Dairy and Food Process & Products Technology
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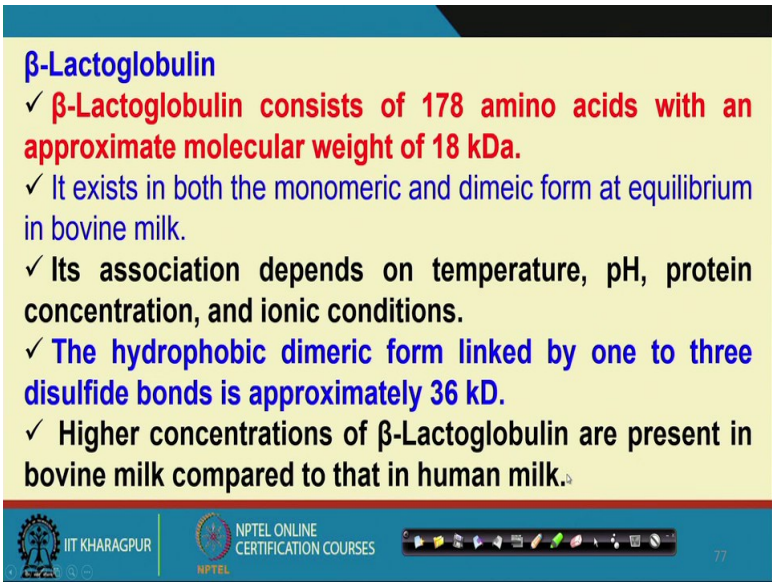
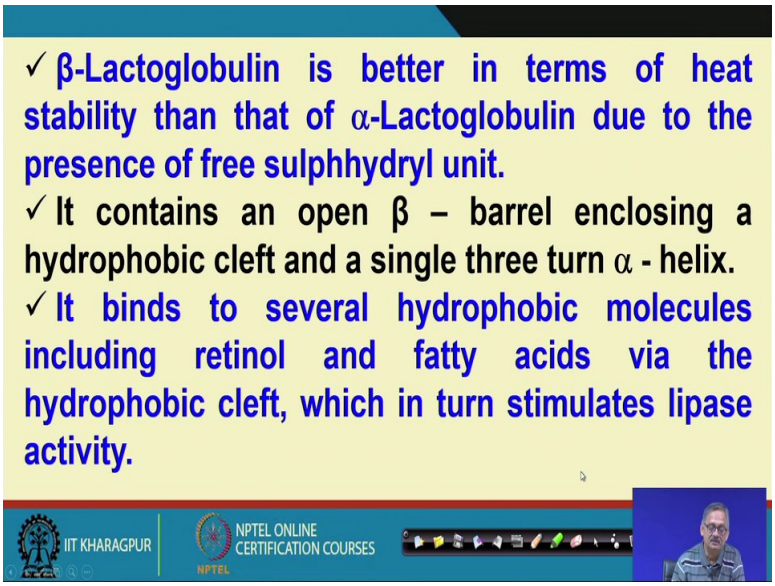
Lecture - 32
Whey Protein (Contd.)

So, we were discussing about the Whey Protein and because of the time constraint, we had to stop at beta lactoglobulin or beta lactalbumin right. And let us look into its continuity.



That, this was that higher concentrations of beta lactoglobulin are present in bovine milk compared to that in human milk right.

