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Assessment some Function Properties of Acid Casein in Different Types of Milk

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ABSTRACT

The present work has been carried out mainly to study some functional testing such as solubility and foaming properties in four types of acid caseins Buffalo, sheep, goat and camel at different pH value ranging between 2- 8. The obtained result revealed that high solubility for all types of acid casein was at pH 2 and pH 8 except in acid sheep casein was at pH 5. Also, foaming expansion value for all acid casein was high at pH 2 and pH8. The obtained results concluded that foaming properties increased with increasing the solubility of all types of acid casein.

Keywords: Buffalo, Sheep, Goat, Camel, Casein, solubility, foaming properties.

INTRODUCTION

Milk proteins especially casein and its caseinate derivatives have functional, physico –chemical and nutritive properties which make them useful in food processing Fox and Mullvihill (1982), Southwand (1985), El – Dakhakhny and Soliman (1995). Two important properties for characterizing the functionality of casein and caseinates, Such as the viscosity and solubility have been reported by Hooker *et al.* (1982). The functional properties of casein such as viscosity, solubility, emulsifying capacity and electrophorese mobility were also studied Douglas *et al.* (1981).

Various authors has illustrated that solubility is an ability of dairy ingredients to readily go in the solutions and remain soluble under in different formulations such as mineral levels or different pH or different processing conditions like heat treatments Hasmukh (2017). Augustin and Clarke (2008) reported that foam formation is important in the development of the texture of foods such as ice cream, mousse whipped topping and meringues casein and whey proteins contribute to the foaming properties of milk. Caseins are adsorbed at interfaces in preference to whey proteins Dickinson *et al.* (1989) and Ibrahim, (1997) reported that foam expansion was lower in proteins isolated from acid whey than those from skin milk and acid whey mixtures.

Mainly, the objective of this study was to determine the foaming properties as foam expansion and the solubility of four types of casein (Buffalo casein, sheep casein, goat casein and camel casein at different pH values ranging between 2 to 8.

MATERIALS AND METHODS

Milk supply:-

Buffalo and sheep milk were obtained from the farm of Agriculture, Sohag University, Egypt. Goat milk was obtained from a farm house situated of Sohag city. Raw camel milk samples were collected from individual camels in a private farm, Matrouh Governorate.

The obtained milks were defatted by centrifugation at Dairy Department Faculty of Sohag Agriculture.

Preparation of acid casein from different types of milk:-

Acid casein was prepared by addition of 1N HCl gradually with stirring to a pH 4.6 the precipitated casein was dissolved in 1N NaoH and reprecipitated this procedure was repeated twice. The final precipitate was repeatedly washed with distilled water to remove the last traces of acid. This casein was washed and dried according to murthy *et al.* (1985). The obtained casein was milled by a domestic blender.

Determination of casein solubility:-

One (g) of acid casein was dispersed in 100 mL distilled water at room temperature, the casein dispersion were assessed at pH values ranging from 2 – 8 using o.1 N HCL or o.1 NaoH. Samples were maintained at 4C^{o} for 24 hour after which the pH was readjusted. The dispersion were centrifuged at 3000g for 20 min at room temperature and filtered through Whatman No.1 filter paper. The supernants were determined by macro kjeldahl method as described by AOAC (2000). The soluble protein was expressed as percentage of the original protein content

Foaming properties:-

Casein samples (2 g) were suspended in distilled water and the pH was adjusted to a pH range from 2 to 8 using 2 N HCL or 2 N NaoH. Foam was developed according to the method reported by mohanty *et al*. (1988). A 200 ml casein solution at pH values 2 – 8 was whipped at room temperature using a commercial blender for 5 min at top speed. The foam was transform immediately to 500 ml graduated cylinder and the total volume was noted.

RESULTS AND DISCUSSION

Chemical composition:

The chemical composition of acid casein prepared from different types of milk was show in Table (1): total nitrogen for different types of acid casein was 13.89, 14.45, 13.35 and 9.12 % for buffalo, sheep, goat and camel milk acid casein respectively. It was shown that camel acid casein was very low in TN compared to the others three acid casein. As regard to the ash content, it was shown that ash content in camel acid Casein was somewhat similar to the content of ash content in buffalo casein (4.17 % for camel acid casein and 3. 63% for buffalo acid casein). The high content of ash in camel acid casein was attributed the high content in salts especially chloride salts Yagi (2000) and Khaskheli *et al.* (2005). .

Table 1. Chemical Composition of acid casein prepared from different types of milk.

