Introduction to Maternal Infant Young Children Nutrition

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Lecture - 20
Session - 5

Science of Breastfeeding

Hello everyone, today I am going to talk about Breast Feeding The Science and an Art, this is session number 5 and very interesting session because now we are going to start with the breast milk, breastfeeding art, science. So, you will learn about infant nutrition, extremely important in child's life because that gives foundation to child's health.

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So, we always think that only poor mothers or uneducated mothers or illiterate mothers they may need help or sometimes people feel that somebody who is highly educated she may need help because she does not probably know the culture or there are all these myths but what we found that whether a woman is educated, whether she is coming from a very healthy, I mean wealthiest quintile or if she's poor or she's tribal, kin does not matter, each and every woman needs guidance with breastfeeding.

So, it is important that we do not create this kind of preconceived notion that she will need help or she will know it or, every woman needs help, so that is important to know.

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Human milk a beautiful, beautiful infograph, what it has, it has different sections as you can see and it gives a kind of information about ingredient of human milk, content of human milk. So, we will start with basically the right most corner, top right most corner, what it has it has all this threonine and methionine, cysteine, those are all amino acids.

Amino acids make your protein. So, basically it has all the amino acids which are required in the diet all of them, it has essential amino acid, it has non-essential amino acids, very good, very digestible protein breast milk has it is called whey protein, so very high in whey protein, very easily digestible.

Second section over here it is your triglyceride, your you know all these different kind of fats, lauric acid and phosphatidylcholine and all this, these are all basically different kind of fats. The kind of fat that breast milk has, it has omega-3, DHA and EPA and those fats are important for your brain, baby's brain, for eyes and for heart.

So and there are many studies that as I have mentioned earlier also, many studies which are published showing that babies who take mother's milk have higher IQ and that is because of the kind of fat that mother's milk has. When you buy formula what they do is they remove the cow milks fat, so they remove that saturated fat which is important for brain and they put in all vegetable oils.

So that is kind of unnatural really, so that is why I have given in one of my tutorial on complications of formula and cow milk about these fats. Another thing what it has these are your macrophages or IgA, IG complements, this all basically your immune function, immune cells. Breast milk is a live substance, so if you add any micro bacteria or any bacteria or viruses it immediately gets killed because this breast milk is a live product.

Very, very important macrophage, macrophage has a large cells, macro means large, the large cells and they engulf bacteria they engulf a lot of your microorganisms. It has all immunoglobulin, it has IGA, IGM, IGE there are all this immunoglobulin that breast milk has and that is why even in Covid babies are protected if babies get mother's milk.

Any type of infection, if mother has any kind of infection in fact breast milk will increase those immune cells, will fight against the infection, so many times mother may ask whether I can breastfeed? Yes, she can breastfeed even if she has a cold, cough, diarrhea or any of those infection, even in HIV actually mother can breastfeed.

Then you have these are all enzymes, so enzymes are antitrypsin and histamine is this all enzymes which digest your food and it is helping in a lot of biochemical reactions, these are all your hormones, so you have your T3, T4, TSH all those different prostaglandin, cholecystokinin, cortisol, insulin so mother's milk has all this hormones, leptin again very, very important for the baby.

Here what you have in this section, you have kind of growth hormone, kind of factors, so it has GCSF, it has calcitonin it does not like all these other kind of hormones like growth factors it is all again ingredient which are required for growth. Then you have over here all the vitamins, so basically all your fat soluble vitamin and water soluble vitamin, remember if vitamins are low in mother, then those mothers will have less vitamin in their breast milk, vitamin is your type 1 nutrient.

So, any type 1 nutrient which is lacking in mother will be lacking in breast milk also. This one also has minerals, so you have your zinc, iodine all that potassium, magnesium, so type 2 micronutrient will not kind of change so much if mother is lacking because those micro nutrients will come from cells, it will come from muscle tissue.

So remember the type 2 micronutrient does not change in breast milk, then you have something called nucleotides, so these are your nucleotides, a very important information of DNA, in repair of DNA kind of making new cells, so this all your nucleotides which are present in mother's milk.

So, there is nothing that you can compare to mother's milk, the best nature's gift to baby really, so please make sure that each and every mother get this information, we have a very good tutorial on importance of breastfeeding, complications of formulas and cow milk if you have any family member who is planning to become pregnant or who is pregnant please kind of pass on this tutorial to them.

It is crucial that the mother and the family listen to what science has to say and once they understand this then I would recommend that they watch those technique tutorial, the art of breastfeeding because that is another thing which is which is you have to pass through that hurdle, because many mothers give up too soon because of the poor technicality or poor understanding of the techniques.

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So, let us talk a little bit about science of breast milk, so breast milk has a lot of different factors of course, most important is your nutrition, it is optimum nutrition for an infant, they do not need anything except probably vitamin D, it is optimal food for health,

growth and development of the infant, it is not only beneficial to infant but also to mothers. What are the advantages of breastfeeding?

So, basically it has nutritional factors it has immunological factors, it has psychological factors, economical factors and physiological factors.

