's blood volume. Loss of iron increment during and after delivery& lactation is roughly "950 mg". Fundamental day by day iron need 27 mg for pregnant ladies extra 10mg for Lactation.

**Figure**:2



**Reasons for iron deficiency in pregnancy**

Physiological iron deficiency happens because of physiological adjustment in pregnancy. Because of noteworthy increment "plasma volu. than "RBC mass" increment hemodilution. In pregnancy extends requirements of Fe expanded 2–3 times while folate 10–20 times.

Significant reasons for iron deficiency are:

- Nutrition ineffiency–components like ( iron, folate and nutrient B12 insufficiencies)

- Diseases jungle fever, HIV, renal, neoplasia

- Hemolytic anemias – drugs, innate

- Hb-pathies – sickle cell, thalassemia

Healthful IDA standard all most 91% explanation of sickliness in pregnancy. IDA comparing broad purpose behind maternal, fetal grimness and mortality. 1000mg extra iron is need for 55kg pregnant ladies. Assessed 0.8 mg for introductory three months , 4–5 mg for next a quarter of a year and under >6 mg for conclusive trimester.

The explanation of physiological iron deficiency are:

1. sudden changes in numer of RBC volu. furthermore, Hb .

2. Deprivation in iron.

Physiological hemo-weakening, with a top in "$20^{th}$ –$24^{th}$ week incubation, & Hb changes in during incubation.

Drop in Hb during mid-incubation and procedure produces relative hemo-weakening which support blood through placenta.

4.5 mg every day mean iron necessity expanded lead to ID , during the beginning of pregnancy iron exhaust from diet and development of iron is lacking to adjust need of iron in body Serum ferritin consinder as bio-marker of deficient store iron, estimation of <30 μg/l. less iron prevent creation of RBC.

**The executives of IDA**

The officials as per the Postpartum.

The strategy for repletion of iron stores in IDA of pregnancy is guided by the reality of shortcoming, the period of pregnancy, obstetric perils of channel (for instance less than ideal labor,placenta praevia) and non-obstetric maternal comorbidities (hemoglobinopathy, relentless disease, etc.). The flowchart depicts our approach to manage directing IDA in pregnancy depending upon the stage and response.

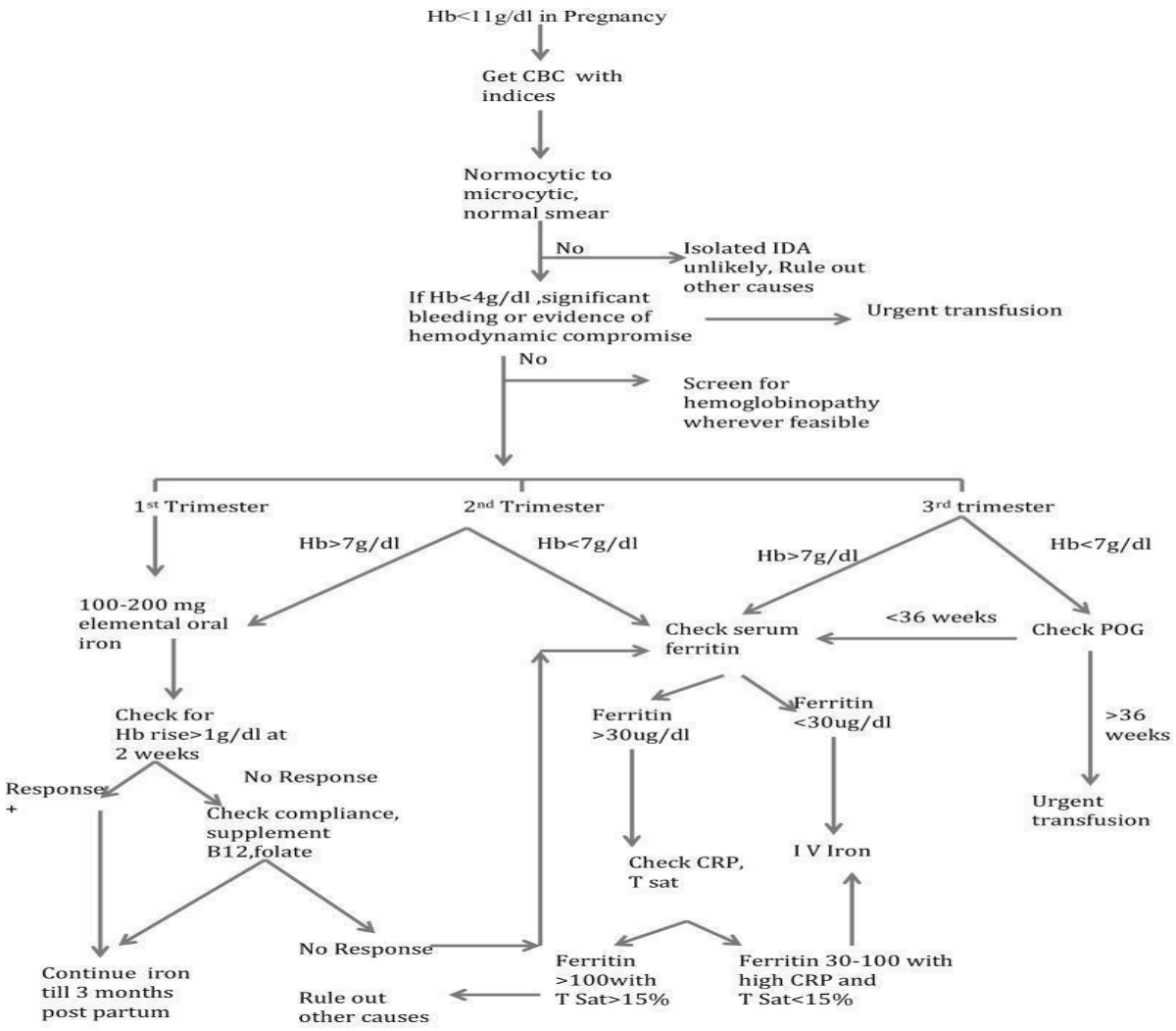



Figure: 3

## Current Management Therapies

**1.Oral Iron**

**2.IV Iron ,**

**3.RBC transfusion**

**4 Erythropoiesis stimulating agents**

## Oral Iron

Intestinal iron absorption is limited. The utmost rate of absorption of 100 mg of oral iron is 20% to 25% and is reached only in the late stage of iron deficiency . 10% and 13.1% correspond to mean absorption rate by latent iron deficiency and IDA respectively ,

whereas healthy males absorb 5% and healthy females 5.6%.60 Iron that remains in the intestinal lumen may cause mucosal injury, and studies in animal models suggest an exacerbation of disease activity and the induction of carcinogenesis in IBD. Furthermore, dose-dependent gastrointestinal side effects hinder compliance and result in nonadherence in up to 50% of patients. Thus, it is reasonable to adjust the dosage to improve tolerability. Although doses often scales from 100 to 200 mg of elemental iron per day, successful repletion can be achieved with doses as low as 15 to 30 mg of elemental iron daily. Several formulations are available over the counter and are typically composed of ferrous iron salts

(eg, ferrous sulfate, ferrous gluconate, and ferrous fumarate).

Oral iron supplementation is effective when intestinal uptake is intact. However, its utilize should be finite to patients with mild anemia (Hb, 11.0-11.9 g/dL in non-pregnant women and 11.0-12.9 g/dL in men) because repletion occurs slowly. When faster repletion is desired, intravenous administration is the preferred route. Nevertheless, oral iron is readily accessible, economical, and oportune, making it a viable treatment option.

The response to therapy should be carefully monitored. The Hb level should increase elevate, 2 g/dL within 4 to 8 weeks, although some patients may report an improved sense of well- being after a few days. If the Hb level does not respond appropriately within this time frame, treatment should be modified (changed to intravenous iron) and the cause of the lack of response evaluated (Figure). Depending on the severity of the deficiency and underlying cause, normalization of the Hb level may take up to 3 months, and it may take longer to replace iron stores (ferritin >100 µg/L).

