



University of Baghdad

College of Medicine

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Title: INFANT FEEDING(2)

Grade: Fifth years

Module: PEDIATRICS

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Objectives

Formula feeding and types
Weaning
First year feeding problems
Over feeding
Regurgitation
Colic
Constipation

Formula Feeding



Most women make their feeding choices for their infant early in pregnancy.

The usual intake to allow a weight gain of 25-30 g/day will be 140-200 ml/kg/day in the first 3 mo. of life.

But after that, the rate of weight gain declines.

Vomiting and spitting up are common, and when weight gain and general well-being are noted, no change in formula is necessary.



In addition to complementary foods introduced at **6 mo.** of age, continued breast-feeding or the use of infant formula for the entire 1st year of life should be encouraged.

UNICEF estimates that a formula-fed child living in unclean conditions is between **6** and **25** times more likely to die of **diarrhea** and **four times** more likely to die of **pneumonia** than a breastfed child.

Rarely, use of powdered infant formula (PIF) has been associated with serious illness, and even death, due to infection with *Cronobacter sakazakii* and other microorganisms that can be introduced to PIF during its production.

Although *C. sakazakii* can cause illness in all age groups, infants are believed to be at greatest risk of infection.

The WHO believes that such infections are under-reported.

(*Cronobacter sakazakii* : It is a Gram-negative, rod-shaped, pathogenic bacterium. In infants it can cause bacteremia, meningitis and necrotizing enterocolitis. with some strains able to survive in a desiccated state for more than two years).



• Forms of Infant Formula:-



1- Ready-to-feed cans do not need to be diluted with water. The formula can be poured directly into a bottle and refrigerated until use. This formula is the most convenient because no mixing or measuring is necessary; however, it is also the most expensive.

2- Liquid concentrate formula is mixed with an equal amount of water. Then it is poured into the bottles and refrigerated until use.

3- Powdered infant formula is mixed with water. One level scoop (from can) of the formula is added to each 1 ounces of water in a baby bottle.

Do not pack the formula into the scoop or tap the side of the can before leveling off the scoop. Shake the bottle well to mix. Refrigerate until ready to use. This type of formula is the least expensive.



A comparison of human milk, cow's milk and infant formula (per 100 ml)



	Mature breast milk	Cow's milk	Infant formula (modified cow's milk)
Energy (kcal)	62	67	60–65
Protein (g)	1.3	3.5	1.5–1.9
Carbohydrate (g)	6.7	4.9	7.0–8.6
Casein:whey	40:60	63:37	40:60 to 63:37
Fat (g)	3.0	3.6	2.6–3.8
Sodium (mmol)	0.65	2.3	0.65–1.1
Calcium (mmol)	0.88	3.0	0.88–2.1
Phosphorus (mmol)	0.46	3.2	0.9–1.8
Iron (μmol)	1.36	0.9	8–12.5

Milk Components by Percentage in Different Species

	Total Solids	Fat	Protein	Lactose
Human	12.2	3.8	1.0	7.0
Cow – Holstein-Friesian	12.4	3.7	3.1	4.9
Cow – Jersey	14.6	5.1	3.7	5.0
Goat	12.3	4.8	2.9	4.1
Sheep	19.3	7.4	4.5	4.8
Camel	15.0	5.4	3.8	5.2
Rabbit	32.8	18.3	11.9	2.1
Blue Whale	55.0	40.9	11.9	1.3
Polar Bear	47.6	33.1	10.9	0.3