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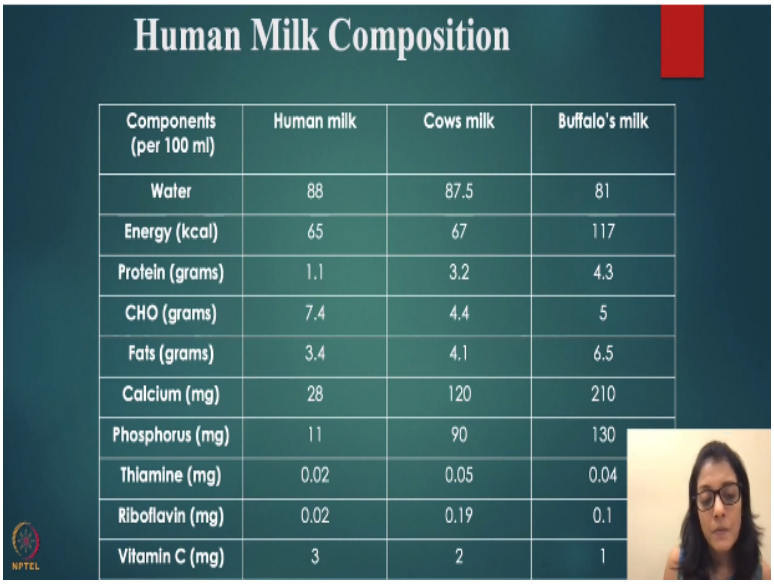

Now, this is the table which shows the composition, human milk composition it is compared to cow milk and buffalo milk. So, if you look at comparison, so this is your protein, so protein is lowest in human milk but is highly digestible, very easily digestible, cow milk protein is predominantly casein, casein protein is really hard, very heavy, it is the same protein basically when you make Paneer (Cottage Cheese) out of milk.

So that casein, that Paneer (Cottage Cheese) is casein and whatever water is left behind that is whey. Just make sure when you make Paneer (Cottage Cheese) at home do not throw away that whey, just use it in either making rice or dal or whatever you make and buffalo milk has 4.3 grams of protein, so buffalo milk has highest protein.

Carbohydrate basically highest in human milk, fats highest in buffalo milk 6.5 grams per 100 ml, calcium you can see look at the amount of calcium cow milk and then buffalo

milk some of the highest amount, phosphorus again is increasing, not necessarily good for baby in a so much high amount and basically vitamin C is high in human milk.

So, this has been just a main difference basically between human milk, cow milk and buffalo milk.

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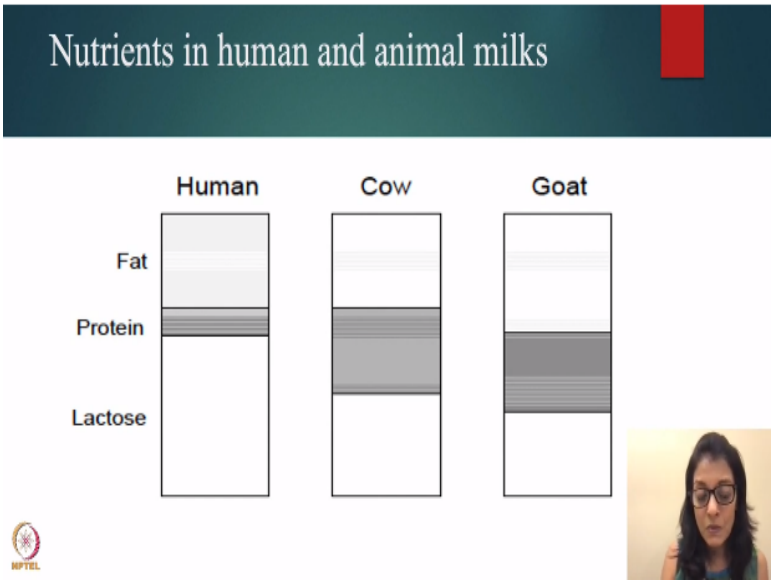

This is what I spoke about that protein is low in human milk and high in cow and goat, here they have given goat. So, protein is kind of pretty much a little bit lower than cow but higher than human milk. lactose as I told you earlier also lactose is higher in human milk, little bit less in cow and goat milk but goat milk has a high amount of fat as you can see goat milk is very fatty.

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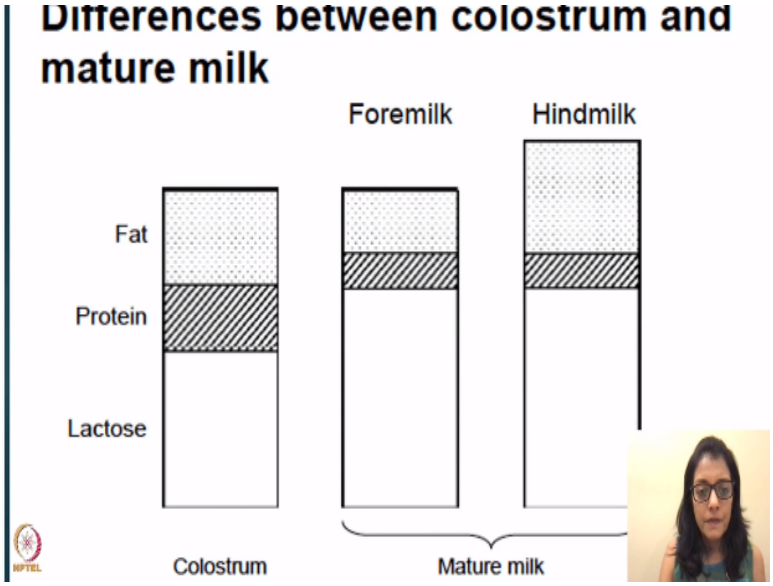

This is the difference between foremilk and hindmilk. Now, if you look at mature milk, mature milk comes in say on around day three you have a transition milk and after about a week or so then a mature milk comes in, so when the mature milk comes in the front part of the milk, which is in front part of the breast it is foremilk and that is kind of little bit watery, it has kind of good amount of protein but the fat, fat is not much in foremilk as you can see over here, the fat is not much.