**Intravenous Iron**

Intravenous iron is very effective in the treatment of iron deficiency anemia and should be considered when oral iron is ineffective. The efficacy of oral iron is diminished when uptake through the gut is impaired (eg, in celiac disease, autoimmune gastritis, ACD, or post-gastric or duodenal resection) or when iron deprivation are huge and/or continuous (eg, with menorrhagia, gastrointestinal bleeding, or postsurgery). Lessen patient compliance due to side effects also restrict the efficacy of oral iron. In these situations, IV iron therapy

is favored due to, gut is bypassed, allowing faster repletion. Ferritin expression increases shortly after administration and reaches higher levels than with oral iron, which can diminish the recurrence of iron deficiency anemia in the long term.

The main disadvantage of intravenous iron is the necessity for administration by a health care professional, with the associated costs. Safety was an affair in the past because of an rise in serious adverse events noted with high-molecular-weight iron dextran (HMWID). This was generalized to include all intravenous formulations; however, a review of the US Food and Drug Administration database from 1998 to 2000 showed that the cumulative rate of serious adverse events for all intravenous formulations except HMWID (ie, low-molecular-weight iron dextran, iron sucrose, and ferric gluconate) is low (<1:200,000). Furthermore, a study of ferric carboxymaltose and HMWID revealed similar efficacy, with fewer hypersensitivity reactions for ferric carboxymaltose. Few studies have directly compared the intravenous formulations in terms of efficacy to recommend the most effective one, but it is advisable to avoid HMWID because of the potential risk of anaphylactic reactions. In the United States and Europe, HMWID has been taken off the market. A test dose is required for all dextran- containing compounds, and if sensitivity to dextran is known, it is also prudent to include a test dose for iron sucrose and iron gluconate.

**Blood Transfusion**

Blood transfusion should be highly restricted in chronic iron deficiency anemia. It may be considered for patients with active bleeding who arehemodynamically unstable, or for patients with critical anemia (Hb level<7 g/dL), acute myocardial ischemia, or if all other treatments fail to correct the anemia. In patients with significant cardiovascular disease, higher cutoff values (Hb <8 g/dL) may apply. Transfusions are only a temporary solution, and proper management should include the dentification and treatment of the underlying condition. In addition, intravenous iron (and erythropoiesis-stimulating agents if necessary) should be administered together to correct and maintain the Hb level and iron stores and prevent the need for subsequent transfusions

**GAPS - CURRENT THERAPIES:**

- **Oral- Iron-**
- Poor absorption
- Gaastro-intestinal refluxes –
- Dose dependent GI side effects affect compliance.
- Pro-oxidant effect leads to staining of mucous and stools.
- **IV iron-**
- Iron overload and tissue damage
- Risk of infection
- Increases oxidative stress
- Painful to the patients
- Poor compliance

Higher dose of iron leads iron toxicity in parenchymal tissues. ID and IDA occur due to dysfunction of hepcidin, (Fpn ), (Tf),( TfRs) synthesis. Higher of hepcidin & lower of Fpn level resulted to lower plasma iron concentration.

**Unfavorable impacts of high portion of oral iron supplementation**

Gastric bothering, queasiness, epigastric distress, and obstruction are brought about by the antagonistic impact of poor consistence of IFA tablets. The unfriendly impacts increment with the organization of higher portions of iron. Other antagonistic impacts of high portion of iron, for example, the expanded danger of harm intestinal epithelium on account of the course of action of free radicals and extended oxidative concern in the intestinal mucosa have also been accounted for. High Fe level are similarly known to augment hepcidin levels, which subsequently decreases the iron maintenance. Higher bits of iron supplementation (>60 mg fundamental iron) during pregnancy have been associated with gestational diabetes mediated through extended oxidative weight, lipid per oxidation or possibly "DNA" harm


**Figure: 4**

**IV Iron supplementation**

It includes IV Iron Administration transfusion. this therapy have identified limits.
Rapid clearance occue of IV Adminstration iron from blood stream , the transfusions slightly relieve the ineffective erythropoiesis, & increase the level of hepcidin.

**NEED FOR ALTERNATIVE TREATMENT FOR IRON DEFICIENCY**

Both oral and parenteral iron are fraught with accompanying adverse drug reactions. While the oral route presents with mild tolerable side effects in a greater percentage of users (up to 40%), fatal anaphylaxis has been noted with the parenteral route in up to 0.7% of the users. Parenteral iron therapy is associated with adverse drug reactions such as bradycardia, chest pain, hypotension or hypertension, diarrhoea & others intestinal refulx. 35% patients receiving iron sucrose exhibit mild adverse effects such as headache, nausea and diarrhoea, while iron dextran users complain of phlebitis when concentrated solutions are given over a drawn out time frame.

Due to high risk anaphylaxis in parenteral iron therapy or transfusion reactions .
However, even this modality of treatment is not very patient friendly due to increased incidence of mild tolerable adverse drug reactions and poor oral bioavailability. Hence a need for an alternative treatment formulation exists. One such alternative form of therapy is lactoferrin, an iron binding glycoprotein.

## TREATMENT MODALITIES OF IDA

### Lactoferrin

Lactoferrin recognized as generation oral iron that belongs from transferrin family of proteins and a crucial controller to amount, non bounded Fe within blood and the ability to enhance iron binding.

Lf, a glycoprotein binds with cationic iron having two times more affinity to bound with Iron molecule. It helps in homeostasis of iron in body which leads to cure deficiency of iron. It is synthesis with in exocrine glands 7 neutrophils ,when condition of any inflammation occur.

Level of iron does not exceed 10-17 M , reduce microb growth & oxidative strees. .

### Actions of Lactoferrin

Lactoferrin is found to play versatile roles in iron absorption, immunity, inflammation, tumour growth, myelin genesis and enzymatic activities as discussed below.

### Lactoferin in Iron Homeostasis

Lactoferrin, due to its structural resemblance to transferrin has been implicated in influencing iron homeostasis. This idea came into existence when infants fed exclusively on breast milk (iron content 0.2 to 0.7 mg/l ) failed to demonstrate iron deficiency whereas infants fed on formula feeds needed to be supplemented with iron in order to prevent iron deficiency . Although the iron content of breast milk is low, its bioavailabilty is high. This, coupled with the abundant concentration of lactoferrin in breast milk may be responsible for preventing iron deficiency in breast fed infants. A urinary iron concentration in neonates was found to be corresponding to lactoferrin concentrations in mothers' milk further proving the uptake of lactoferrin by neonates.

The notion that lactoferrin was involved in the absorption of iron was further Strengthened by the evidence of receptors specific for lactoferrin on human intestine as established by Cox et al. in 1979. It has been shown that lactoferrin receptors transport iron across the intestinal brush border and facilitate iron accumulation.

**Lactoferrin and AI**

Systems by which "Bowin lactoferrin" (bLf) applies its quieting activity are being talked about, in 2006, by arranging the essential clinical fundamental on the effect of 30 days of BLF oral association (100 mg multiple times each earlier day suppers) in pregnant women with IDA or AI, we got shocking results .really, pregnant women tolerating 100 mg of bLf, iron splashed at 20–30% multiple times every day got 70–84 _g/day of iron, independently.

BLF is amazingly removed from that which is required each day (1–2 mg), a basic addition of the gathering of Hb and TSI was perceived after 30 days of the treatment. BLF treatment showed a basic improvement of hematological limits, including red platelet number, hemoglobin, complete serum iron, serum ferritin centers and level of hematocrit, in pregnant women encountering IDA, with an anticipated decay of serum IL-6 levels. The lessening of flowing iron can be connected with hazardous iron weight or over-trouble in cells. These changes in iron status would in this manner have the option to impact microbial turn of events and the earnestness of maladies especially region of the truth where pollutions, for instance, wilderness fever and tuberculosis are outstandingly normal, adding to the high transcendence of outrageous shortcoming, terribleness and mortality. iron supplementation in these districts isn't simply futile and deficient in extending hematological limits, yet also potentially pernicious, considering the way that, during the extreme time of pollutions, the extended IL-6 levels improve the hepcidin and down-control Fpn, along these lines growing the peril of continuously genuine infections the dumbfounding results got for subject affected by ID, IDA or AI compensated with BLF oral association that BLF restores iron containment through the decrease of IL-6 which consequently, reduces iron intracellular over-trouble in light of new Fpn up-enunciation.