ESPGHAN RECOMMENDED STANDARDS FOR THE COMPOSITION OF INFANT FORMULA

Proposed compositional requirements of infant formula

Component	Unit	Minimum	Maximum
Energy	kcal/100 ml	60	70
Proteins			
Cows' milk protein	g/100 kcal	1.8*	3
Soy protein isolates	g/100 kcal	2.25	3
Hydrolyzed cows' milk protein	g/100 kcal	1.8†	3
Lipids			
Total fat	g/100 kcal	4.4	6.0
Linoleic acid	g/100 kcal	0.3	1.2
α -linolenic acid	mg/100 kcal	50	NS
Ratio linoleic/ α -linolenic acids		5:1	15:1
Lauric + myristic acids	% of fat	NS	20
Trans fatty acids	% of fat	NS	3
Erucic acid	% of fat	NS	1
Carbohydrates			
Total carbohydrates‡	g/100 kcal	9.0	14.0
Vitamins			
Vitamin A	μ g RE/100 kcal§	60	180
Vitamin D ₃	μ g/100 kcal	1	2.5
Vitamin E	mg α -TE/100 kcal	0.5¶	5
Vitamin K	μ g/100 kcal	4	25
Thiamin	μ g/100 kcal	60	300
Riboflavin	μ g/100 kcal	80	400
Niacin#	μ g/100 kcal	300	1500
Vitamin B ₆	μ g/100 kcal	35	175
Vitamin B ₁₂	μ g/100 kcal	0.1	0.5
Pantothenic acid	μ g/100 kcal	400	2000
Folic acid	μ g/100 kcal	10	50
Vitamin C	mg/100 kcal	8	30
Biotin	μ g/100 kcal	1.5	7.5
Minerals and trace elements			
Iron (formula based on cows' milk protein and protein hydrolysate)	mg/100 kcal	0.3**	1.3
Iron (formula based on soy protein isolate)	mg/100 kcal	0.45	2.0
Calcium	mg/100 kcal	50	140
Phosphorus (formula based on cows' milk protein and protein hydrolysate)	mg/100 kcal	25	90
Phosphorus (formula based on soy protein isolate)	mg/100 kcal	30	100
Ratio calcium/phosphorus	mg/mg	1:1	2:1
Magnesium	mg/100 kcal	5	15
Sodium	mg/100 kcal	20	60
Chloride	mg/100 kcal	50	160
Potassium	mg/100 kcal	60	160
Manganese	μ g/100 kcal	1	50
Fluoride	μ g/100 kcal	NS	60
Iodine	μ g/100 kcal	10	50
Selenium	μ g/100 kcal	1	9
Copper	μ g/100 kcal	35	80
Zinc	mg/100 kcal	0.5	1.5
Other substances			
Choline	mg/100 kcal	7	50
Myo-inositol	mg/100 kcal	4	40
L-carnitine	mg/100 kcal	1.2	NS

*The determination of the protein content of formulae based on non-hydrolyzed cows' milk protein with a protein content between 1.8 and 2.0 g/100 kcal should be based on measurement of true protein ([total N minus NPN] \times 6.25) (31).

†Formula based on hydrolyzed milk protein with a protein content less than 2.25 g/100 kcal should be clinically tested.

‡Sucrose (saccharose) and fructose should not be added to infant formula.

§1 μ g RE (retinol equivalent) = 1 μ g all-trans retinol = 3.33 IU vitamin A. Retinol contents shall be provided by preformed retinol, while any contents of carotenoids should not be included in the calculation and declaration of vitamin A activity.

||1 mg α -TE (α -tocopherol equivalent) = 1 mg d- α -tocopherol.

¶Vitamin E content shall be at least 0.5 mg α -TE per g PUFA, using the following factors of equivalence to adapt the minimal vitamin E content to the number of fatty acid double bonds in the formula: 0.5 mg α -TE/g linoleic acid (18:2n-6); 0.75 mg α -TE/g α -linolenic acid (18:3n-3); 1.0 mg α -TE/g arachidonic acid (20:4n-6); 1.25 mg α -TE/g eicosapentaenoic acid (20:5n-3); 1.5 mg α -TE/g docosahexaenoic acid (22:6n-3).

#Niacin refers to preformed niacin.

**In populations where infants are at risk of iron deficiency, iron contents higher than the minimum level of 0.3 mg/100 kcal may be appropriate and recommended at a national level.

NS, not specified.

TYPES OF POWDERED INFANT FORMULA

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1-COW'S MILK PROTEIN-BASED FORMULAS

- The protein concentration varying from (1.45 to 1.6 g/dl), considerably higher than in mature breast milk (1.3 g/dl). provide 60-70 kcal/dl.
- The predominant whey protein is β -globulin in bovine milk and α -lacto albumin in human milk.
- Plant or a mixture of plant and animal oils are the source of fat in infant formulas (provides 40-50% of the energy).