Parameters	Acid casein			
%	Buffalos	sheep	Goat	Camel
Total nitrogen	13.89	14.45	13.35	9.12
Total proteins	88.62	92.16	85.09	58.17
Total solid	94.67	95.42	95.77	95.89
Moisture	5.33	4.58	4.23	4.11
Ash	3.63	1.67	1.57	4.17

Total proteins = Total nitrogen× 6.38

Solubility:

The results in Table (2) and Figure (1, 2, 3 and 4) showed the percentage of solubility for acid casein for buffalo, sheep, goat and camel milk at different pH values (2-8). In the case of buffalo casein, solubility index at pH 2 was 44.9 while at pH 8 this value reached 78.70. Data in the same Table showed that the maximum solubility index values were at pH 8 for all acid casein. These values were 78.70, 76.73, 64.65 and 75.12 % for buffalo, sheep, goat and camel acid casein respectively. It was shown that at pH 4 for all types of acid casein, the lowest values of solubility were obtained. It was 12.20, 10.10, 18.50 and 8.44 % for buffalo, sheep, goat and camel acid casein respectively. This result was agreement with Cayot *et al*. (1991) illustrated that the highest levels for the solubility were presented at pH 8.0 and 2.0.

Table 2. Solubility index of acid casein prepared from different types of milk.

Samples	Solubility % pH values						
	2	3	4	5	6	7	8
Buffalos casein	44.90	18.30	12.20	16.60	19.96	33.80	78.70
Sheep casein	48.50	15.50	10.10	8.50	11.20	27.60	76.73
Goat casein	43.96	23.10	18.50	24.25	27.71	31.17	64.65
Camel casein	75.96	27.51	8.44	8.44	17.73	43.05	75.12

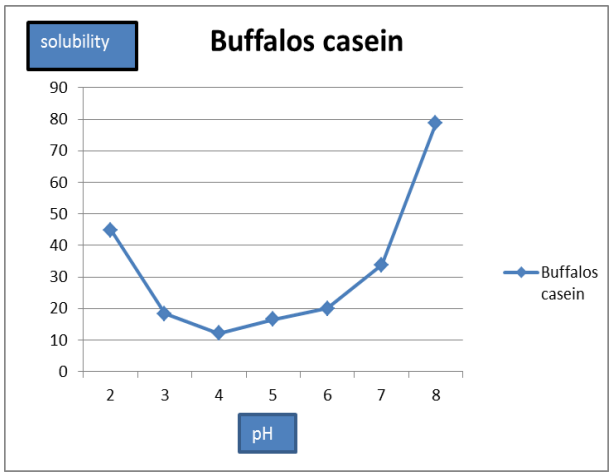

Figure 1. Solubility of acid casein prepared from buffalos milk.

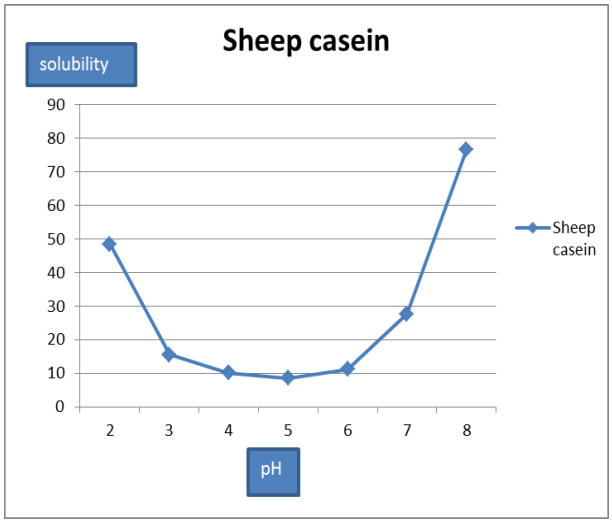

Figure 2. Solubility of acid casein prepared from sheep milk.

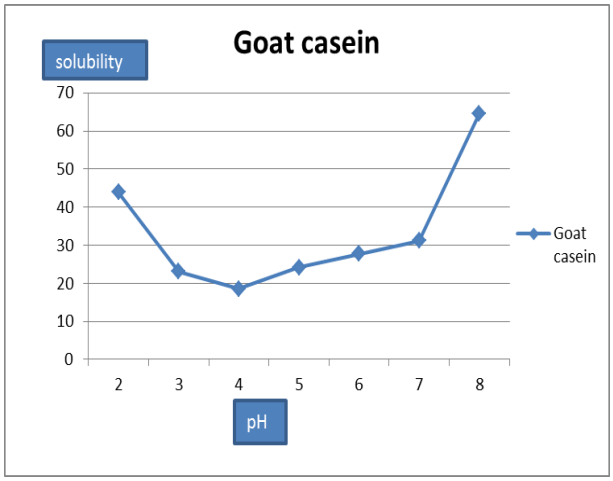

Figure 3. Solubility of acid casein prepared from goat milk.