**Proposed Mechanism of Action of Lactoferrin in Anaemia**

Lactoferrin mainly works in 4 ways:

1. By Regulating Hepcidin Ferroportin Axis
2. By Downregulating Inflammation
3. By Increasing Compliance
4. Increase in Systemic Iron Reserve

1. **By Regulating Hepcidin Ferroportin Axis**

- Iron homeostasis disorders occur due to hepcidin and/or ferroportin dysregulation.
- By ferroportin, hepcidin control level of iron in blood.
- Fpn phosphorylation, internalization and degradation in lysosomes occur due to binding of hepcidin to ferroportin, results restrict iron
- hepcidin production is increased by.

a. Over dosing of Iron

b. Disease Condition (Inflammation)

- During Disease Condition hepcidin level increases by Fpn which leads AI followed by IDA & restrict iron inside the cells.
- high serum IL-6 control Fpn mRNA expression, restricts Fe in blood.

2. **By Downregulating Inflammation**

- Ferronomic because of its antibacterial properties has also been demonstrated to downregulate the over-expression of macrophages resulting into reduced inflammation which in turn reduces Interleukin-6 levels and upregulates ferroportin expression.

3. **By Increasing Compliance**

- Lactoferrin in various studies in comparison to iron salts have been demonstrated satisfactory patient compliance & little or no AE arising due to iron administration including, nausea, vomiting, GI disturbance etc.

4. **Increase in Systemic Iron Reserve**

- Ferromic's Lactoferrin to prompt move through provocative m1 macrophagic - tolerogenic phenotypes m2 in this manner advancing Iron discharge in the ferritin of M2 macrophage consequently expanding iron save in the foundational course for transport to different organs of the body.

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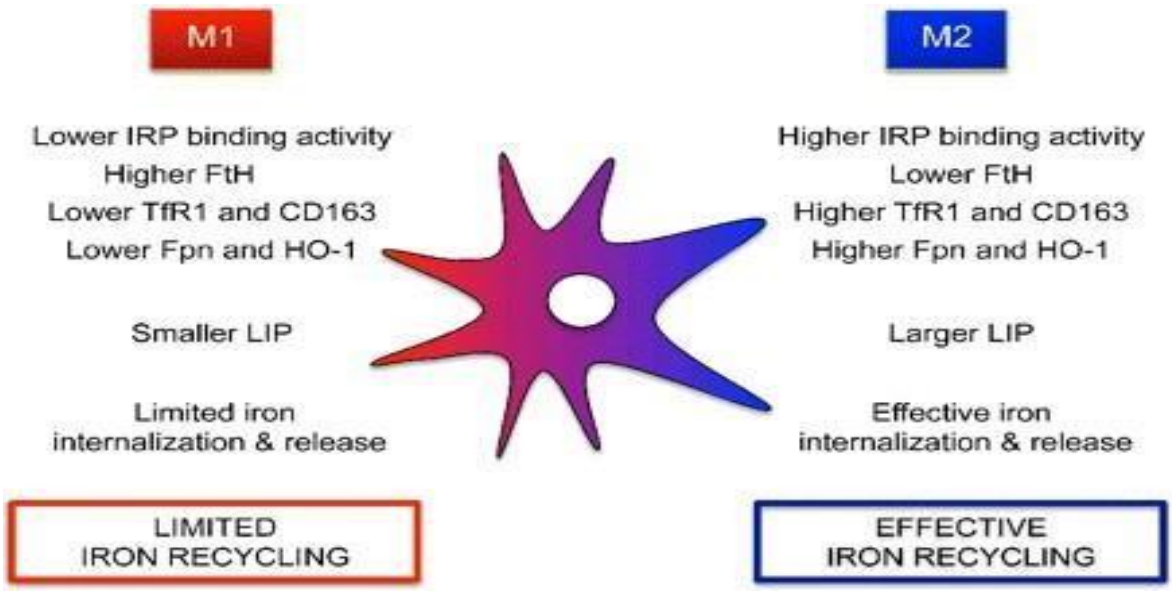


Figure :5

**<u>Unmed need & Future Up gradations for treatment IDA in Pregnancy</u>**

**Enteric-coated (EC) tablets under WIFS**

Under the WIFS programme, enteric-coated (EC) tablets of IFA are administered to adolescents having poor bioavailability of iron. The absorption of iron is best in the upper part of the duodenum, where the presence of acid from the stomach helps the absorption. Iron from EC tablets is released in the lower parts of the intestine, where absorption is low. A recent clinical trial, using state-of-the-art stable isotopic methods, was conducted to assess the relative absorption of iron from EC versus non-EC tablets, in iron-deficient Indian women. Absorption of iron from EC tablets was substantially lower than non-EC tablets(4.3 vs. 12.1%). On the other side, a comparative study found that iron absorption from the sugar-coated tablet of ferrous sulphate was significantly higher than EC IFA tablets as it did not bypass the acidic environment of the stomach. Regulatory bodies such as the United Kingdom National Health Services have recommended that the modified-release iron formulations (EC) should not be used for the treatment of anaemia.

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**ORAL LIPOSOMAL IRON**

Iron salts like ferrous pyrophosphate are enveloped with liposome, a spherical structure of a phospholipidic nature that is alike to those human cell membranes. This preparation crosses the gastric acid barrier and reaches the small intestine intact. In the intestine, the M cells due to their low lysozyme content integrally absorb liposomal iron without the need for specific transporters. Oral liposomal iron effective in lower pH, preventing early degradation of the substance and/or its inactivation and to be absorbed directly. This mechanism provides liposomal iron a greater availability, reduces gastrointestinal side effects, and prevents iron instability in the gastrointestinal tract to be directly absorbed into the intestine and directly liberated into the liver. The absorption or bioavailability of liposomal pyrophosphate iron is 3.5 times greater than the free pyrophosphate iron, 2.7 times higher than iron sulfate, and 4.1 times higher compared with iron gluconate. The plasma concentration of liposomal iron was utmost after 2 hours from the assumption, which guarantees greater bioavailability of the element for all metabolic processes.

**Intervention the other supplements with iron in IDA**

According to the study of Suharno et al,there are different reasons for paleness, iron supplementation may just halfway address the hematological deficiency. Projects that include arrangements containing iron, folic corrosive, and nutrients An and C, coordinated to babies, kids, and pregnant and lactating ladies are exceptionally desirable.Similarly, considerably more consideration ought to be centered around the utilization of different micronutrient-strengthened food arrangements..

In Table different mix of enhancements given.

**Table 2: pregnant women- given oral iron and vitamin A**

| Supplement | Sample Size | Results (Hb >110 g/l |
|---|---|---|
| Placebo | 63 | 17% |
| Retinol | 64 | 38% |
| Fe | 64 | 70% |
| Fe & Retinol | 64 | 98% |

**Iron-EDTA**

Iron-EDTA is all around consumed and not receptive, it doesn't cause fat (for example in bread) to get rotten. In this manner, it is reasonable for use in other (not recently strengthened) nourishments. It is likewise artificially steady, which takes into account long capacity of nourishments.

Be that as it may, extra data is required for its adequacy and security before its proposal . Studies on different fortress have been supported by the coming of a few new innovations including the advancement of iron-EDTA. Twofold fortress with iron-EDTA and nutrient An in Guatemala and with iodide and metallic iron in India has just been analyzed. The worry that iron-EDTA may hinder bioavailability (for example that it may advance the loss) of different minerals, for example, zinc or calcium, is alleviated by concentrates in people with stable isotope tracers. In a drawn out examination in Guatemala, zinc blood levels really rose following 30 months following the utilization of iron-EDTA braced sugar . Actually, other creature and human information affirm improved ingestion of zinc-iron-EDTA. In any case, further exploration is important to see how press EDTA communicates with different micronutrients. Extend research on iron-EDTA to incorporate its ebb and flow territories of utilization, yet in addition its utilization in non-conventional vehicles (for example a satisfactory fortificant, its impact on assimilation of different minerals, and the

viability of its ingestion to impact dinner iron bioavailability contrasted and that from ferrous sulfate).
Proceed with exploration to decide how EDTA advances the ingestion of the non-haem iron pool.

**Quality and bundling of iron enhancements**

Enhancements are required in the nature of iron tablets, particularly in their security (for example evasion of splitting, and crumbling, and ingestion of dampness) and other physical qualities (for example their shading and scent). Advancement of improved bundling to limit weakening before dispersion, and imaginative and safe methods of apportioning the tablets, is likewise needed.The plan and testing of these parts of iron supplementation is huge in improving adherence.