Hindmilk, the back part of the milk that is much higher in fat, so babies who drink much more or baby completely empties one breast those babies kind of tend to do well, not only in terms of weight but also in IQ because fat is again very high in omega-3, omega, DHA, so make sure that you completely empty your breast and then go on the other side and when you completely empty you want to do objective examination by looking at press the breast, I will show you in my one tutorial how to express manually, but there is a technique to it so you learn it.

You make sure that there is no hindmilk left then you go on the other side, colostrum is basically your fat, colostrum is very fatty and it is a high amount of protein, so you can see compared to mature milk look at the amount of fat it has amount of protein because it is so much, it is a very small quantity that babies get in the beginning the mothers produce, so it is kind of calorie dense.

And a lot of time initially first couple of days baby tend to sleep more, do not worry about it, it is okay because it has good amount of fat and protein, so that is about colostrum.

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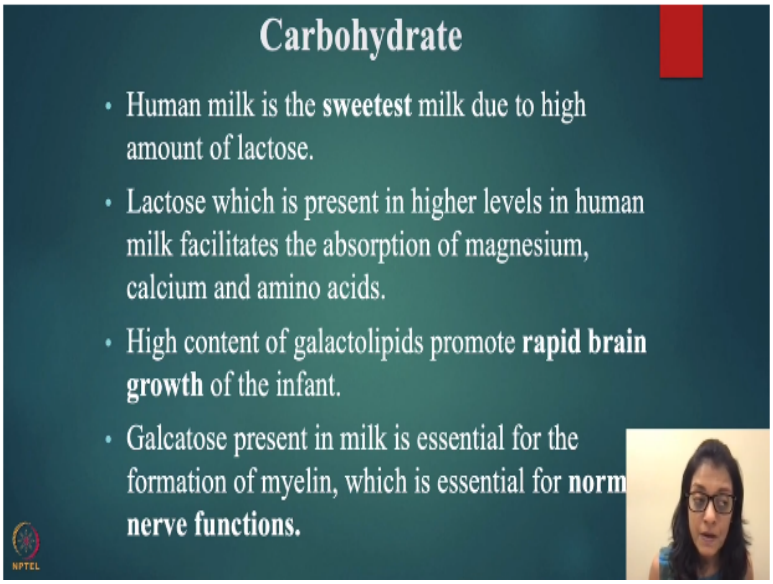

In one of our tutorial we have given how much colostrum mothers get on day one, day two, day three, day four it is important to understand that because many times mother feel like oh I am not getting milk, I am not getting milk, but they need to know that there is only some amount of milk that they will get. Carbohydrate human milk is the sweetest milk due to high amount of lactose, lactose which is present in higher level in human milk facilitate the absorption of magnesium, calcium and amino acids.

So, that lactose is really important in mother's milk. The high content of galactolipids promote rapid brain growth also, so it is important for brain growth and galactose which is milk sugar present in milk is essential for formation of myelin which is important for the normal function or function. Myelin is the sheet which covers the nerve, neuron cells, so galactose is really important, it gives immediate energy to the baby.

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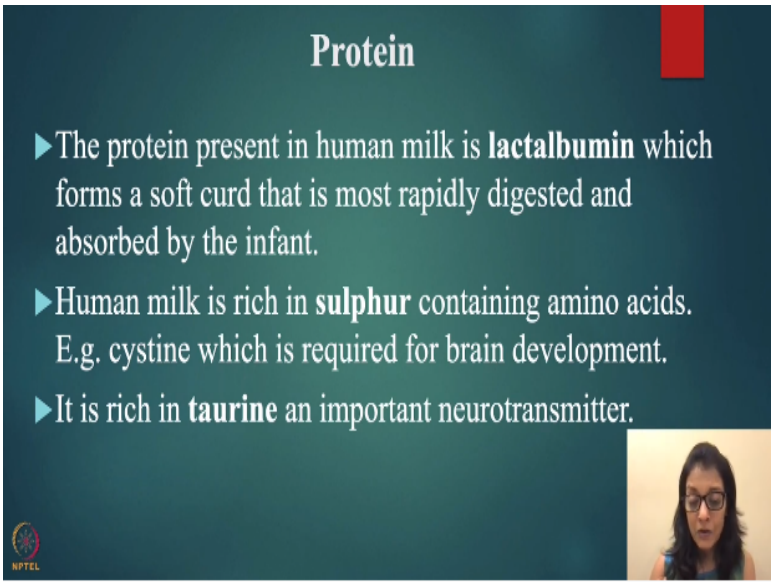

Next is your macro protein, protein is present in the form of lactalbumin, that is your milk protein which forms a soft curd, so many times you see when the baby finish feeding they will have a little bit of curdling, like a curdle, the milk curdles and that is your lactalbumin and this lactalbumin is very easily digestible and absorbed by infant very fast, so it is predominantly a whey protein.