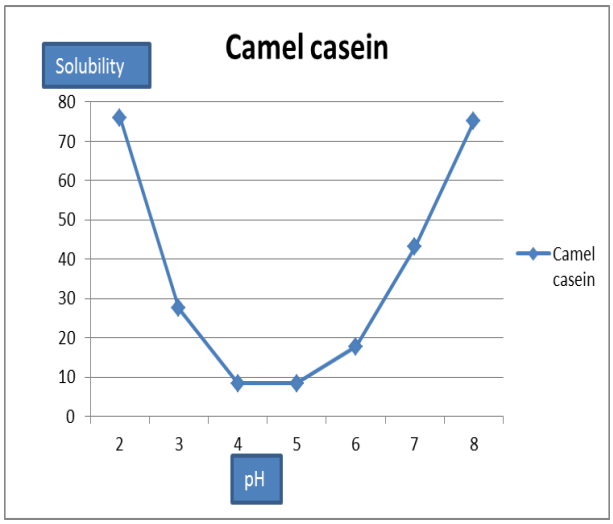

Figure 4. Solubility of acid casein prepared from camel milk.

$$\text{Solubility} = \frac{\text{Soluble N in filtrate}}{\text{T.N}} \times 100$$

In literature, many authors reported that the solubility of casein depended on many factors such as: the electric change on casein micelles, casein micelles size, the amount of calcium phosphate in casein micelles and the amount of salts in casein micelles Post et al. (2012), Konstance and Strange (1991) and Ahmad (2008).

Data in Table (2) showed that in the case of camel casein the Maximum solubility was in pH 2 and pH 8, it reached 75.90 and 75.2 respectively. These values confirmed that, the amount of ashes in camel milk was high and at was 4.2 % Table (1).

Foaming property:-

Foaming capacity as assessed in this paper by measuring the Percentage of volume expansion (volume increase or overrun).

Table (3) showed that increasing the solubility led to the increase of foaming expansion. Foaming expansion was low around pH 4 to 6 and relatively higher at around pH 2 – 3 and pH 7 to 8. According to the result obtained by Richest (1979) showed that better foam Volume and stability around ackaline pH (7 -8.5).

Table 3. Foaming properties of acid casein prepared from different types of milk.

Sample	Treatment	pH values						
		2	3	4	5	6	7	8
Bufflos Casein	Volume after whipping	315	300	210	215	255	270	310
	Volume increase	115	100	10	15	55	70	110
	Foam expansion%	157.5	150	105	107.5	127.5	135	155
Sheep casein	Volume after whipping	370	340	250	250	270	285	340
	Volume increase	170	140	50	50	70	85	140
	Foam expansion%	185	170	125	125	135	142.2	170
Goat casein	Volume after whipping	340	260	210	210	250	280	285
	Volume increase	140	60	10	10	50	80	85
	Foam expansion%	170	130	105	105	125	140	142.5
Camel casein	Volume after whipping	285	240	210	210	215	270	275
	Volume increase	85	40	10	10	15	70	75
	Foam expansion%	142.5	120	105	105	107.5	135	137.5

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تقييم بعض الخصائص الوظيفية للكازين الحامضي لانواع مختلفة من الالبان.

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تم اجراء هذه الدراسة لتقييم بعض الخصائص الوظيفية مثل القابلية للذوبان وخصائص الرغوة وذلك لاربعة انواع من الكازين الحمضي الذي تم تحضيرة من اللبن الجاموسي ولبن الغنم ولبن الماعز ولبن الابل , وقد اجريت هذة الاختبارات عند درجات مختلفة من الرقم الهيدروجيني (من رقم هيدروجيني ٢ الي رقم هيدروجيني ٨) , وقد اوضحت النتائج ان قابلية الزوبان كانت عالية لجميع انوع الكازين الحامضي عند رقم هيدروجيني ٢ ورقم هيدروجيني ٨ باستثناء الكازين المحضر من لبن الغنم فقد كانت الزوبانية مرتفعة ايضا عند رقم هيدروجيني ٥. وقد اظهرت النتائج ان قيم الزيادة في حجم الرغوة كانت مرتفعة لجميع انواع الكازين الحامضي عند رقم هيدروجيني ٢ و رقم هيدروجيني ٨ , وقد خلصت النتائج المتحصل عليها الي ان خصائص الرغوة ذادت مع زيادة قابلية الزوبان في جميع الانواع