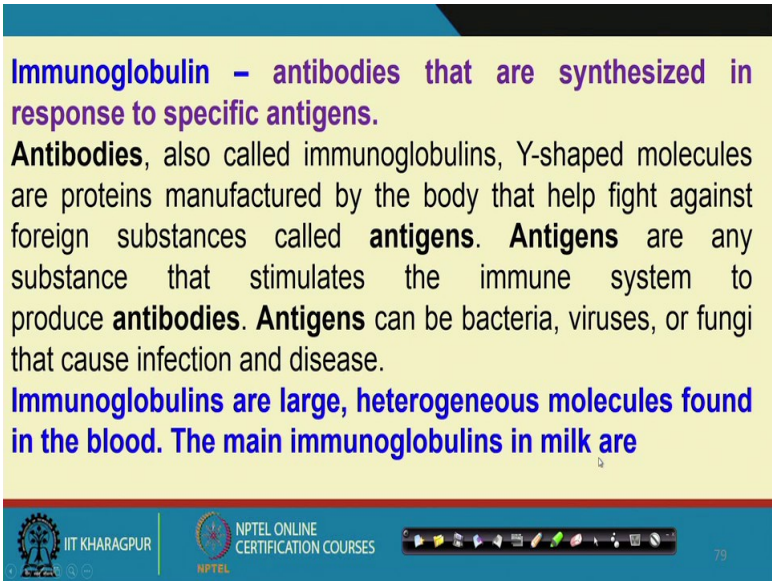


Now, some more are there about the beta lactoglobulin; that beta lactoglobulin is better in terms of heat stability than that of the alpha lactoglobulin due to the presence of free sulphhydryl unit right.

Free sulphhydryl unit is there because of that it is better in terms of heat stability than that of the alpha lactoglobulin. It contains open beta barrel enclosing a hydrophobic cleft, and a single three turn alpha helix, it also binds to several hydrophobic molecules including retinol and retinol rather and fatty acids via the hydrophobic acid, with via the hydrophobic acid cleft which in turn stimulates lipase activity right.

So, these are the sum of the reasons we come across, why different proteins when present in milk, they are subjected to different enzymes when we will come to enzyme also, that time you will see that how different types of enzymes are present in milk and what actions they are causing or producing right. However, it is here we see that, it binds to that beta lactoglobulin binds to several hydrophobic molecules, including retinol retinol and fatty acids via hydrophobic cleft, which in turn stimulates lipase activity right.

So, the moment lipase activity is there or it stimulates lipase activity, which intern acts on the lipe lipids right lipase is the enzyme acting on the lipid right.

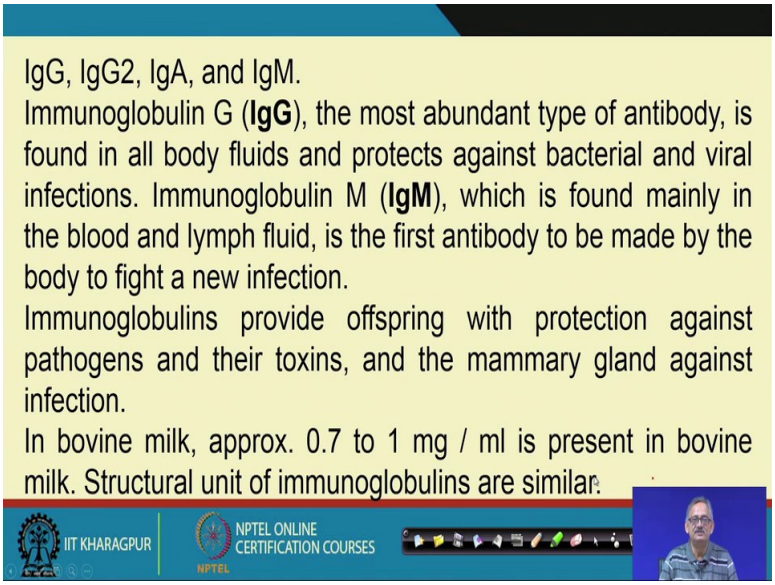


So, other whey proteins are like immunoglobulin; immunoglobulin right from the word immune. So, it appears that, some immunity or things like that is associated right. It is true that it is associated with both antibodies that are synthesized in response to specific antigen.

So, antigen antibodies these are associated with immunization or immunity of the; I don't say living unit, I don't say only bovine or mammals. It is true for all living units and this immunoglobulin typically is associated with the antibody and antigen these things right. Antigen antibodies are I mean these are I don't say mirror image, but they are like I mean as close as they are which one is there the other also will be there right.

So, antigen antibody these are now what is that antibody? Antibodies also called immunoglobulins; antibodies also called sorry immunoglobulins and also called immunoglobulins and there are y shaped molecules are proteins manufactured by the body, that help fight against foreign substances called antigens. So, the moment antigen has taken place the immediately body mechanism tries to develop antibody to that antigen right and this antigen is the source of the infection. So, antigens are any substance that stimulates the immune system to produce antibodies right.

