

EFFECT OF SKIM MILK POWDER, RETENTATE AND FLAVOUR COMPOUNDS ON THE QUALITY OF RICOTTA CHEESE

Gomaa, M. Sh. ; E.S. El-Sokkary and M. M. M. Refaey
Dairy Dept., Fac. Agric., Mans., Univ., Mansoura, Egypt

ABSTRACT

Ricotta cheese made from sweet or salted Ras cheese whey coagulated with heat and direct acidification with acetic and lactic acid to pH 5.8-5.9 at 87.88°C. It was previously mentioned that cheese made by acetic acid achieved a higher total score points, while cheese made by lactic acid resulted in a higher yield. It was also observed that the cheese made by added potassium sorbate as preservative and packaged under vacuum was of a lower microbiological properties. Therefore, in the light of these results Ricotta cheese was made from salted whey using a mixture of acetic and lactic acid (1:1), with the addition of skim milk powder and retentate at the rates of 1, 2, and 3 %. The yield of cheese gradually increased with increasing the levels of skim milk powder and the retentate being added to the whey. Sensory evaluation indicated that the cheese made by the addition 2% skim milk powder and 1% retentate achieved a higher total score. The microbiological properties did not vary in the fresh cheese. Prolonging the storage periods and by increasing the levels of skim milk powder and retentate resulted in a cheese of higher microbiological quality increased.

It could also be indicated from the previously obtained results, that the cheese made by added 2% skim milk powder and 1% retentate achieved a higher total score, so in this section, cheese was made with added certain herbs to improve the flavor of cheese. The cheese coagulated with acetic and lactic acid (1:1) and with the addition of 2% skim milk powder, and with the addition of olives had the highest total scores points, compared with other treatments. The cheese coagulated with acetic and lactic acid (1:1) and with the addition of 1% retentate and green pepper had the highest total scores points, compared with other treatments.

INTRODUCTION

Fresh Ricotta is a white, soft, moist and unripened grainy cheese which resembles the Cottage cheese in its appearance. It is fairly plain or may have semi-sweet flavour when made from fresh sweet or salt whey. Traditionally, Ricotta cheese has been prepared by heating whey or whey and milk blends to 40 to 45°C, adding salt and continuing heating to reach 80 to 85°C. At this point suitable food grade acidulants is added to reduce the pH 6.1- 6.0, and induces coagulation of the proteins (Shahani, 1979; Mathur and Shahani, 1981 and Modler, 1988).

Several precipitants for Ricotta cheese manufacture have been suggested in the literature. These include citric acid, acetic acid, lactic acid whey powder and cheese starter. Several factors should be considered when choosing correct precipitant, these include availability, cost curd characteristics, yield and flavour (Weatherup, 1986 and Modler and Emmoms, 1994). Potassium sorbate was used as chemical preservative and packaged under vacuum in an attempt to increase storage periods and Effect of skim milk powder, retentate and flavour compounds added during the manufacture

MATERIALS AND METHODS

Ras cheese whey was obtained from Dairy plant in Mansoura city. The chemical composition of Ras cheese whey is indicated in Table (1).

Table (1): Chemical composition of Ras cheese whey.

Whey type	Chemical composition				
	TS%	TP%	FAT%	Acidity%	pH
Sweet whey	7.53	1.78	0.4	0.25	4.45
Salted whey	13.17	1.25	0.5	0.22	5.85

Food grade acids i.e. ,lactic, acetic and citric were used as acidulant Table (2) shows the amount of acid solutions (30%) (Weatherup,1986) lactic, acetic and citric required to give whey of pH value 5.8 -5.9, in either sweet or salted cheese whey.

Table (2): Amount of acidulants(acetic and lactic by 1:1) required to adjust the pH value different added skim milk powder and retentate Ratios to 5.9-8-5.9.

Added type	Amount of acidulant (ml of 30% sol./liter whey)			
	control	1%	2%	3%
Skim milk	3	3.3	3.5	3.6
Retentate	3	3.2	3.4	3.6

sol: Solution

Retentate was obtained from it composition is shown in table (3).

Table (3): Shows the chemical composition of retentate.

Components	Percentages
Moisture%	4.4
T. P.%	69.8
Lactose%	17.2
Fat%	1.4
Ash%	7.2

Skim milk powder was obtained from Abo olla company it composition shown in table (4).

Table (4): Shows the chemical composition of skim milk powder.