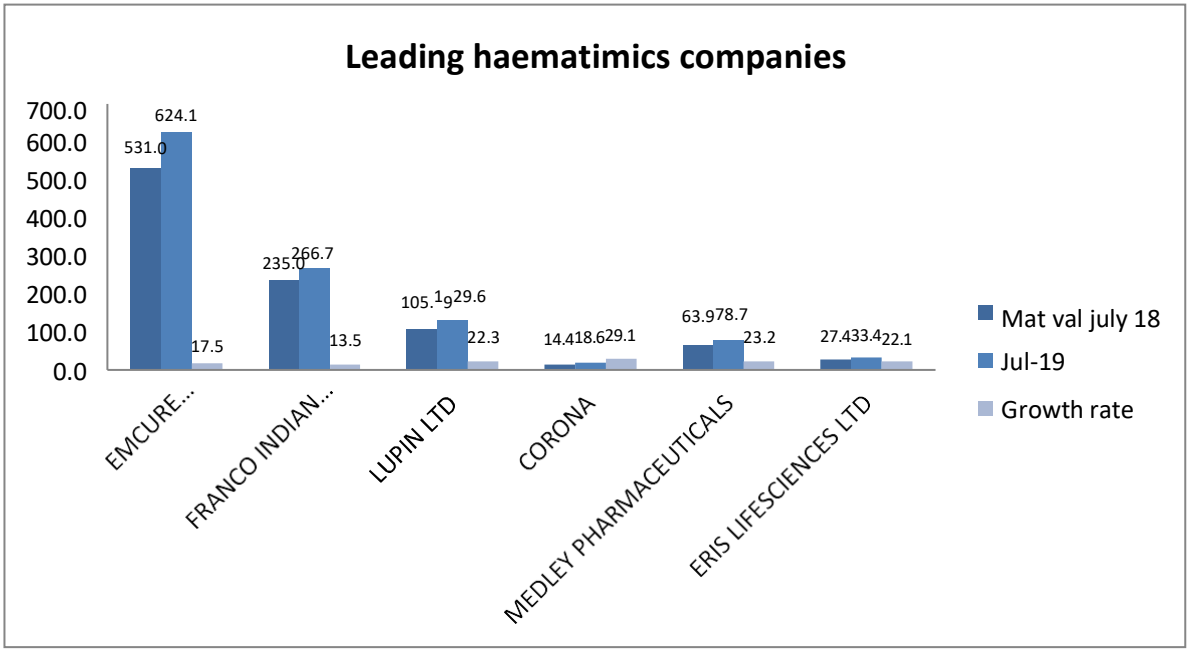
**COMPITITOR IDA ANALYSIS**

Here main aim of competitive analysis to find leading molecule of competitor in IDA and analyzing molecule to launch.

The moving annual turnover of Indian Haematinics market 2019 was estimated **21.562 billions** (MAT 19- 2156.2 cr) with the Growth Rate of approx **10.1 %**. Previously in 20018 the MAT was **19.586 billion** (1958.6 cr). Competitive profiling analysis is done with companies like Emcure, lupin, Franco Indian pharmaceuticals, Zuventus healthcare ltd., Medley pharmaceuticals, Alkem laboratories, Macleods pharmaceuticals, Aristo pharmaceuticals, Indchemie health specialist. Data of MAT value 18, MAT value 19 and GR is used to analyze the product with with high MAT value and GR and for understanding leading IDA molecules of competitor profile.

**1. List of top 6 corporate according to their MAT values are given below:**

| Company | Mat val july 18 | MAT Jul-19 | Growth rate |
|---|---|---|---|
| EMCURE PHARMACEUTICALS LTD | 531.0 | 624.1 | 17.5 |
| FRANCO INDIAN PHARMACEUTICALS PVT LTD | 235.0 | 266.7 | 13.5 |
| LUPIN LTD | 105.9 | 129.6 | 22.3 |
| CORONA | 14.4 | 18.6 | 29.1 |
| MEDLEY PHARMACEUTICALS | 63.9 | 78.7 | 23.2 |
| ERIS LIFESCIENCES LTD | 27.4 | 33.4 | 22.1 |




Amongst the 6 corporate Emucre pharmaceuticals showed the highest Growth Rate of 17.5% with the MAT19 value (624.1 cr).

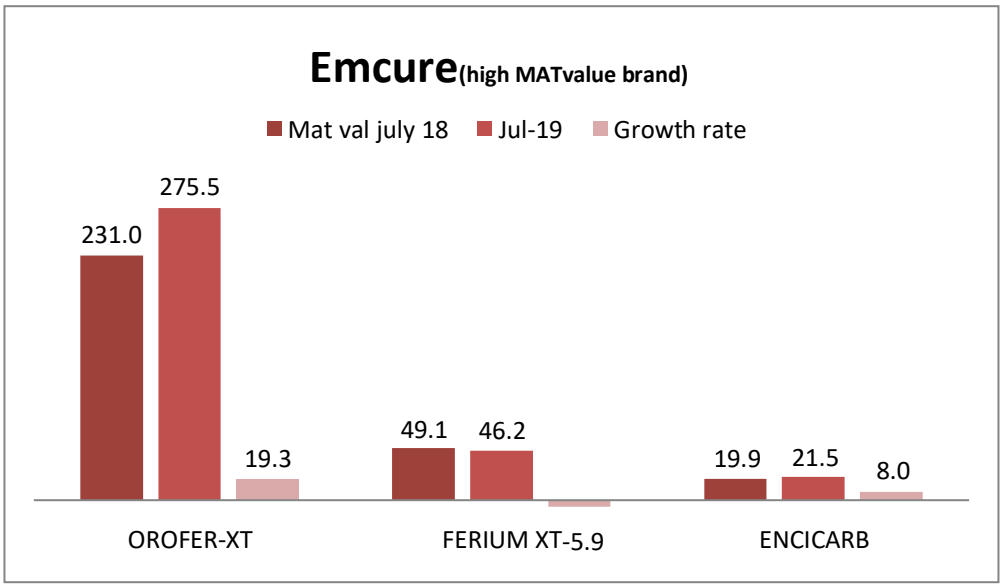
**2. Data of top brands of individual company is given below**

**A. Emcure** is the leading company of Haematinics of having MAT 19 value 624.1 cr and

17.5 % Growth rate

**Here is the list of top 3 brands of Emcure with high MAT value**

| Brand | Mat val july 18 | Jul-19 | Growth rate |
|---|---|---|---|
| OROFER-XT | 231.0 | 275.5 | 19.3 |
| FERIUM XT | 49.1 | 46.2 | -5.9 |
| ENCICARB | 19.9 | 21.5 | 8.0 |




Amongst the all brands of Emcure **OROFER- XT** is the brand which showed highest MAT value (27.5 cr), OROFER-XT is the extension of OROFER , other extension of OROFER are OROFER-FCM (121.3 cr), OROFER-S (88.4 cr)

**a. List of brands of Emcure with high Growth rate is given below:**

| Brand | Mat val july 18 | Jul-19 | Growth rate |
|---|---|---|---|
| FERIUM XT PLUS | 0.0 | 4.1 | 40019.6 |
| FERIUM 1K | 5.8 | 13.5 | 131.6 |
| COBAFORTE CD3 | 3.0 | 3.9 | 30.1 |

**A**mongst the all brands of Emcure FERIUM- XT plus brand showed highest Growth rate 40019% followed btr the FERRIUM 1K with 131.6%, these are the extended brands of FERIUM.