Antigens can be bacteria, virus, fungi that causes the infection and diseases in the body system. So, when this antigen is there, it is triggering simultaneously to produce the antibodies to fight against the antigen right. So, immunoglobulins are large heterogeneous molecules found in blood, the main immunoglobulins in milk are.



The main immunoglobulins in milk are IgG right IgG or Ig2 IgA and IgM. So, main immuno globulins are IgG Ig2 IgA and IgM. Out of which this immunoglobulin g that is the IgG, the most abundant type of antibody and is found in all body fluids accept in all body fluids and protects against bacterial and viral infections right.

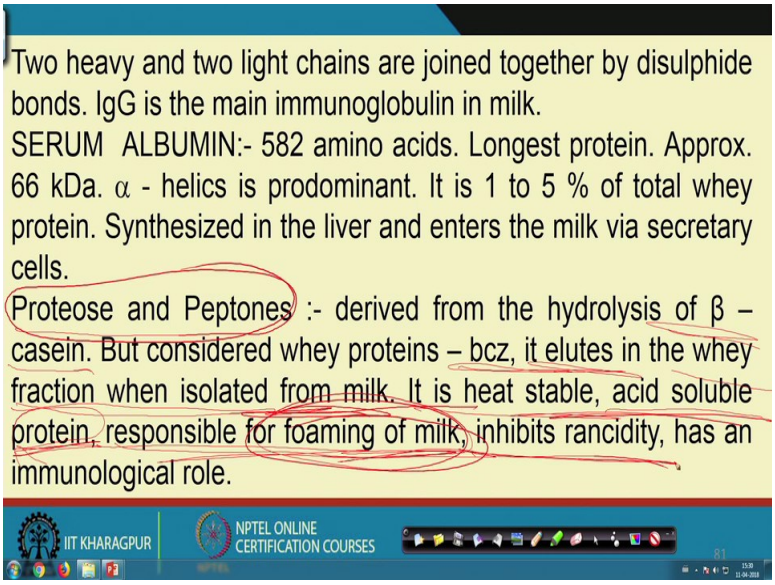
It protects against bacterial and viral infections and this is present in all body fluids right whatever body fluid we have, it is not only the blood which is the body only having right. So, body fluids are also there. So, there it is all IgG or immunoglobulin G and it is abundant and type of antibody present in the body and present throughout the fluid of the body. Now another one is immunoglobulin M or IgM which is found mainly in the blood and the lymph, which is found mainly in the blood and the lymph and is the first antibody to be made by the body to fight in new infection.

So, the first antibody which is produced by the body to fight against the infection which has come up; so, there is the IgM. And this again if you have seen if you have come across with the blood test of your parents or seniors, then you might have seen some of them might have been advised by the doctors to undergo the test like IgG IgM etcetera right. So that means, how good is the antibody, how good is the protective mechanism of the body that is to be understood or that is to be tested. So, thats why those tests are given. So, here also we see this antibody IgM, that is the first antibody which is developed by the body to protect against the newly invent invaded the infection right.

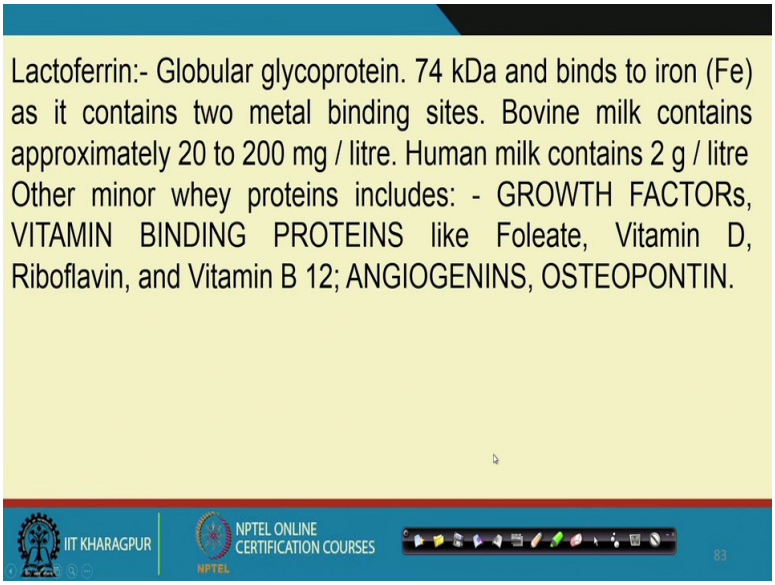
Then immunoglobulins provide offspring with protection against pathogens and their toxin and the memory gland against infection right. Many times or subsequently also perhaps will come across, that there are some diseases which are also infecting on the mammary gland as well the tip so that the milk which is being milked or which is being extracted from the animal or mammalian, that could be infected right. So, this is a very bad situation if by chance that kind of infection happens. So, it provides offspring that is number of next generation with protection against pathogens and toxins and the mammary gland against infection. .