Components	Percentages
Moisture%	2.75
T.P.%	36
Lactose%	52
Fat%	1.25
Ash%	8

Fine grade (edible)potassium sorbate was obtained from CHAS-Pfizer Co .Inc. New York, USA.

Sodium hydroxide was obtained from El-Gomhoria Chemicals Company.

- Green pepper, parsley, olives, and capriole were added to cheese in percentages of 1.5%, 2.5% and 3.5% in crude .
- {Green pepper and olives (1:1)} this compound added to cheese as follows: (1.5:2.5), (2.5:1.5) and (2:2) .
- Black pepper and black cumin were added as flavor ingredients to cheese percent 0.5% ,0.75 ,and 1%in crude .
- {Black pepper and black cumin (1:1)} were added to cheese percent (0.25;0.5%) ,(0.50:0.25%) and (0.50:0.50%) .

Ricotta cheese was manufactured according to methods described by Weatherup(1986). Ras cheese whey with pH 4.45 -5.85 was used. This was placed in a cheese vat and neutralized to pH > 6.5 by the addition of sodium hydroxide solution (40 % w/v). A pilot test was made to estimate the volume of acidulants required to adjust the pH value of the whey to 5.8 -5.9. The whey was used alone or mixed with skim milk powder has the mentioned blow proportions in cheese making. The whey was heated to 65°C to destroy the residual rennet, which would cause premature coagulation of casein . The appropriate quantity of skim milk was then added. The mixture was heated to 87 -88°C and acidulants were added. Agitation was stopped immediately after the addition of acidulants, as prolonged agitation at this stage prevents cured floatation. The cured was left in whey for 10-12 min before commencement of draining. Traditionally, the curd is ladled from the surface of the whey. This was found to be cumbersome, and it was more convenient to run off the whey. Fine crud particles were removed from the whey using a muslin filter .After drainage ,the curd was packaged and held at 4°C.

Total solids ,ash, fat , total protein, soluble nitrogen non protein nitrogen and acidity were determined according to Ling (1963). pH values were measured using laboratory pH meter with glass electrodes pH-meter Jan way 3010 – England) ,salted as determined by Kosikowski (1966). The ash content of milk and whey were measured according to ling (1963). Total bacteria count were determined using the media described by (Difco1971). Coliform bacteria were counted by using Maconky broth, which by using of 17 gm/litre. The plates were incubated at 37 °C for 24 hours.

Mould and yeasts counts were determined using malt extract agar medium (Pitt1979). Lipolytic and Proteolytic bacteria were enumerated as described by Chalmers (1962). Organoleptic properties were evaluated by whey the score system scoring flavor (40 points), body and texture (30 points) and appearance (30 points) according to Hassan (1996).

RESULTS AND DISCUSSION

Data presented in Table (5) show that. In general, the increase of skim milk powder and retentate added resulted in an increase in all total solids contents. The addition of 1 % retentate ,on the other hand, resulted in more increase of total solids content. The addition of skim milk powder and retentate powder increased the total solids, the addition of 3 % retentate had the highest total solid content, compared with 3 % skim milk powder , while the addition 1 % retentate had the highest rate of total solids increase,

compared with and 3 % retentate. Also, addition of the same concentration skim milk powder, increased the ration of skim milk power and retentate.

Results in Table (5) show that the increase of skim milk powder and retentate resulted in an increase in fat content. While, the addition of 1 % yielded more increase in the fat content, when compared with the same percent of skim milk powder. The same effects were observed among other percentage of addition of skim milk powder and retentate powders. Also, the addition of 3 % percent of retentate resulted in the highest fat content when compared with the addition of same level of skim milk powder . It was observed the highest rate of increase when 1 % percent of retentate was added.

It appears from the results in Table (5) that addition of 1 % retentate increased total nitrogen content when compared with the same percent of skim milk powder. The highest rate of increase was also observed when 1 % percent of retentate was added . On the other hand, by adding an increase the ration of the skim milk powder and retentate at least the rate of increase on total nitrogen content.