Lactose is the major carbohydrate in mother's milk and in standard cow's milk-based infant formulas for term infants.

2-SOY FORMULAS

Free of cow's milk protein and lactose and provide 67 kcal/dl.

The protein is a soy isolate supplemented with L-methionine, L-carnitine, and taurine to provide a protein content of 1.65-1.9 g/dl.

A soya formula should not be used **below 6 months** of age as it has a **high aluminium** content and contains **phytoestrogens** (plant substances that mimic the effects of endogenous oestrogens).

indications :- A- Infants with documented IgE-mediated cow's milk protein allergy.

B-Hereditary lactase deficiency or Galactosemia.

C-Situations in which a vegetarian diet is preferred.

3-PROTEIN HYDROLYSATE FORMULA

These formulas consists of proteins that have been broken down into smaller pieces, making it easier for babies to digest.

May be **partially hydrolyzed**, containing oligo peptides with a molecular weight of <5000 d, or **extensively hydrolyzed**, containing peptides with a molecular weight <3000 d.

Indications :-

- 1- Infants intolerant to cow's milk or soy proteins.
- 2- Gastrointestinal malabsorption due to cystic fibrosis, short gut syndrome, and prolonged diarrhea.

4-AMINO ACID FORMULAS

Are peptide-free

Formulas that contain mixtures of essential and nonessential amino acids. They are specifically designed for infants with dairy protein allergy who failed to thrive on extensively hydrolyzed protein formulas.

e.g. Neocate, EleCare.





Whole cow's milk is not recommended under one year of age because :

- 1-Intolerance occurs.**
- 2-Increase incidence of iron def. anemia.**
- 3-Contains more solutes that the kidneys of small babies can not cope with.**



Weaning

Weaning is the process of gradually introducing a mammal infant to what will be its adult diet and withdrawing the supply of its mother's milk.

When's the best time to start weaning?

The AAP recommends exclusive breast-feeding for the first six months after birth — and breast-feeding in combination with solids foods until at least age 1.

What are the three stages of weaning?

Stage 1 – Introduction of solid foods – from around 6 months.

Stage 2 – More textures and tastes – from around 7 months.

Stage 3 – Wider variety and family food – from around 9-12 months



Extended breast-feeding is recommended as the mother and her baby wish to continue.

Still, when to start weaning your child is a personal decision.

Whenever the mother choose to start weaning her baby from the breast, stay focused on her child's needs as well as

-Resist comparing your situation with that of other families.



Are there certain times when it wouldn't be smart to start weaning?

Consider delaying weaning if:

1- Concerned about allergens.

Might prevent or delay eczema, cow's milk allergy, and wheezing in early childhood.

2- The child isn't feeling well.

If the child is ill or teething, postpone weaning until he or she is feeling better.

3- A major change has occurred at home. Avoid initiating weaning during a time of major change at home. If the family has recently moved or the child care situation has changed, for example, postpone weaning until a less stressful time.



What's the best way to begin weaning?

When you start the weaning process, take it slow. — over the course of weeks or months — will cause milk supply to gradually diminish and prevent discomfort caused by engorgement.

(treated by applying cold compresses to the breasts to help decrease swelling and discomfort).



Keep in mind that children tend to be more attached to the first and last feedings of the day, when the need for comfort is greater.

These feedings might be the last ones your child drops. As a result, it might be easier to drop a midday breast-feeding session first.

After a lunch of solid food, your child might become interested in an activity and naturally give up this session.



Once you've successfully dropped one feeding, you can start working on dropping another.

You might also choose to wean the baby from breast milk during the day but continue breast-feeding at night.

Remember, it's up to the mom and her child.

Important Principles for Weaning

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Begin at \approx 6 mo of age

Avoid foods with high allergenic potential (cow's milk, eggs, fish, nuts, soybeans).

At the proper age, encourage a cup rather than a bottle.

Introduce 1 food at a time.

Energy density should exceed that of breast milk.

Iron-containing foods (meat, iron-supplemented cereals) are required.

Zinc intake should be encouraged with foods such as meat, dairy products, wheat, and rice.

Phytate intake should be low to enhance mineral absorption.