Human milk is rich in sulfur, now of course, in my previous session I discussed about sulphur, again crucial for liver, crucial for brain development systems, important brain development, so just make sure that babies get human milk. It is also rich in amino acid called taurine and taurine is a very important neurotransmitter.

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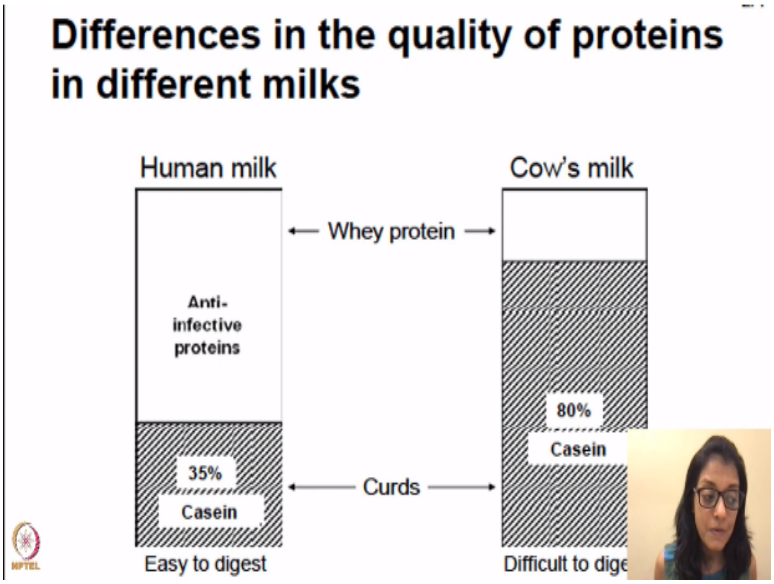

We are just discussing very kind of short, I do not want to go too much in detail because we have kind of people from different backgrounds, so I do not want to go too much in that medical aspect or nutrition and dietitian or nutrition aspect of a breast milk but we have explained in a very simple way in our tutorials.

Now, this is the difference of quality of protein in different milk, so here if you look at it human milk has predominantly whey protein, 35 percent casein over here cow milk has 80 percent casein, casein is the Paneer (Cottage Cheese), so definitely when children have cow milk it is very difficult to digest, they tend to have lot more vomiting, bloating stomach upset. Babies who are breastfed they are generally very quiet unless they have colic but otherwise they are they are pretty happy babies.

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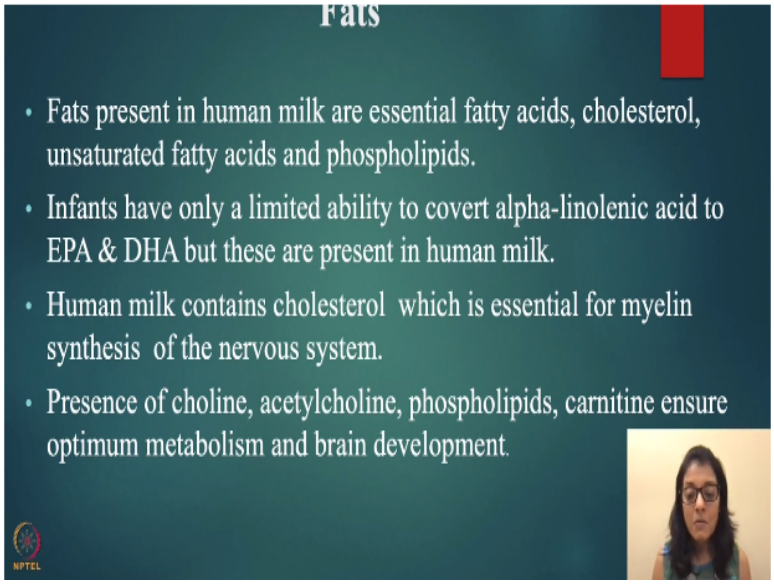

Now, let us talk about fats, so fats present and human milk are essential fatty acids, they also have cholesterol, unsaturated fatty acid and phospholipids. So, cholesterol is one of the most important nutrient which are required for brain formation and for brain function and for myelin, myelin synthesis so please make sure that give your milk and cholesterol is not bad.

Infants have very limited ability to convert alpha-linolenic acid to EPA, DHA that means what it means that some of the vegetable oils like flax seeds oil, walnut oil some of this vegetable oils have omega-3 but which omega-3, alpha-linolenic acid, only 4 to 10 percent of the alpha-linolenic acid gets converted to your EPA, DHA.

Now, young children, young babies they do not have ability to convert this alpha-linolenic into EPA, DHA. so even if suppose they are not drinking mother's milk and if they are taking say cow milk or formula, formulas does not have EPA, DHA, they claim that they have added EPA, DHA but studies have not conclusive that that helps with the child's IQ, so best way to make your child intelligent is to just give your own milk.

There are other fats in mother's milk acetylcholine, choline, phospholipids, carnitine this all basically very important for brain development, so fat is one of the most important macro in mother's milk.