Table (5): Effect of addition of different levels of skim milk powder and retentate powder on chemical properties of Ricotta cheese made from whey and coagulated with acetic and lactic (1:1), during storage.

chemical properties	Storage period (days)	Treatments						
		control	Skim milk			Retentate		
			1%	2%	3%	1%	2%	3%
TS%	Fresh	31.38	34.12	36.35	38.18	38.01	41.26	43.8
	7	31.73	34.54	36.67	38.38	38.23	41.59	44.12
	14	32.02	34.0	36.88	38.67	38.62	41.96	44.43
	21	32.31	35.00	37.12	38.94	39.02	42.33	44.85
FAT%	Fresh	8.80	9.00	9.50	9.70	9.62	10.00	10.22
	7	8.84	9.25	9.56	9.73	9.66	10.12	10.34
	14	8.87	9.31	9.59	9.77	9.72	10.26	10.42
	21	8.92	9.33	9.62	9.79	9.76	10.34	10.51
TN%	Fresh	1.90	2.10	2.22	2.34	2.41	2.73	2.92
	7	1.94	2.15	2.26	2.36	2.43	2.75	2.94
	14	1.97	2.18	2.28	2.39	2.47	2.78	2.96
	21	2.00	2.21	2.30	2.42	2.52	2.81	2.99
SN%	Fresh	0.80	0.90	0.96	1.02	0.96	1.20	1.41
	7	0.85	0.93	0.98	1.05	0.97	1.23	1.44
	14	0.88	0.97	1.00	1.09	0.99	1.27	1.48
	21	0.9	0.99	1.02	1.11	1.02	1.31	1.52
NPN%	Fresh	0.4	0.51	0.62	0.71	0.61	0.82	1.00
	7	0.44	0.54	0.65	0.73	0.63	0.85	1.04
	14	0.47	0.56	0.67	0.76	0.67	0.87	1.07
	21	0.50	0.59	0.69	0.78	0.69	0.91	1.12

Data illustrated in Table (5) show that the addition of 1 % retentate make more increase in soluble nitrogen content when compared with same level of skim milk powder. The same effects were observed when an increased level of skim milk powder and retentate powder was added. The addition of 3 % of retentate resulted in the highest soluble nitrogen, compared with the same percent of skim milk powder.

It could be seen from Table (5) that the addition of retentate resulted in more increase in the non protein nitrogen, when compared with same level of skim milk powder. The same effects were observed if more skim milk powder and retentate powder was added.

Results in Table (6) show that little difference were occurred in acidity and pH value of cheese in the different treatments .At the same time decrease in acidity was accompanied with an increase in pH value, by increasing the concentration of retentate and skim milk powder. Also, observed the addition of 1 % retentate resulted in an increase of the acidity and decrease in the pH value when, compared with the same percent of skim milk powder. Meanwhile, an increase in acidity and decrease in pH value were detected during storage. Also, the addition 3 % percent of retentate resulted in the highest acidity and the lowest pH value.

Table (6): Effect of adding different levels of skim milk powder and retentate powder on chemical properties of Ricotta cheese made from whey and coagulated with acetic and lactic (1:1) during storage.

Chemical properties	Storage period (days)	Treatments						
		control	Skim milk			Retentate		
			1%	2%	3%	1%	2%	3%
Acidity%	Fresh	0.16	0.15	0.14	0.13	0.18	0.17	0.14
	7	0.18	0.17	0.15	0.16	0.22	0.22	0.17
	14	0.21	0.32	0.23	0.21	0.26	0.29	0.21
	21	0.25	0.36	0.27	0.24	0.3	0.34	0.26
pH	Fresh	6.43	6.46	6.52	6.6	6.21	6.42	6.63
	7	6.22	6.33	6.45	6.42	6.11	5.97	6.32
	14	6.12	5.83	6.06	6.17	6.00	5.77	6.13
	21	6.02	5.72	5.98	6.03	5.92	5.54	6.00
Ash%	Fresh	9.46	10.52	11.73	12.56	12.17	13.22	14.46
	7	9.52	10.57	11.78	12.61	12.26	13.33	14.53
	14	9.58	10.61	11.81	12.66	12.34	13.46	14.64
	21	9.36	10.64	11.86	12.72	12.46	13.54	14.78
Salt%	Fresh	2.82	2.98	3.21	3.43	3.512	3.72	3.96
	7	2.85	3.02	3.26	3.46	3.53	3.75	3.98
	14	2.89	3.05	3.29	3.49	3.57	3.79	3.99
	21	2.92	3.10	3.32	3.52	3.61	3.82	4.06
Yield%	Fresh	8.5	10.72	13.27	17.25	11.66	15.00	18.45

Data presented in Table (6) showed that the addition of 1 % retentate resulted in more increase in ash content when compared with the same level of skim milk powder. The same effects was observed if more skim milk and retentate powder were added. That the addition of 3 % retentate had the highest ash content, compared with same percent of skim milk powder.