Breast milk should continue to 12 mo; formula or cow's milk is then substituted. **Give no more than 24 oz/day of cow's milk.**

Fluids other than breast milk, formula, and water should be discouraged. **Give no more than 4–6 oz/day of fruit juices. No soda.**





First year feeding problems:

Under feeding:

It is suggestive by crying ,restlessness & failure to gain wt. adequately despite complete emptying of the breast or the bottle.

It is also result from the failure to take sufficient quantities of food even when offered.





The child will not gain wt. and actually he will lose wt. and become marasmic (looks as an old man and loose the muscle bulk, constipation, failure to sleep, irritability, and excessive crying are to be expected).

The child will be def. in vit. A,B,C,D; Fe. def. anemia & protein def. also .



Treatment :

Treatment of underfeeding includes:-

a- Increasing nutrient intake.

b-Correcting any deficiencies of vitamins and/or minerals.

c-And instructing the caregiver in the art and practice of infant feeding.

d- If an underlying systemic disease, child abuse or neglect, or a psychologic problem is responsible, specific management of that disorder is necessary.

Over feeding:



Overfeeding means a baby is consuming more milk (breast milk or infant formula) than he needs for his growth and energy needs.

Regurgitation & vomiting are the major symptoms.

The symptoms associated with overfeeding are commonly mistakenly attributed to colic, reflux, milk protein allergy or intolerance, or lactose intolerance.





What separates overfeeding from these conditions is that the baby displays healthy growth.

What are the complications of overfeeding a baby?

Chronic overfeeding can lead to:

- 1. Overweight and obesity.**
- 2. Makes acid reflux worse.**
- 3. Vomiting.**
- 4. The risk for this group of children is linked to diabetes, heart disease, high blood pressure, asthma, and sleep disorders as they get older.**



Top 20 countries with the highest and lowest overweight & obesity rates

*Not included countries with less than 1 million inhabitants

Source: The World Factbook - Central Intelligence Agency (CIA) 2016-2020



Top 20 highest (overweight people as a percentage of total population)

1. United States 36.2 %
2. Jordan 35.5
3. Saudi Arabia 35.4
4. Qatar 35.1
5. Libya 32.5
6. Turkey 32.1
7. Egypt 32.0
8. Lebanon 32.0
9. United Arab Emirates 31.7
10. New Zealand 30.8
11. Iraq 30.4
12. Bahrain 29.8
13. Canada 29.4
14. Australia 29.0
15. Mexico 28.9
16. Argentina 28.3
17. South Africa 28.3
18. Chile 28.0
19. Uruguay 27.9
20. Syria 27.8

Top 20 lowest (overweight people as a percentage of total population)

- | | | |
|--------------------|--------------------|----------------------|
| 1. Vietnam 2.1 % | 8. Ethiopia 4.5 % | |
| 2. Bangladesh 3.6 | 9. South Korea 4.7 | 15. Burundi 5.4 % |
| 3. Timor-Leste 3.8 | 10. Eritrea 5.0 | 16. Niger 5.5 |
| 4. India 3.9 | 11. Sri Lanka 5.2 | 17. Afghanistan 5.5 |
| 5. Cambodia 3.9 | 12. Uganda 5.3 | 18. Burkina Faso 5.6 |
| 6. Nepal 4.1 | 13. Madagascar 5.3 | 19. Rwanda 5.8 |
| 7. Japan 4.3 | 14. Laos 5.3 | 20. Malawi 5.8 |

How To Prevent Overfeeding In Babies?

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You may take the below steps to prevent overfeeding:

1. Breastfeed: The baby gets breast milk only when they suckle, which makes overfeeding almost impossible in such cases .



2. Try paced bottle feeding: Paced bottle feeding is a method of controlling the flow of milk from the bottle. It is an excellent means to prevent overfeeding in infants .

3. Maintain a feeding schedule: Maintain a feeding schedule, and the baby will adjust to it eventually. The baby then gets hungry at the same time each day and should be fed on time to avoid feeding more than usual between long intervals.

4. Wait for the hunger cues: Look for signs of hunger like sucking at the fingers or moving their lips when touched gently. A baby who is hungry will latch on the nipple right away. Feed them only when they are hungry.