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Then let us talk about minerals, a mineral is basically your sodium, potassium, magnesium, zinc this all your mineral. Breast milk has a low level of iron but is very highly available because of the presence of lactalbumin and lactoferritin which enhances iron absorption. Calcium to phosphorus ratio is 2 is to 1 which helps in his ideal absorption, zinc absorption is also better from breast milk due to presence of zinc binding protein in breast milk.

So, all these minerals are there and they are in a very good bioavailable state, so it is easy to absorb from breast milk. Similar kind of suppose iron was present in cow's milk but cow milk iron is not bioavailable, even if it may anyway cow milk is not high in iron in any way but whatever iron is there it is the bioavailable is very, very poor.

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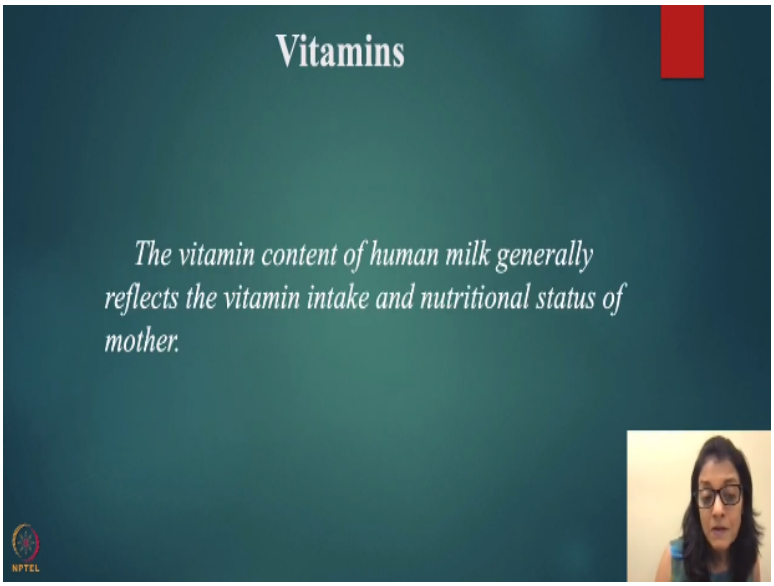

Vitamins content of human milk generally reflects the vitamin intake and nutritious status of the mother. Now, this is why I already explained that if mother is deficient on those vitamins then a baby will have vitamin deficiency too. So for example, most common deficiency which mother has is your vitamin D, so make sure that babies they get vitamin supplements or at least they are exposed to the sun okay.

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Protection against infection, so mother is infected, I already explained to you what happens when the mother is infected her immunity goes up and her immunity basically passes on to the baby through breast milk, so that is important that mother continue to breastfeed even if she has viral infections or any other bacterial infections.

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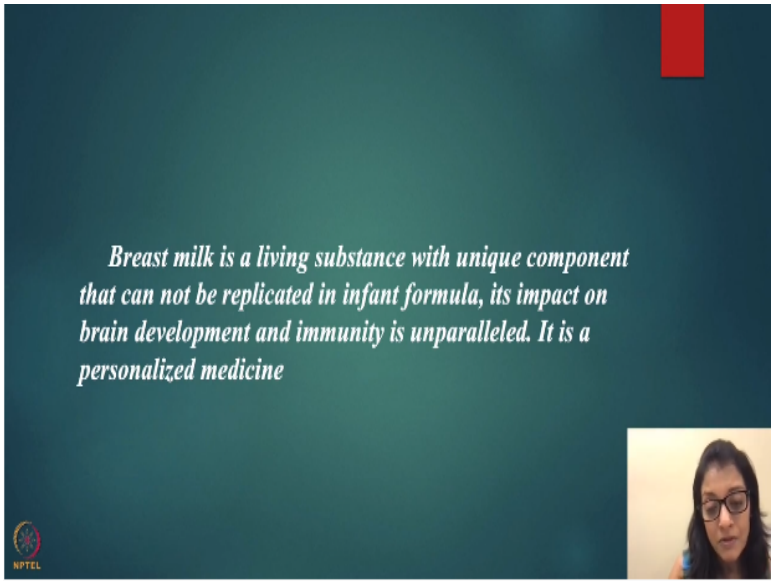

Living substance with unique component that cannot be replicated infant formula, I keep reiterating this and I cannot say enough, its impact on brain development immunity is unparalleled it is a personalized medicine for your baby. Very, very crucial very important please let mothers know, it is a personalized medicine, it is a foundation of baby health.

If breastfeeding not given in first at least minimum in first one day or so as I mentioned about the golden hour then the lifelong repetition is bound to happen, so to prevent from a lot of infections, lot of other conditions, diseases make sure your children get your milk right away and continue to get milk as long as you can you can give it.

