Camel’s Milk Protein Fractionation by SDS-Polyacrylamide Gel Electrophoresis

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Abstract

This study was designed to fractionate, identify and quantify Camel’s Milk proteins and whey proteins by using the technique of gel Electrophoresis. Experimental study. Polyacrylamide gel electrophoresis in sodium dodecyl sulphate (SDS-PAGE) was carried out using a Bio-Rad, Mini Protean II apparatus (Bio-Rad Laboratories Hercules, California 94547, USA). Treated and untreated casein samples of camel milk were separated using a polyacrylamide gel. The study resulted in that; the casein was fractionated into α-casein, β-casein and κ-casein. While the whey proteins were fractionated into α-lacto albumin and β-lactoglobulins. The fractionation of protein from one day to one week of lactation was very difficult while during lactation from over one week to sixteen weeks the α-casein band was medium, β-casein was high, and κ-casein was very low. On the other hand, the casein fractionation during 32 weeks to 48 weeks of lactation, the α-casein and β-casein were in high concentration while the κ-casein was very low or absent. Also, the α – lactalbumin band was medium and the β-lactoglobulins appear absent in whey protein. In conclusion the absence of β-lg in camel milk leads to make it as suitable. Substitution for children allergic to bovine milk protein because β-lg is the main causative agent for allergy from bovine milk.

Key-words: Camel’s Milk, Protein, Fractionation, Electrophoresis

Introduction

Camel’s milk is rich in proteins which are classified into two main classes, major milk proteins including caseins α, β and κ-caseins and two whey proteins, α-lactalbumin and β-lactoglobulin. Also minor milk proteins including lysozyme, lactoferrins, lactoperoxidase and immunoglobulin. The colostrum is rich in immunoglobulins and serum albumin, whereas levels of casein and α-LA were relatively low and increased gradually until the average values reached the levels of regular milk. It is shown that, there is lack of β-LG in the camel’s milk [1]. Halima et.al [2] reported that, the main components of whey proteins in camel milk and colostrum were similar to that in bovine, except for the lack in β-lactoglobulin. On analysis of small proteins in camel’s milk, the camel α-lactalbumin structure was determined. It was then discovered that α-lactalbumin preparations, after the first purification step of exclusion chromatography, contain additional proteins with special properties. One of these proteins, corresponding to a major non-lactoalbumin component [3]. Casein is a major part of protein in camel milk. Milk of dromedary camel contains protein ranged from 2.15 to 4.90 percent [4] and has 1.63 to 2.76 percent casein protein that
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constitutes 52 to 87 percent of total milk protein, whey protein constitutes 20 to 25 percent that make it the second biggest fraction of protein and whey protein in range of 0.63 and 0.80 percent\textsuperscript{5,6}.

Camel milk β-lactoglobulin is found in traces, while α-lactalbumin comprises the major camel milk portion. In the milk of bovines, α-lactalbumin constitute only 25 percent, while β-lactoglobulin made 50 percent of the total whey protein that make it the major whey protein of bovine milk\textsuperscript{7}.

Materials and Methods

Protein Fractionation of Camel’s Milk by (SDS-Polyacrylamide Gel Electrophoresis. (SDS-PAGE))

Polyacrylamide gel electrophoresis in sodium dodecyl sulphate (SDS-PAGE) was carried out using a Bio-Rad, Mini Protean II apparatus (Bio-Rad Laboratories Hercules, California 94547, USA) according to Laemmli\textsuperscript{8}. Treated and untreated casein samples of camel milk were separated using a polyacrylamide gel.

Results

1. Proteins fractionation by Electrophoresis (In four phases of lactation)

The gel electrophoresis techniques were used to fractionate proteins of camel’s milk and also identification and quantification of milk proteins and whey proteins. The casein was fractionated and analyzed into α-casein, β-casein and κ-casein, and the whey proteins of camel milk were fractionated into α – lactalbumin and β -latoglobulins as shown in Figure (1).