5. Do not force the baby to eat: If the baby is full, then do not force them to feed more. Or you will end up overfeeding them.

This is typically how we bottle feed



This is paced feeding!



PACED BOTTLE FEEDING



Vomiting & Regurgitation:



- **Vomiting** is the forceful ejection of gastric contents.
- **Possetting and regurgitation** are terms used to describe the non-forceful return of milk, but differ in degree.

Possetting describes the small amounts of milk which often accompany the return of swallowed air ('wind'), whereas **regurgitation** describes larger, more frequent losses.





Possetting occurs in nearly all babies from time to time, whereas regurgitation may indicate the presence of more significant gastro-oesophageal reflux.



Common causes of vomiting in infants

Gastro-oesophageal reflux

Feeding problems

Infection

- Gastroenteritis
- Respiratory tract/otitis media
- Whooping cough (pertussis)
- Urinary tract infection
- Meningitis

Dietary protein intolerances

Intestinal obstruction

- Pyloric stenosis
- Atresia – duodenal, other sites
- Intussusception
- Malrotation
- Volvulus
- Duplication cysts
- Strangulated inguinal hernia
- Hirschsprung disease

Inborn errors of metabolism

Congenital adrenal hyperplasia

Renal failure



Red Flag' clinical features in the vomiting child

- Bile-stained vomit** Intestinal obstruction
- Hematemesis** Esophagitis, peptic ulceration, oral/nasal bleeding
- Projectile vomiting, in first few weeks of life** Pyloric stenosis
- Vomiting at the end of paroxysmal coughing** Whooping cough (pertussis)
- Abdominal tenderness/abdominal pain on movement** Surgical abdomen
- Abdominal distension** Intestinal obstruction, including strangulated inguinal hernia
- Hepatosplenomegaly** Chronic liver disease
- Blood in the stool** Intussusception, gastroenteritis – salmonella or campylobacter
- Severe dehydration, shock** Severe gastroenteritis, systemic infection (urinary tract infection, meningitis), diabetic ketoacidosis
- Bulging fontanelle or seizures** Raised intracranial pressure
- Failure to thrive** Gastroesophageal reflux, coeliac disease and other chronic gastrointestinal conditions



Colic:



Definition: It is a complex of paroxysmal abdominal pain presumably of intestinal origin.

It is of unknown cause.

But recent studies suggest that it has some relation to irritable bowel syndrome in adults of the same family.





It is common in babies and called **(3 months colic)**, there will be an unexplained irritability & severe crying, it occurs usually in the **afternoon**.

Careful physical examination to exclude other causes of colic as:

- Intussusception
- Strangulated hernia
- Otitis media
- Pyelonephritis,....etc.





CAUSES OF INFANTILE COLIC

- A)ALLERGIES
- B)GERD/ACID REFLUX
- C)OVER STIMULATION
- D)GAS PRODUCING FOODS
- E)AIR INTAKE FROM FEEDING /CRYING
- F)IMMATURE DIGESTIVE &NERVOUS SYSTEM



Infantile Colic



Wessel 's criteria

Episodes of inconsolable crying in an otherwise healthy infant

Crying/ and/or fussing for
 ≥ 3 h/d
 ≥ 3 days/week
 ≥ 3 weeks

1954

Modified Wessle's criteria

Colicky infants cry constantly during the evening at about the same time each day in an otherwise healthy infant

Crying/ and/or fussing for
 ≥ 3 h/d
 ≥ 3 days/week
 ≥ 1 week

The Rome III criteria

Paroxysms of irritability, fussing or crying that starts and stops without obvious cause;