In bovine milk approximately 0.7 to 1 milligram per liter, 0.7 to 1 milligram per liter is present this is in bovine milk right. So, this immunoglobulin is around 0.7 to 1 milligram per milliliter present in bovine milk structural unit of immunoglobulins are similar. So, immunoglobulins here we said IgG, IgM, Ig2 IgA. So, there structural similarity they have structural similarity. So, if one structure is remembered may be others are very close and that similarity you can draw and also you can identify or tell right.

So, all immunoglobulins they have structural similarity right.



Now, two heavy and two light chains are joined together. Heavy and light means big amino acid chains or small amino acid chains that is what it is meant; that two heavy and two light chains are joint together by disulphide bond right that is sorry that is disulfide bonds two heavy and two light chains are there.



So, that is disulphide bond. So, one S one S. So, this and this can react or this can be linked or joint right

So, two heavy and two light chains are joined together to for by the by the disulphide bond. So, IgG is the main immunoglobulin and milk; IgG is the main immunoglobulin in milk and then another protein called serum albumin. I hope this serum we have defined earlier and not going to repeat. Serum albumin there are 582 numbers of amino acids, 582 numbers of amino

acids and longest protein because you see so, many numbers of till now we have seen 100 150 around things.

Now, here it is 582 almost 600; so 3 to 4 times. So, those when you so, it is the longest protein that serum albumin is the longest protein, approximately around 66 kilo Dalton is the molecular is the molecular mass right 66 kilo Dalton. Alpha helix is predominant, alpha helix is predominant and it is 1 to 5 percent of the total whey protein right. This serum albumin is 1 to 5 percent of the total whey protein that depends on like earlier also we have said that the type of breed or place or feed or many many causes are there for which this can be bearing between 1 to 7 or 5.

Synthesize this is this serum albumin is synthesized in the liver and enters the milk via secretary cells. So, there are secretary cells right there are secretary cells. And these secretary cells are allowing the synthesized serum albumin and enters into the bloodstream right. Synthesized in the liver and enters the milk via the secondary cells right. Then other proteins like protee proteose and peptones right again from the word, protein it is sounding similar that proteose and peptones, they are derived from the hydrolysis of beta casein.

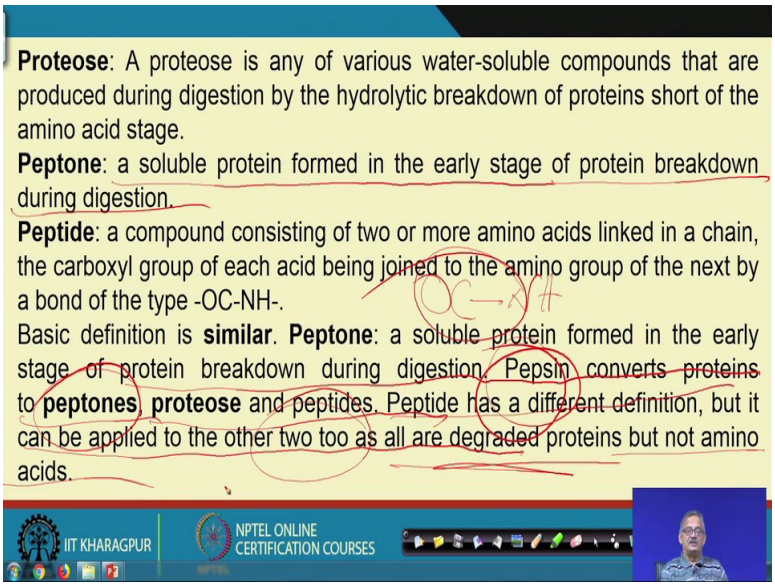
We have seen alpha s 1 alpha s 2 beta and gamma caseins are there. So, here it is alpha and from the beta casein by the hydrolysis, this proteose and peptones are prepared right or it is synthesized. But considered, but considered whey proteins this is also considered as whey protein. Though it is made from beta casein, but still hydrolysis of beta casein still it is in the family of whey protein not in the family of casein right because it elutes because it elutes in the whey fraction when isolated from milk right. So, elutes means extracted it elutes it right extracted from some as absorb things come out. So, they are call elute right.