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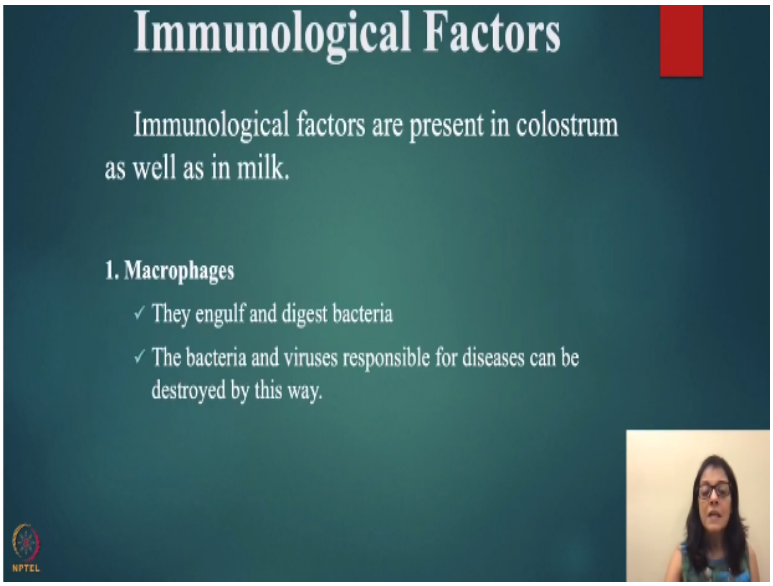

What are the immunological factors? Immunological factors are present in colostrum as well as in the milk, microphages are those big cells, I mentioned to you, they engulf and digest bacteria and thus the bacteria and the viruses responsible for diseases can be destroyed in this way.

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Second one is your lymphocytes, those are your white cells, lymphocytes are the white blood cells responsible for attacking wide range of infectious organism, human will contain T cells and B cells. T lymphocytes offer protection against malaria.

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What is lactoferrin? Lactoferrin is iron containing protein found both in colostrum and mature milk, this is again another important ingredient I want you to remember lactoferrin, what it does it inhibits the growth of certain iron dependent bacteria in the GI tract and therefore it affords protection against GI infections, so that is why lactoferrin is really important because it will prevent diarrheas especially or GI infections, also basically it is iron binding, iron containing protein.

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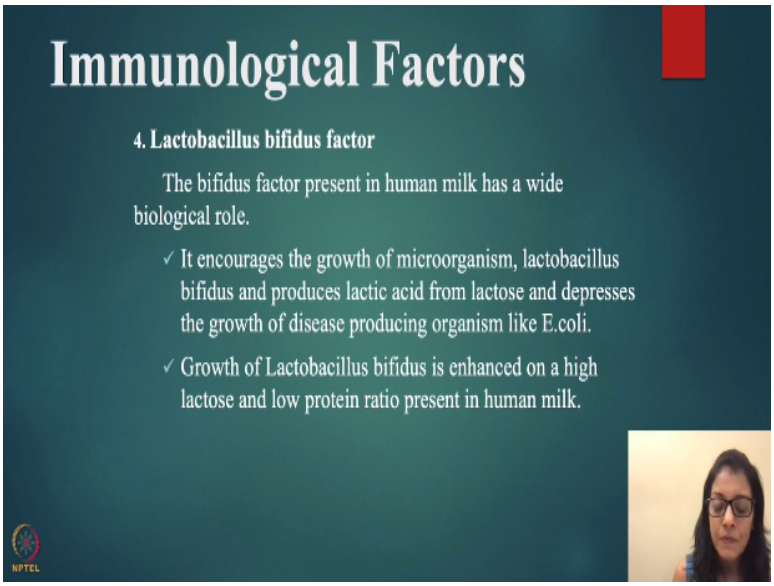

Lactobacillus bifidus factor, so basically this particular factor is present in human milk and it has lot of function, what are the function it has? It encourages the growth of certain microorganism like lactobacillus bifidus, that is why it is called lactobacillus bifidus factor because it kind of stimulates the growth of this organism and it produces lactic acid, lactic acid is produced from what?

From lactose, which is your milk sugar and what it does, what does this lactic acid do, it depresses the growth of diseases producing organism like E.coli, so there are certain organisms which are pathogenic, means which causes disease, so this particular lactic acid will prevent the growth of those disease producing pathogens or the disease producing organisms.

Growth of lactobacillus bifida is enhanced on high lactose and low protein ratio present in human milk, so how does this growth of lactobacillus bifidus occur because of the high lactose in milk and also low protein ratio in human milk, so your sugar to protein ratio is low.

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Immunological factor, so enzymes breast milk supplies enzymes like amylase, lipoprotein lipase, lacto peroxidases, it is a lot of other enzymes which I showed in the diagram, this enzyme what it does increases digestibility and act as a defense again microbes.

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So, there is another factor of immunological. Immunoglobulins, immunoglobulins are the defensive protein, secretory IgA, IgG, IgM are present in human milk. Fatty acids and monoglycerides, fatty acids and monoglycerides present in human milk are able to

penetrate the membranes of viruses and bacteria and destroy them, so again very important fatty acids and monoglycerides these are your fats.

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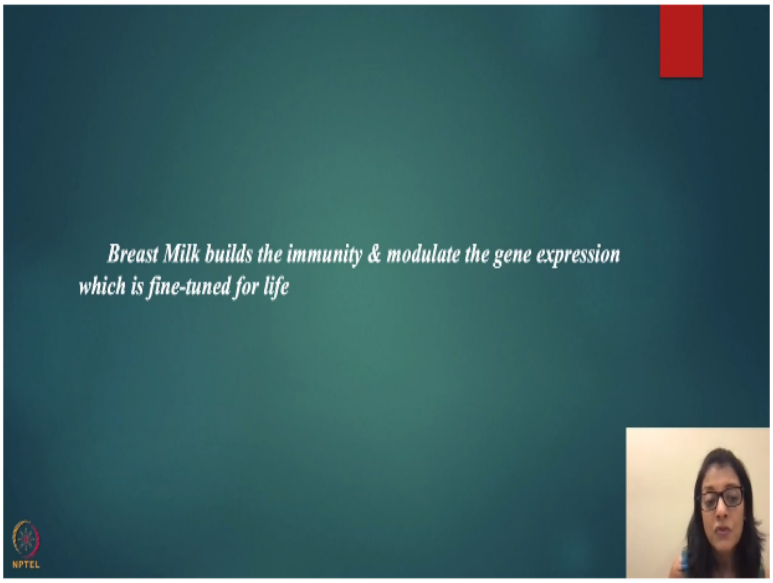