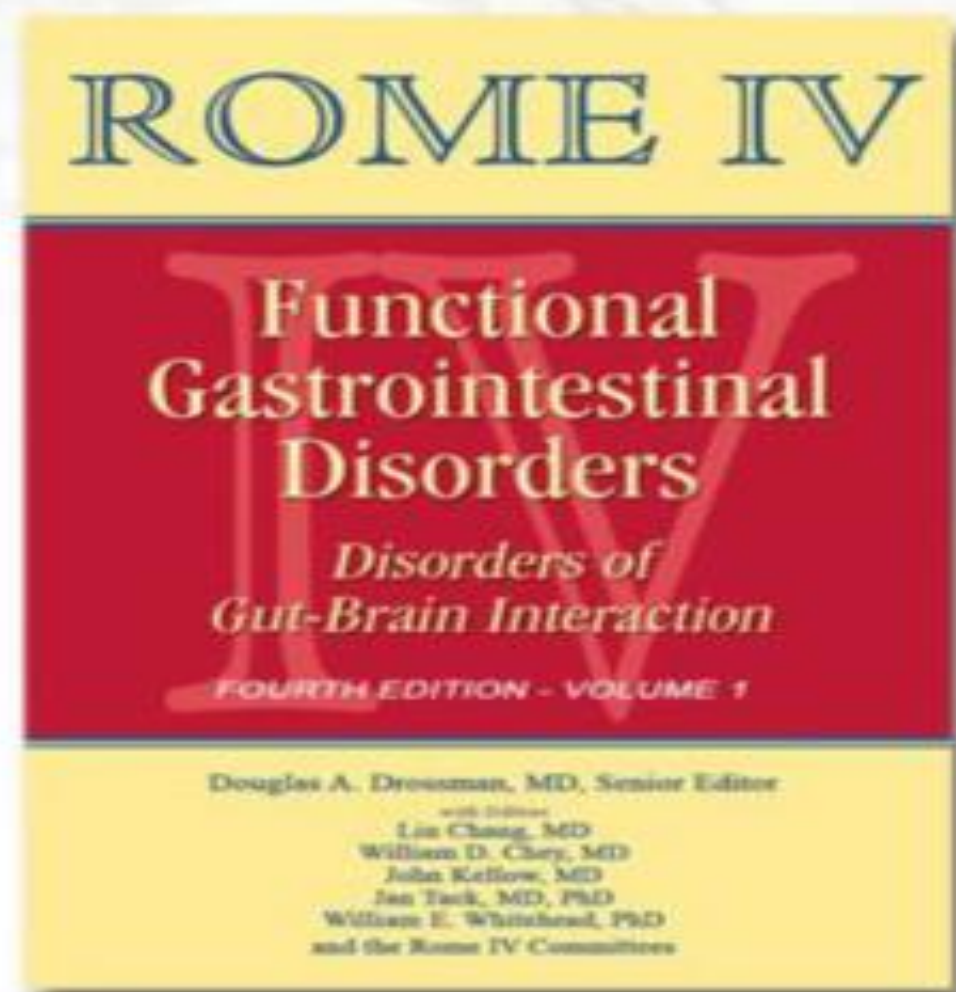
≥ 3 h/day
 ≥ 3 days/week
 ≥ 1 week

- absence of failure to thrive

In infants from birth to 4 mo of age

2006

Infantile Colic



➤ What is New ?

ROME III



- ✓ After appropriate medical evaluation & symptoms cant be attributed to any other condition

2016

Treatment:

1-Holding the infant upright or prone across the lap or on a hot water bottle or heating pad occasionally helps.

2- Passage of flatus or fecal material spontaneously or with expulsion of a suppository or enema sometimes affords relief.

3-Carminatives before feedings are **ineffective** in preventing the attacks.

4-Sedation is occasionally indicated for a prolonged attack.



5-If other measures fail, both the child and the parent may be sedated for a period.

6- In extreme cases, temporary hospitalization of the infant, often with no more than a change in the feeding routine and a period of rest for the parent, may help.



7- Prevention of attacks should be sought by improving feeding techniques, including :-



a- “Burping.”

b- Providing a stable emotional environment.

c- Identifying possibly allergenic foods in the infant's or nursing mother's diet.

d- And avoiding underfeeding or overfeeding.



Although it is not serious, colic can be particularly disturbing for the parents as well as the infant. Thus, a **supportive and sympathetic physician** can be particularly helpful, even if attacks do not resolve immediately. The fact that the condition rarely persists beyond 3 mo. of age should be reassuring.



CONSTIPATION



Constipation is infrequent bowel movements or difficult passage of stools.

The cause of constipation is often unclear and multifactorial.