2. Protein fractionation during period from (one day to one week)

The fractionation of protein during this period is very difficult.

3. Protein fractionation during period from (over one week to 16 weeks)

The results were shown in Figure (1). The α-casein band was medium, β-casein was high, and κ-casein was very low. While, the α – lactalbumin band was medium and the β -latoglobulins appears absent in whey protein.

4. Protein fractionation during period from (over 16 weeks to 32 weeks of lactation).

The results were shown in Figure (1). The bands concentration of α-casein, β-casein and κ-casein were similar at the phase of one week to 16 weeks. While, the band of α – lactalbumlin is medium and also the β -latoglobulins appears absent in whey protein.

5. Protein fractionation during period from (32 weeks to 48 weeks of lactation)

The results were shown in Figure (2). The milk casein was fractionated into α-casein, β-casein and κ-casein. The bands of α-casein and β-casein were high compared with others phases of lactation.
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Figure (1) protein fractionation during period from (over one week to 16 weeks) & (16-32 weeks)

1: α-casein / 2: β-casein / 3: κ-casein of (1-16 weeks)
1*: α-casein / 2*: β-casein / 3*: κ-casein of (16-32 weeks)

Figure (2) protein fractionation during period from (over 32 weeks to 48 weeks)

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Discussion

The results of the present study validate the result of the FAO research, which reported by Ramet [9]. So the present study showed that the kappa casein is very weak and has low band during electrophoresis in all phases of lactation. (As shown in Figure 1 and 2). On the other hand, the camel’s milk is characterized by the absence of β-lactoglobulin similar as in human milk [9]. In the present study the camel’s milk contains no β-lactoglobulin, in all phases of lactation as shown in the Figure (1) & Figure (2). While, Merinet et al.[10] reported that, the proteins of camel’s milk are the decisive components for preventing and curing food allergies because camel’s milk contains no β-lactoglobulin. The camel’s milk non contains any amount of β-lactoglobulin, and has a different beta-casein. In 1989, Beg et al.[11] found that the camel’s milk has a different beta-casein, that is responsible for allergies. Therefore, the β-lactoglobulin and a beta-casein are responsible for allergies in cow milk. The present study results are in agreement with those reported by Merinet et al.[10] and Beg et al.[11]. Moreover, in some countries the camel’s milk used as therapeutic food, because it has special elements characterized of high nutritive values. In particular, camel’s milk, which is consumed in many countries (such as Kazakhstan) for its medicinal virtues, is renowned for being richer in some lactoproteins compared with cow’s milk. In fact, the concentrations of Lf and IgG in camel’s milk seem to be only slightly higher than those in other milks [12]. In the present study the the fractionation of protein during one week is very difficult while during the period from over one week to sixteen weeks of lactation the band of α-casein was medium, β-casein was high, and κ-casein was very low. The concentration of α–lactalbumin was medium and the β-lactoglobulins appears absent in whey protein. On the other hand, in the present study the casein fractionation during 32 weeks to 48 weeks of lactation α-casein, β-casein were in high concentration while the κ-casein was very weak or absent.

According to Merinet et al.[10] it was shown in colostrum and milk that most camel serum proteins are similar in molecular weights to bovine whey proteins. The main differences between the serum protein samples are the lack of β-lg and the high amount of camel serum albumin. Moreover, the different proportion of the various proteins. Camel colostrum is rich in IgG and camel serum albumin, which are reduced in amount already after 3 days postpartum. The main protein in whey of camel colostrum is camel serum albumin while that of whey of bovine colostrum is β-lg. In the present study the results were variable during four phases of lactation. The present results agreed with that reported by Halima et al., [2] in that, the main components of whey proteins in camel milk and colostrum were similar to that in bovine, except for the lack in β-lactoglobulin.

In conclusion that the absence of β-lg in camel milk lead to make it as suitable substitution for children allergic to bovine milk protein because β-lg is the main causative agent for allergy from bovine milk.

References


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