So, breast milk builds immunity and modulate the gene expression which is a fine tune for life, it is basically a gene modulator, I would say gene expression modulator not the gene modulated, gene expression, what does it mean is like for example, it is basically kind of I would say epigenetic factor, epigenetic means it will not change the genes but it will change the environment around the gene.

So, gene will express in a good way, so the gene expresses, like gene expresses like for example, if somebody has diabetes and say nobody in the family has and that person has diabetes. So, basically what it means that there are problems in the epigenetic factors when something that went wrong in the environment that he expressed diabetes, the gene expressed diabetes or gene modulation.

The gene expression modulated and that is how he developed diabetes, so that is your epigenetic factors, gene by itself does not change, that gene changes are basically occurring in mutation, when you have a mutation when you have like something like cancer then your gene changes, but otherwise most of these diseases which are lifestyle diseases are not because of genetic it is because of the epigenetics.

It is the environment around that person which makes that person get diseases, so there are a lot of diseases, and now insulin resistance is one of the biggest kind of root cause that they have found which causes diabetes, blood pressure and all different kind of diseases.

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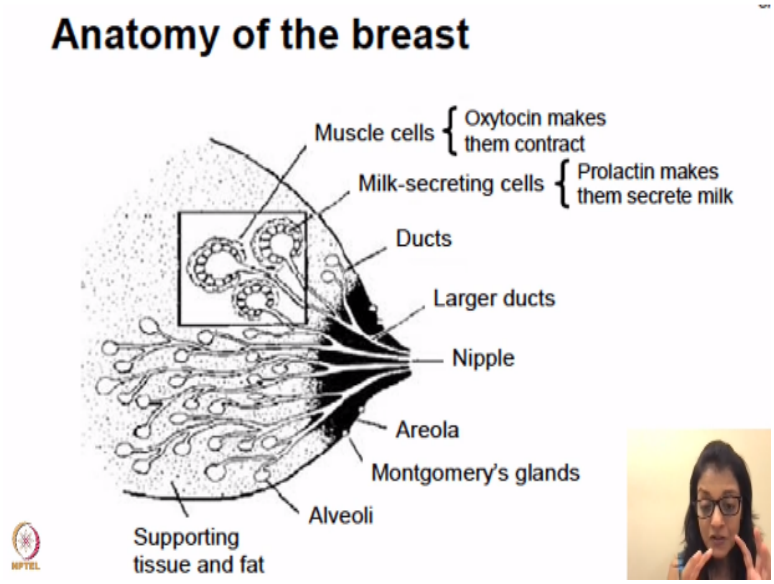

So, here I am going to talk about now how breastfeeding works, because unless we understand the physiology about anatomy we would not understand how breast milk is

produced and what exactly happens, so here we will discuss about that. The cells it causes basically contraction of the cells and the milk flows out, so that is important.

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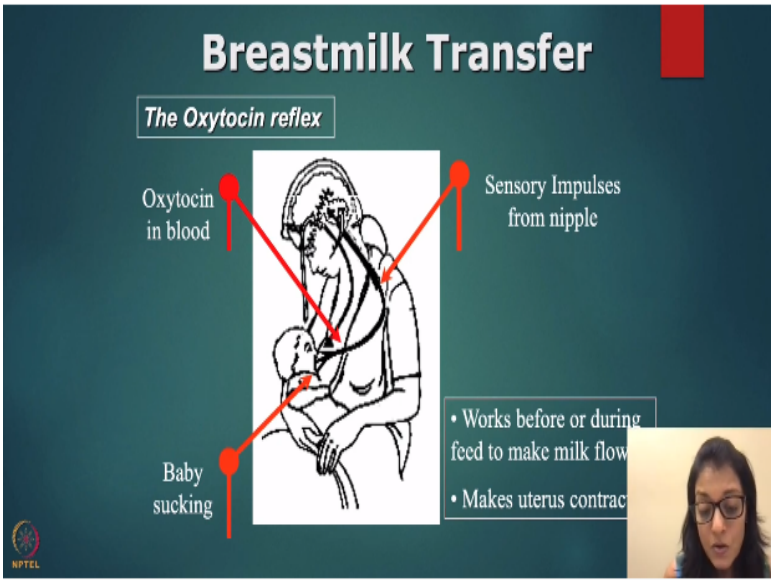

There you go and when does it work? It works before during feed to make milk flow, so many times what happens is if mother is pumping with the pump and she will realize that she is just not getting milk, she is not getting milk, she will get maybe two teaspoon or three teaspoon and mostly that is because she has not gotten letdown reflects.

And she will immediately know if she got the letdown reflex by certain signs and symptoms which I will explain to you later but remember that the letdown reflex is very, very important and for that mother has to be in a very good state of mind.