In babies, Hirschsprung disease, anorectal abnormalities, hypothyroidism and Hypercalcaemia need to be considered.

Constipation may be precipitated by dehydration or reduced fluid intake or an anal fissure causing pain.

In older children, it may relate to problems with toilet training, unpleasant toilets or stress.



Definition

- **Rome IV criteria (Need 2 of the following):**
 - **Straining***
 - **Lumpy or Hard Stools***
 - **Sensation of Incomplete Evacuation***
 - **Use of Manual Maneuvers (digital evacuation)***
 - **Sensation of Anorectal Obstruction/Blockage***
 - **< 3 Bowel Movements per week**

* Need to be associated with >25% of defecations



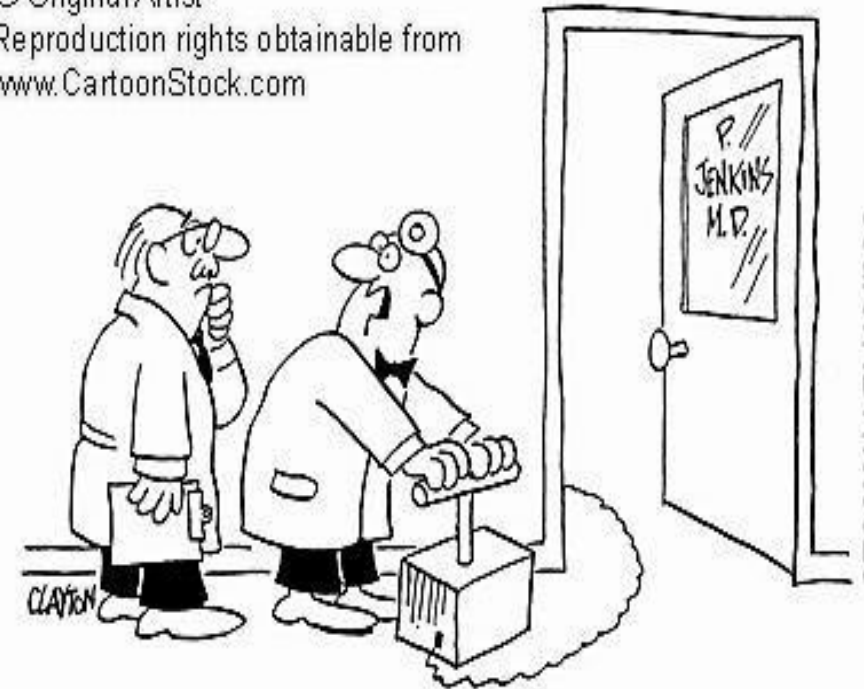
Obstipation

Is intractable constipation.

Constipation is practically unknown in breast-fed infants receiving an adequate amount of milk and is rare in formula-fed infants receiving an adequate intake.



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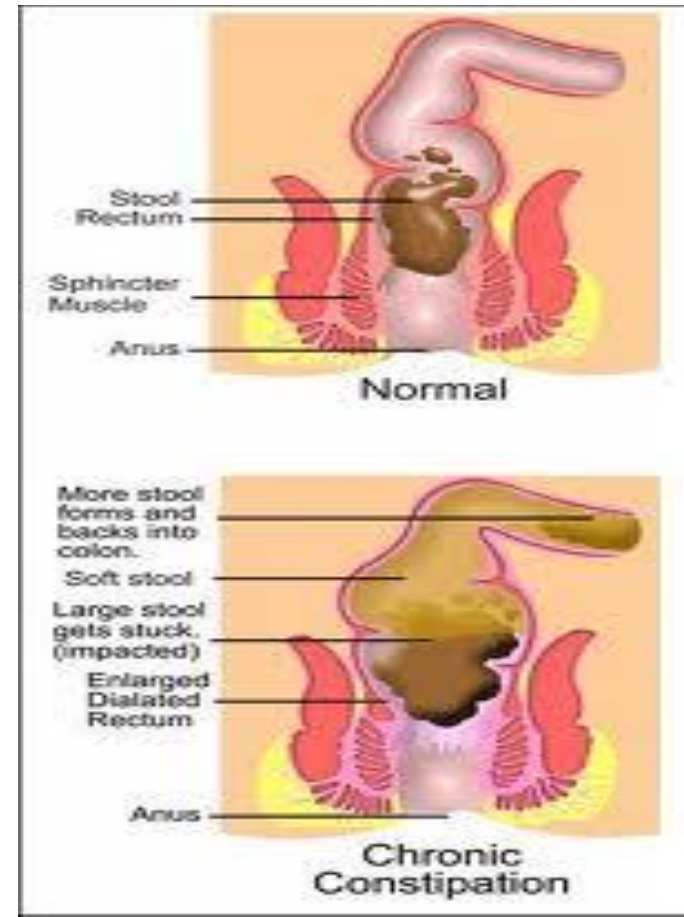