So, it elutes in whey protein a whey fraction, when isolated from milk right. So, it is heat stable and acid soluble protein heats stable and acid soluble both are there. So, these proteose peptones are heat stable as well the acid whenever it is being put in acid. So, it is acid soluble proteins. Responsible for foaming of milk that foam when it comes I do not know how many of you have seen that during the milking time, the there is a lot of foam which is which is generated right and you are you are normally advised don't take the first milk or may be the last milk.

Because the moment you take the first milk, then this can up systematic standardization or this type of systemization has not taken place. Whereas, the moment you got the moment you

got that high acid soluble and heat stable proteins, which are responsible for the foaming of the milk. So, foaming of milk is the responsible for this, this one is and it inhibits rancidity right. If there is some fat so, that can be that fat can be hydrolyzed rancid it can be it can be rancid, but this prevents or inhibits the rancidity who that protoese peptones these proteins right and it has an immuno immunological role.

So, that means, some immunity concerned things are associated with this proteose and peptones.



Some more information hopefully we can share and that is that proteose is what? Is any of various water soluble compounds, that are produced during digestion by the by the hydraulic breakdown by the hydraulic hydrolytic breakdown not hydraulic hydrolytic breakdown of protein short of the amino acid stage right proteins short of amino acid stage. That is the proteins are not so big, not to the extent that it is broken to the to the amino acids basic units.

But not very far away from the amino acid stage somewhere in between, but not definitely the one which we had been talking about right. So, it is the proteose is any of various water soluble compounds that are produced during digestion by the hydrolytic breakdown of proteins right that protein short of the amino acid stage right.

So, the other one is the peptone, which is soluble protein found in the early stage of protein breakdown; during the digestion early stage of protein breakdown this is soluble protein right formed in the stage of protein breakdown during digestion. Then peptide; peptidic bond or peptide bonds this you have heard many times right here also in some other cases also. So,

here what is that? Peptide is composed of or consist the peptide is the compound consisting of two or more amino acids, linked in a chain the carboxyl group of each acid being pointed being joined to the amino acid may amino group of the next by a bond by a bond and this bond is of the type OC NH right.

This bond is of the type called OC NC NH right. So, this is the one that peptide does. Basic definition is similar all pepti pepta proteose peptone and peptide the definition wise their similar, but peptone which is the soluble protein formed in the easily formed in the early stage of protein breakdown during digestion.

So, during digestion at the early breakdown because that helps to digest the material and it is that basic definition of is similar peptone soluble protein formed in the early stage of protein breakdown during digestion. And pepsin converse proteins to peptones. Pepsin converts proteins to peptones right and what is that peptone here we have seen? Soluble protein formed in the easy in the early stage of protein breakdown during digestion right.

So, this proteose and peptides when it comes it is peptide has a different definition, but it can be applied to the other two other two as the, but it can be applied to the other two as all are degraded proteins, but not amino acids. Of course, because proteins are made of amino acids, and amino acids are consisting many amino acids which are connected and they are forming some proteins right. So, if we see that the peptones or proteose and peptides all are pepsin convert right and during and during the digestion this conversion happens.

That pepsin converse protein peptones and proteose right into peptides. So, then come. So, what is that peptide is now the peptide has a different definition. But, it can be applied to other two as are degraded proteose, but are not amino acids as these are degraded proteins, but not amino acids, because amino acids are the simplest or smallest unit right.

So, it could be that it is got degraded during the processing whatever be the thing process, but it could have been degraded, but not the amino acids because they have altogether different conversation and they have the degraded. So, it is that the proteins are not amino acids degraded proteins are there, and amino acid being the simplest or smallest unit that cannot be degraded further.

Thank you.