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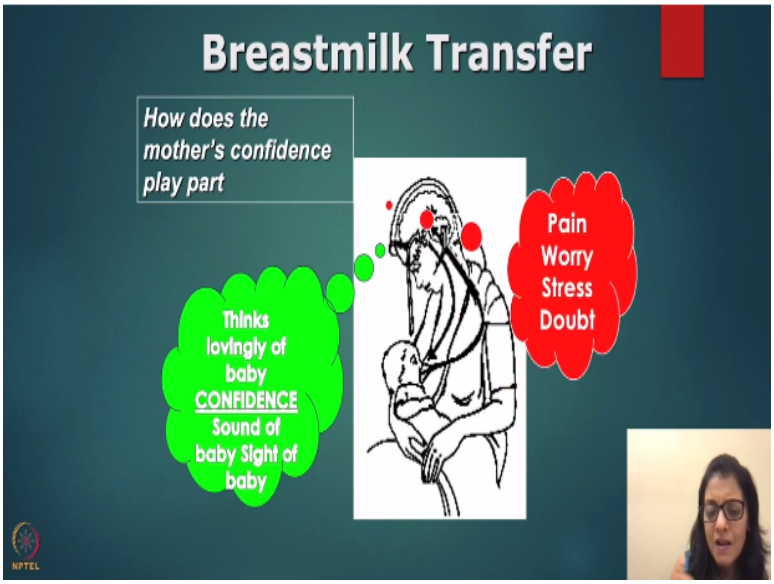

If she is happy, if she is confident, if she is relaxed she will definitely have letdown reflex but if she is not into it, she is in pain, she is worried, she is stressed, she is in doubt, she is sad letdown reflex will not happen and when you do not have letdown reflex those cells do not contract, when the cells do not contract the milk does not come into the areola.

So, that is why just keep mother happy, let her relax, tell her to go out for a walk, not to get too worked up, she has to rest, drink water, eat proper food and then of course, relax and meditate, I think I really recommend mothers to meditate because that relaxes them a lot.

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Now, what are the signs and symptoms of oxytocin release? So, most of the time at least in first few weeks or so what happens she feels that suddenly there is a tingling sensation in the breast and just before when she is trying to feed or when she is full or when she is thinking of the baby even at work she will suddenly feel the tingling sensation and the milk will start flowing, so that is kind of very typical sign of oxytocin release but you would not see that kind of oxytocin release after a couple of months or so.

So, many times she feels 'oh my god now I am not getting that tingling sensation, what happened', so it is very kind of obvious in first couple of months or so. Then what happens that of course, when she is feeding the baby on one side the other side drips that is also a sign of oxytocin release that she is pushing that milk out basically the breast is pushing that milk out.

And when suppose baby comes off the breast, suddenly what she sees is like the milk flowing, it is like a spray coming out of the breast and that is amazing actually, there is so much of milk coming out and that is the importance of letdown reflex, baby will not have to work too hard, milk just flows because of oxytocin.

Then in early days because of oxytocin there is like a pain from uterine contraction and there is a rush of blood during this feed in the first week and slow deep sucks and

swallowing by the baby which shows the breast milk is flowing into his mouth. So, when you look at baby's mouth they will have slow suck and they will have really good suck, then swallow, suck and swallow, few suck and then swallow, so that is another way.

But again it is very common in first couple of months or so and then mothers know, babies know so then it kind of decreases and that sensation.

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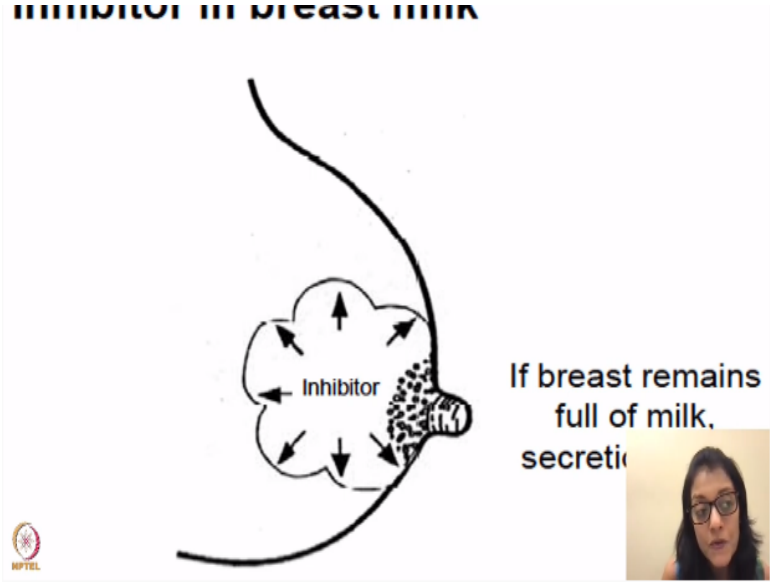

And this is my last slide, what happens if mothers do not breastfeed or for some reason she is breastfeeding very infrequently or it may be sick and baby is not sucking then some amount of milk stays into the breast, those are called milk inhibitor factor MIF, these are inhibitors, it stays in the breast and basically it tells the breast that milk is not needed, stop producing milk and that is how basically slowly, slowly milk dries up and it will stop producing milk, so this is your milk inhibiting factor.