**B. Franco Indian pharmaceutical Pvt. Ltd.**

Dexorange is an only brand marketed by Franco pharmaceutical of MAT 19 value 266.7 cr with 13.5% Growth Rate

**C. Lupin**

MAT 19 value 129.6 cr and Growth Rate 22.3%

**a. List of leading brands according to the MAT 19 value is given below**

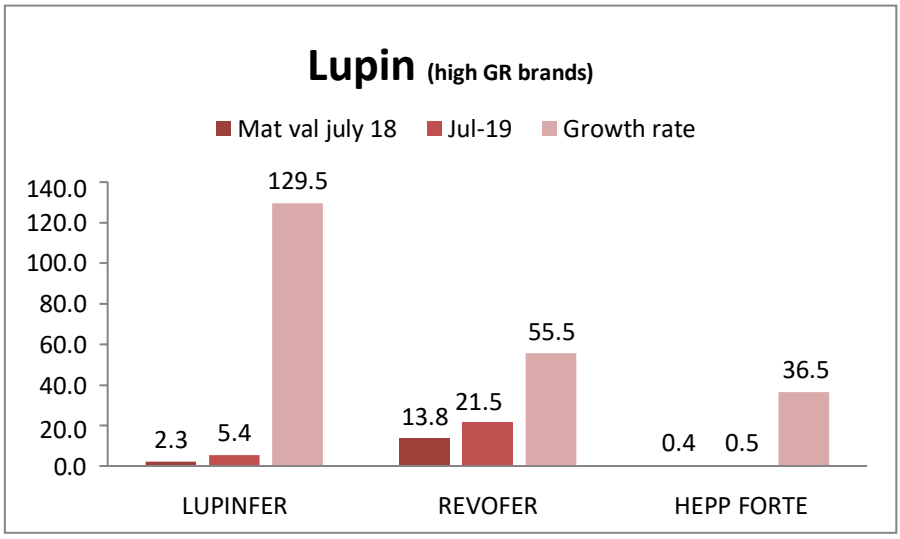
| Brand | Mat val july 18 | Jul-19 | Growth rate |
|---|---|---|---|
| FERINJECT | 26.5 | 31.7 | 19.3 |
| FAA-20 | 25.4 | 27.5 | 8.1 |
| LUPIHEME | 21.3 | 27.4 | 28.8 |

FERINJECT is the leading brand of lupin with highest MAT value of 37.1 cr

**b. List of leading brands according to the Growth Rate value is given below**

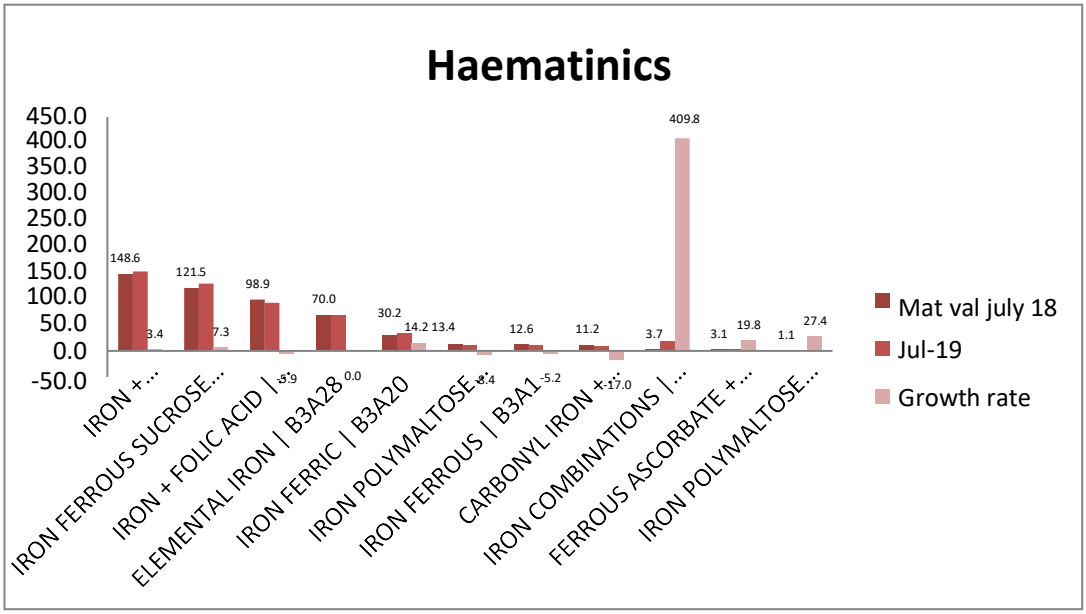
| Brand | Mat val july 18 | Jul-19 | Growth rate |
|---|---|---|---|
| LUPINFER | 2.3 | 5.4 | 129.5 |
| REVOFER | 13.8 | 21.5 | 55.5 |
| HEPP FORTE | 0.4 | 0.5 | 36.5 |

Amongst all the brands of lupin in Haematinics LUPINFER is the brand with highest Growth Rate 129.5%


Lupin (high GR brands)
Mat val july 18
Jul-19
Growth rate
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
2.3
5.4
129.5
13.8
21.5
55.5
0.4
0.5
36.5
LUPINFER
REVOFER
HEPP FORTE

**3. Data of leading molecules of haematinics are given below:**

| Sub super group | super group | Mat val july 18 | Jul-19 | Growth rate |
|---|---|---|---|---|
| **HAEMATINICS** | IRON + CYANOCOBALAMIN + FOLIC ACID | 148.6 | 153.7 | 3.4 |
| | IRON FERROUS SUCROSE COMPLEX \| B3A23 | 121.5 | 130.3 | 7.3 |
| | IRON + FOLIC ACID \| B3A26 | 98.9 | 93.0 | -5.9 |
| | ELEMENTAL IRON \| B3A28 | 70.0 | 70.0 | 0.0 |
| | IRON FERRIC \| B3A20 | 30.2 | 34.5 | 14.2 |
| | IRON POLYMALTOSE COMPLEX \| B3A10 | 13.4 | 12.3 | -8.4 |
| | IRON FERROUS \| B3A1 | 12.6 | 11.9 | -5.2 |
| | CARBONYL IRON + OTHER COMBINATION \| B3A6 | 11.2 | 9.3 | -17.0 |
| | IRON COMBINATIONS \| B3A33 | 3.7 | 18.7 | 409.8 |
| | FERROUS ASCORBATE + IRON + FOLIC ACID \| B3A17 | 3.1 | 3.7 | 19.8 |
| | IRON POLYMALTOSE COMPLEX + ZINC \| B3A11 | 1.1 | 1.4 | 27.4 |
| **HAEMATINICS Total** | | **514.3** | **538.8** | **4.8** |



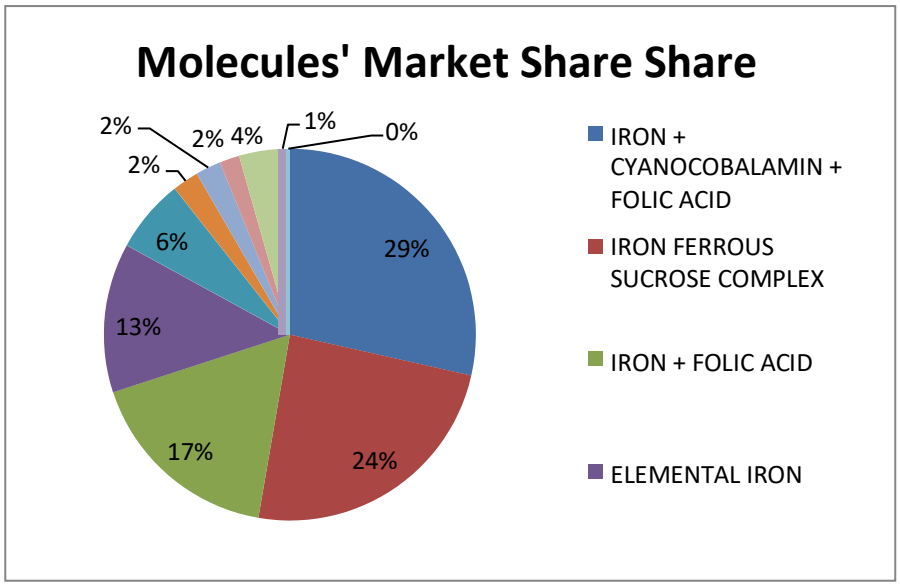

Amongst the molecules **Iron + cynocobalamine + folic acid** is a combination showed highest Mat 19 value (153.7 cr ) with the Growth rate of 3.4 %, followed by iron ferrous sucrose complex with the MAT 19 value (130.3 cr) and Growth rate 7.3 %.