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"WORST CASE OF CONSTIPATION I'VE EVER SEEN."



The consistency of the stool, **not its frequency**, is the basis for diagnosis. Most infants have 1 or more stools daily, but some occasionally have a stool of normal consistency at intervals of up to 36–48 hr.





Whenever constipation or obstipation is present from birth or shortly after birth, a rectal examination should be performed. Tight or spastic anal sphincters may occasionally be responsible for obstipation, and finger dilation is frequently corrective.

spastic anal sphincters may occasionally be responsible. If irritation is alleviated, healing usually occurs quickly.





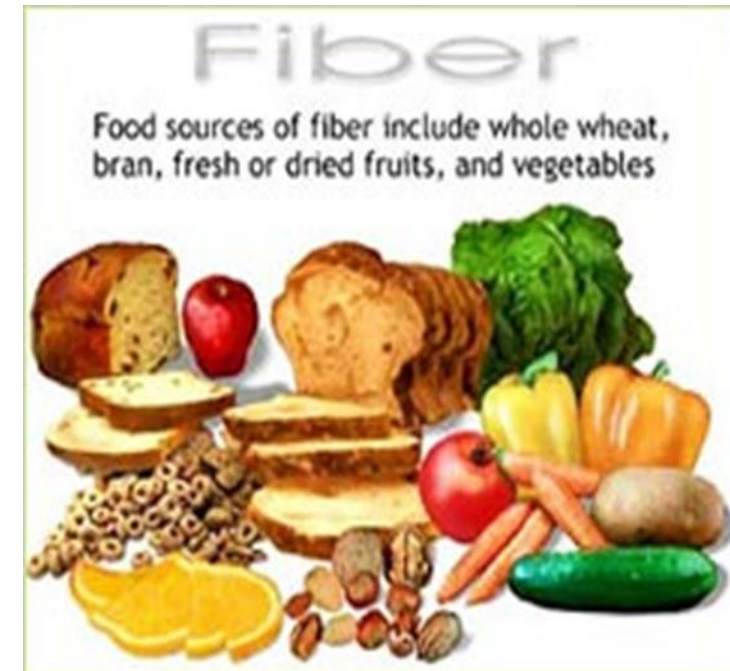
Aganglionic megacolon may be manifested by constipation in early infancy; the absence of stool in the rectum on digital examination suggests this possibility, but further diagnostic work-up is indicated .



Constipation may be caused by :-

- **An insufficient amount of food or fluid.**
- **diets that are too high in protein or**
- **deficient in bulk.** *Simply increasing the amount of fluid or sugar in the formula may be corrective during the 1st few months of life.*

After this age, better results are obtained by adding or increasing the intakes of cereal, vegetables, and fruits.





Prune juice ($\frac{1}{2}$ –1 oz) may be helpful, but adding foods with some bulk is usually more effective. **Milk of magnesia** (MgOH_2) may be given in doses of 1–2 tsp, but should be reserved for unresponsive or severe constipation.

Enemas and suppositories should never be more than temporary measures.



Summary



There are different types of formula feeding which includes: -

- 1-Ordinary formulas.**
- 2- Formulas prepared for special purpose .**
- 3- Weaning (u) begin at 6 mo.**
- 4- Under feeding & overfeeding should be avoided**
- 5- Differentiation between pathol. From non-pathol. throw up.**
- 6- Colics in the first 3mo. Of life is very common non pathol. Problems.**
- 7- Constipation should be managed properly.**

THANK YOU