Iron combination showed highest Growth Rate 409.8%

## 4. Molecule wise Market Share data

### A. List of 11 molecules of haematinics according to the market share are given below:

| Molecule | MS (%) |
|---|---|
| IRON + CYANOCOBALAMIN + FOLIC ACID | 28.5 |
| IRON FERROUS SUCROSE COMPLEX | 24.2 |
| IRON + FOLIC ACID | 17.3 |
| ELEMENTAL IRON | 13.0 |
| IRON FERRIC | 6.4 |
| IRON POLYMALTOSE COMPLEX | 2.3 |
| IRON FERROUS | 2.2 |
| CARBONYL IRON + OTHER COMBINATION | 1.7 |
| IRON COMBINATIONS | 3.5 |
| FERROUS ASCORBATE + IRON + FOLIC ACID | 0.7 |
| IRON POLYMALTOSE COMPLEX + ZINC | 0.3 |

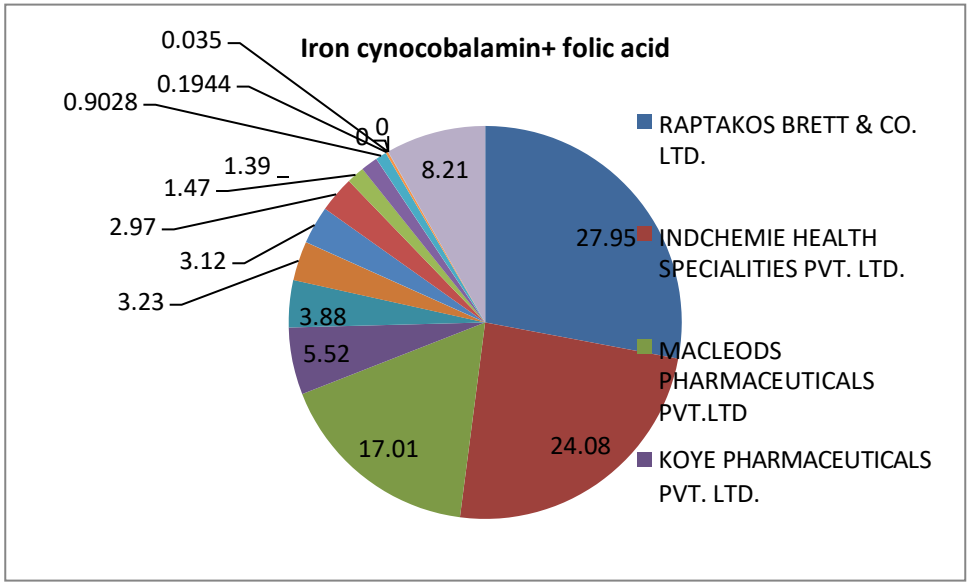



Amongst 11 molecules of haematinics top 5 molecules were analyzed & combination of Iron cynocobalamin and folic acid is a leading molecule with market share of

**5. Company wise market share of above molecules**

**A Data of combination of iron cynocobalamin and folic acid of different companies are given below:**

| IRON + CYANOCOBALAMIN + FOLIC ACID / Brands | Company | MAT July'18 Val in Crs. | MAT July'19 Val in Crs. | MS (%) | GR (%) | Value Addition in a year |
|---|---|---|---|---|---|---|
| | | 148.6 | 153.7 | 100.0 | 3.4 | 5.1 |
| HEPATOGLOBIN | **RAPTAKOS BRETT & CO. LTD.** | 41.1 | 43.0 | 27.9 | 4.6 | 1.9 |
| CHERI | **INDCHEMIE HEALTH SPECIALITIES PVT. LT** | 36.6 | 37.0 | 24.1 | 1.0 | 0.4 |
| RUBIRED | **MACLEODS PHARMACEUTICALS PVT.LTD** | 25.8 | 26.1 | 17.0 | 1.4 | 0.4 |
| COEHB | **KOYE PHARMACEUTICALS PVT. LTD.** | 9.3 | 8.5 | 5.5 | -8.6 | -0.8 |
| IMFERON | **SHREYA LIFE SCIENCES PVT. LTD** | 3.9 | 6.0 | 3.9 | 53.5 | 2.1 |
| IREX | **MICRO LABS LTD** | 4.3 | 5.0 | 3.2 | 15.6 | 0.7 |
| MASHYNE | **USV PVT LTD** | 6.2 | 4.8 | 3.1 | -22.4 | -1.4 |
| FEROZORB | **MACLEODS PHARMACEUTICALS PVT.LTD** | 4.8 | 4.6 | 3.0 | -4.4 | -0.2 |
| HAEMADAY | **AKUMENTIS HEALTHCARE LTD** | 1.7 | 2.3 | 1.5 | 35.6 | 0.6 |
| I-FAG | **AKUMENTIS HEALTHCARE LTD** | 3.4 | 2.1 | 1.4 | -36.2 | -1.2 |
| RICHAR | **ALEMBIC LTD** | 1.1 | 1.4 | 0.9 | 25.6 | 0.3 |
| FUR | **CORONA** | 0.4 | 0.3 | 0.2 | -27.2 | -0.1 |
| CHERY | **INDCHEMIE HEALTH SPECIALITIES PVT. LT** | 0.1 | 0.1 | 0.0 | 9.6 | 0.0 |
| FERRO ATE M | **LUPIN LTD** | 0.0 | 0.0 | 0.0 | -100.0 | 0.0 |
| FERINCA | **SUN PHARMA LABORATORIES LTD.** | 0.0 | 0.0 | 0.0 | -100.0 | 0.0 |
| UNKNOWN | **UNKNOWN** | 10.0 | 12.6 | 8.21 | 26.0 | 2.6 |

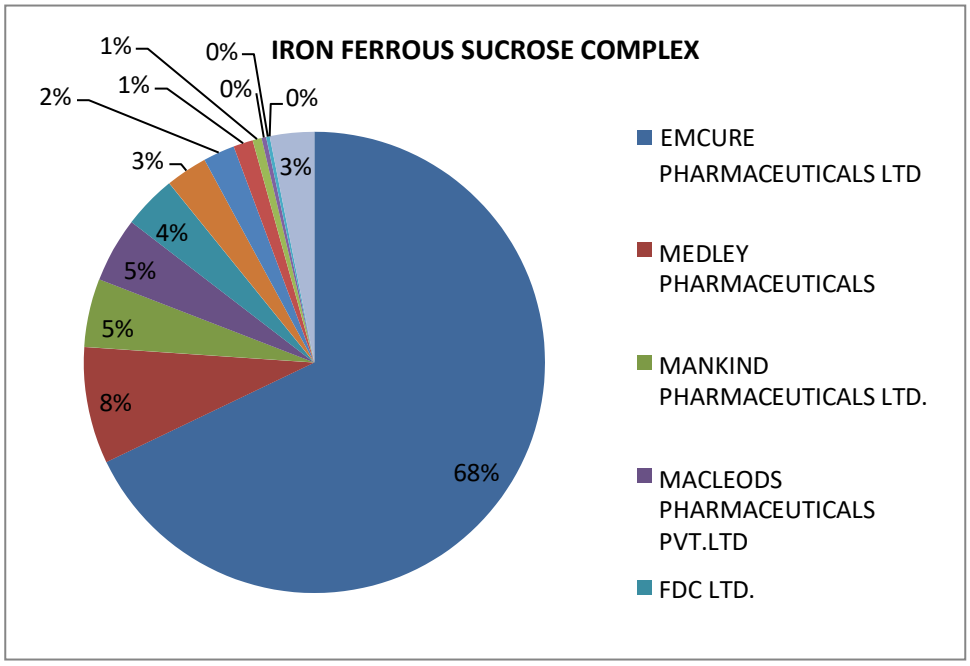



Amongst all the companies Raptakos brett and co. ltd. Showed highest market share percentage in combination of iron cynocobalamin and folic acid , having a brand name of

Hepatoglobine approx 28% market share , Growth Rate of 4.6%, with the value added to the revenue of company in the revenue of company of 1.9 Cr in a year.

**b. Data of Iron Ferrous sucrose complex of different companies are given below:**

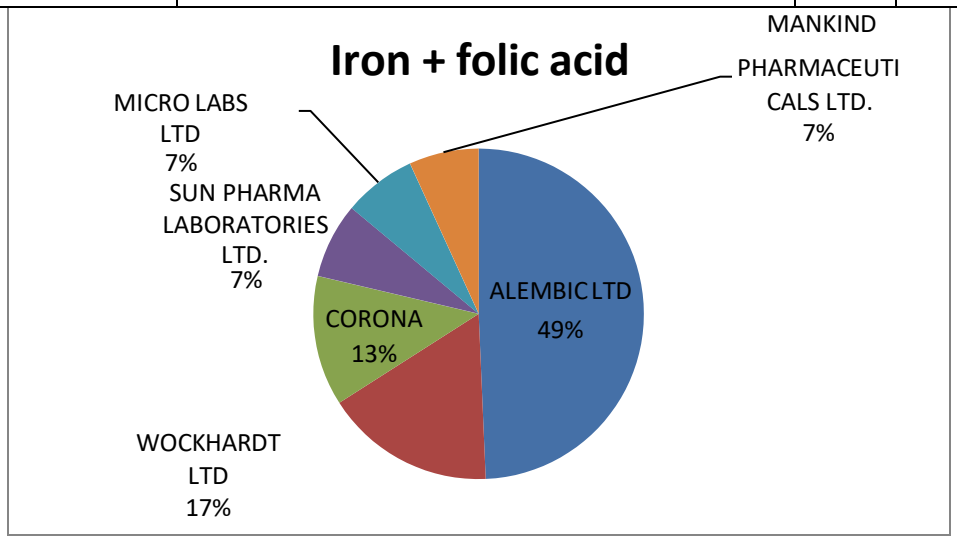
| IRON FERROUS SUCROSE COMPLEX /Brands | Company | MAT July'18 Val in Crs. | MAT July'19 Val inCrs. | MS (%) | GR (%) | Value Addition ina year |
|---|---|---|---|---|---|---|
| | | 121.5 | 130.3 | 100.0 | 7.3 | 8.8 |
| OROFER-S | **EMCURE PHARMACEUTICALS LTD** | 81.2 | 88.4 | 67.9 | 8.9 | 7.3 |
| R.B TONE | **MEDLEY PHARMACEUTICALS** | 6.5 | 10.7 | 8.2 | 65.1 | 4.2 |
| FERIKIND S | **MANKIND PHARMACEUTICALS LTD.** | 5.8 | 6.3 | 4.8 | 8.1 | 0.5 |
| RUBIRED S | **MACLEODS PHARMACEUTICALS PVT.LTD** | 5.9 | 5.9 | 4.5 | 0.3 | 0.0 |
| VITCOFOL S | **FDC LTD.** | 5.0 | 4.9 | 3.7 | -3.2 | -0.2 |
| IROZORB S | **MACLEODS PHARMACEUTICALS PVT.LTD** | 3.6 | 3.8 | 2.9 | 5.7 | 0.2 |
| MICROFER | **MICRO LABS LTD** | 5.3 | 2.9 | 2.2 | -45.8 | -2.4 |
| ANOFER S | **SUN PHARMA LABORATORIES LTD.** | 1.7 | 1.8 | 1.4 | 2.3 | 0.0 |
| HB 29 | **CORONA** | 0.9 | 0.8 | 0.6 | -2.5 | 0.0 |
| I-FAG | **AKUMENTIS HEALTHCARE LTD** | 0.4 | 0.4 | 0.3 | 3.6 | 0.0 |
| ROSEUS | **AKUMENTIS HEALTHCARE LTD** | 1.1 | 0.3 | 0.3 | -68.4 | -0.7 |
| WOFER S | **WOCKHARDT LTD** | 0.0 | 0.0 | 0.0 | -100.0 | 0.0 |
| UNNOWN | | 4.2 | 4.1 | 3.1 | -2% | -0.1 |




Amongst all the companies Emcure was leading company with a largest percentage of market share , 68 % having a brand name OROFER-S , Growth Rate 8.9% and value added to the revenue of company, 7.3 Cr in a year.

**c. Data of combination of Iron+ folic acid of different companies are given below**

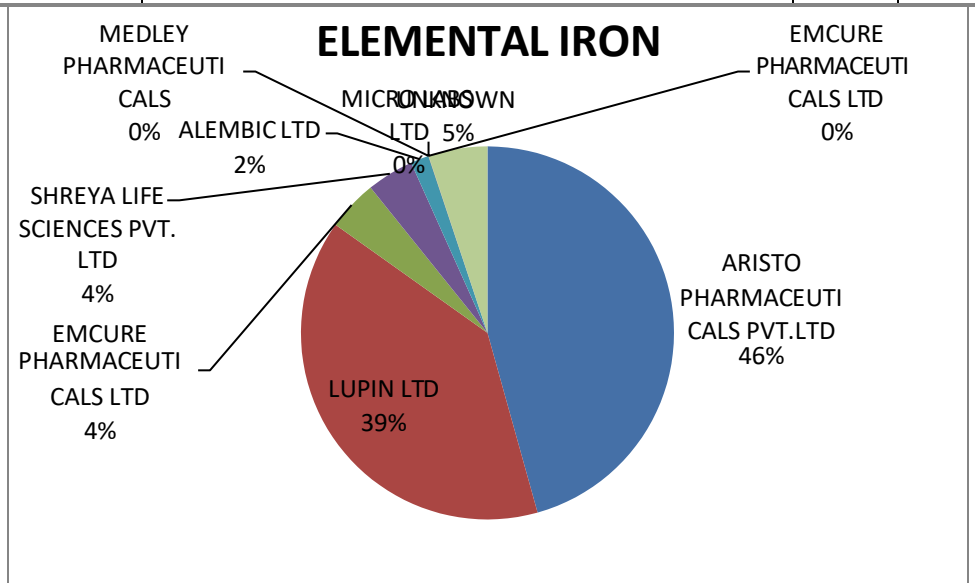
| IRON + FOLIC ACID /Brands | Company | MAT July'18 Val in Crs. | MAT July'19 Val inCrs. | MS (%) | GR (%) | Value Addition ina year |
|---|---|---|---|---|---|---|
| | | 98.9 | 93.0 | 100.0 | -5.9 | -5.9 |
| RICHAR | **ALEMBIC LTD** | 28.7 | 30.3 | 32.6 | 5.9 | 1.7 |
| PP 26 | **WOCKHARDT LTD** | 6.8 | 10.2 | 11.0 | 51.2 | 3.5 |
| FUR XT | **CORONA** | 7.0 | 7.8 | 8.4 | 11.9 | 0.8 |
| SPEEDRAL | **SUN PHARMA LABORATORIES LTD.** | 3.6 | 4.5 | 4.9 | 25.7 | 0.9 |
| FEROX XT | **MICRO LABS LTD** | 4.1 | 4.4 | 4.7 | 6.7 | 0.3 |
| FERIKIND | **MANKIND PHARMACEUTICALS LTD.** | 4.1 | 4.2 | 4.5 | 2.7 | 0.1 |
| OROFER | **EMCURE PHARMACEUTICALS LTD** | 3.8 | 3.9 | 4.2 | 4.7 | 0.2 |
| IMAX XT | **ARISTO PHARMACEUTICALS PVT.LTD** | 2.9 | 3.3 | 3.5 | 13.3 | 0.4 |
| FERIUM XT | **EMCURE PHARMACEUTICALS LTD** | 8.2 | 2.9 | 3.1 | -64.3 | -5.2 |
| FUR | **CORONA** | 1.2 | 2.9 | 3.1 | 133.2 | 1.6 |
| BIOFER XT | **MICRO LABS LTD** | 1.4 | 1.5 | 1.6 | 6.0 | 0.1 |
| ZEBITA XT | **INDCHEMIE HEALTH SPECIALITIES PVT. LT** | 0.7 | 0.8 | 0.8 | 15.9 | 0.1 |
| ZIFOL XT | **MICRO LABS LTD** | 0.7 | 0.7 | 0.8 | -5.7 | 0.0 |
| RICHAR XT | **ALEMBIC LTD** | 0.7 | 0.6 | 0.7 | -4.3 | 0.0 |
| IRENTIA | **AKUMENTIS HEALTHCARE LTD** | 0.4 | 0.1 | 0.1 | -74.0 | -0.3 |
| FERIUM XTDHA | **EMCURE PHARMACEUTICALS LTD** | 0.1 | 0.1 | 0.1 | -35.6 | 0.0 |
| VITCOFER | **FDC LTD.** | 0.1 | 0.1 | 0.1 | -17.0 | 0.0 |
| VITCOFER SYP | **FDC LTD.** | 0.0 | 0.1 | 0.1 | 503.8 | 0.0 |
| ENCIFER O | **EMCURE PHARMACEUTICALS LTD** | 0.1 | 0.0 | 0.0 | -98.9 | -0.1 |
| IMAX | **ARISTO PHARMACEUTICALS PVT.LTD** | 0.0 | 0.0 | 0.0 | -84.9 | 0.0 |
| OROFER-XT | **EMCURE PHARMACEUTICALS LTD** | 11.4 | 0.0 | 0.0 | -100.0 | -11.4 |
| unknown | **Unknown** | 13.1 | 14.6 | 15.7 | 11% | 1.5 |




Amongst all the companies Alembic ltd. Showed highest percentage of market share of combination of iron+ folic acid ,approx 33% with the brand name of RICHAR , Growth Rate 5.9% and value added to the revenue of company, 1.7 Cr in a year.

**D. Data of elemental iron of different companies are given below:**

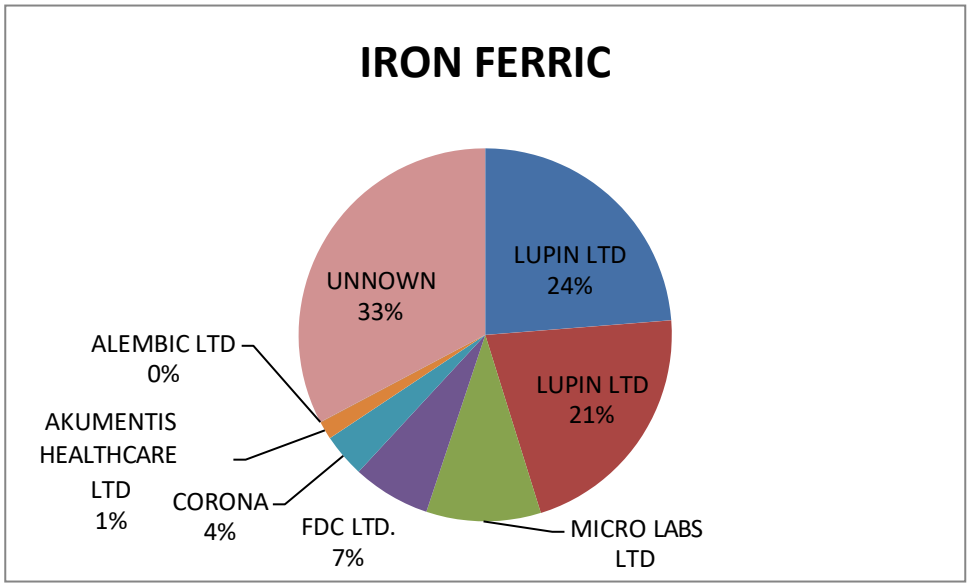
| ELEMENTAL IRON /Brands | Company | MAT July'18 Val in Crs. | MAT July'19 Val inCrs. | MS (%) | GR (%) | Value Addition ina year |
|---|---|---|---|---|---|---|
| | | 70.0 | 70.0 | 100.0 | 0.0 | 0.0 |
| IMAX S | **ARISTO PHARMACEUTICALS PVT.LTD** | 36.7 | 32.0 | 45.7 | -13.0 | -4.8 |
| LUPIHEME | **LUPIN LTD** | 21.3 | 27.4 | 39.2 | 28.8 | 6.1 |
| FERRI | **EMCURE PHARMACEUTICALS LTD** | 3.5 | 3.1 | 4.4 | -12.5 | -0.4 |
| IMFERON S | **SHREYA LIFE SCIENCES PVT. LTD** | 2.0 | 2.8 | 4.1 | 40.7 | 0.8 |
| RICHAR XT | **ALEMBIC LTD** | 1.1 | 1.1 | 1.6 | 0.6 | 0.0 |
| ENCIFER | **EMCURE PHARMACEUTICALS LTD** | 0.6 | 0.0 | 0.0 | -96.7 | -0.6 |
| HBRON | **MEDLEY PHARMACEUTICALS** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BIOFER | **MICRO LABS LTD** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | **UNNOWN** | 4.7 | 3.6 | 5.1 | -23% | -1.1 |
| | | | | | | |




Amongst all the companies Aristo Showed highest percentage of market share approx 46%, with the brand name of IMAX-S , and Growth rate of -13%

**E. Data of Iron Ferric of different companies are given below:**

| IRON FERRIC /Brands | Company | MAT July'18 Val in Crs. | MAT July'19 Val inCrs. | MS (%) | GR (%) | Value Addition ina year |
|---|---|---|---|---|---|---|
| | | 30.2 | 34.5 | 100.0 | 14.2 | 4.3 |
| JILAZO | **LUPIN LTD** | 8.8 | 8.2 | 23.76 | -7.0 | -0.6 |
| ISOFER | **LUPIN LTD** | 7.3 | 7.4 | 21.42 | 1.7 | 0.1 |
| FERISOME | **MICRO LABS LTD** | 3.4 | 3.4 | 9.93 | 2.2 | 0.1 |
| VITCOFOL HB | **FDC LTD.** | 3.1 | 2.3 | 6.77 | -25.2 | -0.8 |
| HB 29 X | **CORONA** | 0.0 | 1.3 | 3.77 | 0.0 | 1.3 |
| HAEMADAY | **AKUMENTIS HEALTHCARE LTD** | 0.3 | 0.5 | 1.59 | 75.9 | 0.2 |
| KINPHOS | **ALEMBIC LTD** | 0.1 | 0.0 | 0.00 | -99.4 | -0.1 |
| | **UNNOWN** | 7.2 | 11.3 | 32.3 | 57 | 4.1 |




Amongs all the companies Lupin showed highest % of market share approx 24%, with the brand name of LILAZO and Growth rate of -7%

**Pipeline Review**

**1. by competitive outline:**

Iron polymaltose complex- can be a focused product which have growth rate of (27.4%)

Novel iron complex, Ferric carboxymaltose recommend intravenously in IDA treatment. It distributed 1000 mg of iron in time of less than 15 minutes.

Ferric carboxymaltose consider as an effective option where oral preparation are ineffective for IDA patient. It delivered iron directly to the reticuloendothelial system, ferritin and transferring. It reduces the risk of iron over loading in serum. IV adm results increases in "serum iron", "serum ferritin" and" transferrin saturation", & finally increase in Hb level & depleted iron

Ferrous combination- is most common molecule in other competitors with good MAT19 value (18.7 CR) and highest GR (409.8%)

2. Sucrosomial iron-Sucrosomia Iron :A innovative oral iron arrangement where ferric pyrophosphate is guaranteed by a phospholipid bilayer notwithstanding a sucrester matrix (sucrosome), which is held through para-cell and trans-cell courses (M cells). This gives SI's stand-out helper, physicochemical and pharmacokinetic traits, alongside its high iron bioavailability and sublime gastrointestinal opposition.

**Conclusion-**

In creating nations like India, 50 to 53 % pregnant ladies' are iron deficient. Iron assumes a significant job in weakness, during the pregnancy need of iron expanded. All through pregnancy, IDA sway on the mother and fetal wellbeing , high hazard for preterm conveyance, fetal development hindrance, low birth weight, and mediocre neonatal wellbeing, and is connected to expanded fetal passing. Oversee Iron inadequacy weakness oral and parental iron treatment is usually utilized, both the treatment has antagonistic impacts and iron over-burden in tissues and iron insufficiency in blood. Oral ferrous sulfate was supported medication in rewarding IDA.

Job of ferroportin and hepcidin is significant in Iron lack sickliness, Lactoferrin, a glycoprotein basically looking like transferrin, is accepted to assume a job in iron retention. Lactoferrin constitute to an appealing and promising option in contrast to ferrous sulfate oral administration.Unlike standard treatment utilizing ferrous sulfate, pallid pregnant ladies getting bLf didn't encounter any unfriendly impacts.

In spite of the fact that the measure of iron provided by 30% iron immersed Lf was lower than that provided by ferrous sulfate , oral Lf essentially improved the quantity of red platelets, hemoglobin, all out serum iron, and serum ferritin fixations contrasted with those recognized in pregnant ladies sub-ideally rewarded with ferrous arrangements.

Market of Haematinics is wide with different iron particles; complete Mat 19 estimation of market was approx 21.562 billion. As indicated by the information and report mix of Iron cynocobalamin and folic corrosive is the main atom.

There is a need of up degree of existing iron treatments on varois regions like, lessening the unfavorable impacts, blends with different micronutrients, concentrating on the job of ferroportin and hepcidin , treatment as per the need of iron in different trimesters of pregnancy , need on concentrating on various phathophysiologies of iron, size of tablets and other monetary variables like expense of treatment.

IDA in pregnancy is strenuous to manage yet a neglected wellbeing request. The administration system is reliant upon the time of incubation and seriousness of iron deficiency. Boundless usage of preventive and helpful techniques is as yet ailing in our nation. Association of mindfulness camps, understanding gathering gatherings and the utilization of web based life can spread consciousness of this general medical problems.

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