Results in Table (6) show that at the addition of 1 % retentate resulted in more increase in salt content, when compared with the same level of skim milk powder. The same effects were observed if more skim milk and retentate powder were added, either at zero time or during storage periods. The addition of 3 % of retentate resulted in the highest salted content, compared

with same level of skim milk powder either in zero time or during storage periods.

Table (6) show the yield of Ricotta cheese made by direct acidification of whey using a mixture of acetic and lactic (1:1) with addition of different levels of skim milk powder and retentate powder (1, 2 and 3 %). The results show that the yield of cheese increased with increasing the level of skim milk or retentate powder added to whey It could also be, observed that the addition of 1 % retentate yielded more increase in cheese yield, when compared with the same percent of skim milk powder. The same effects were observed by adding different of skim milk powder or retentate. It could be , observed that the addition 3% retentate had the highest increase in the cheese yield compared with other levels of retentate the same effects were observed when more 3% skim milk powder was added. These result were contrast with those obtained by Mahran, *et al.*, (1998)

Microbiological properties

As with the microbiological properties of Ricotta cheese made with the addition of different levels of skim milk or retentate powder , it could clearly be observed from the results indicated in Table (7) that the control cheese had the highest total count bacteria, compared with other treatments, either when skim milk or retentate powder were added. While the addition 1% of skim milk powder or retentate had the lower total count of bacteria.

Table (7): Effect of adding of different levels of skim milk powder and retentate powder on microbiological properties of Ricotta cheese made from whey and coagulated with acetic and lactic (1:1) during storage .

Microbiological properties	Storage period (days)	Treatments						
		control	Skim milk			retentate		
			1%	2%	3%	1%	2%	3%
TCx10 ³	Fresh	25	3	7	9	5	9	13
	7	43	14	22	25	18	26	31
	14	57	21	28	31	24	28	39
	21	65	25	33	42	33	35	46
Pr. b x10 ²	Fresh	23	11	15	19	12	15	17
	7	28	17	21	24	17	27	29
	14	32	21	26	29	22	33	38
	21	44	33	36	38	42	48	56
Ly. b x10 ²	Fresh	7	1	5	7	4	6	9
	7	18	8	11	18	12	14	21
	14	26	13	16	23	17	18	30
	21	38	18	22	32	23	27	38
E coli x10 ²	Fresh	0	0	0	0	0	0	0
	7	0	0	0	0	0	0	0
	14	0	0	0	0	0	0	0
	21	0	0	0	0	0	0	0
M&Y x10 ²	Fresh	17	1	3	6	2	5	8
	7	23	3	7	11	5	9	13
	14	35	8	13	18	11	16	24
	21	46	12	19	24	16	24	29

Also, cheese control had the highest Proteolytic, lipolytic bacteria, compared with other treatments, either when added skim milk powder or retentate. While the addition of 1% level skim milk powder had the lowest Proteolytic and lipolytic bacteria, compared with same percent of retentate. The same effects were observed among other percent addition skim milk powder and retentate.

Generally, all cheese treatments were free from coli forms. These results were in contrast with those obtained by Carminati, *et al.*, (2002).

On the other hand the control cheese was contaminated with the highest moulds and yeasts, compared with other treatments. Also, the addition 1% percent of skim powder had the lowest moulds and yeast compared with same level of retentate. The same effects were observed among other percent addition skim milk powder and retentate. These result were in agreement with those obtained by Raimundo, I. de C *et al.*, (2005)

Results in Table (8), showed that the Ricotta cheese made with addition of 2% skim milk powder and 1% retentate had the highest total scores points, compared with other levels and control during storage periods. These result were contrast with those reported by Abdel-Rafee *et al.*, (1997).

From the previously mentioned results in section (1), the resultant cheese was adding 1% retentate milk powder and 2% skim milk powder gained the highest organoleptic properties. Therefore it was planned to make cheese with the addition of flavor compounds like (green pepper, parsley, olives, capriole, black pepper and black cumin) Different proportions .

Table (8): Effect of adding of different levels of skim milk powder and retentate powder on Organoleptic properties of Ricotta cheese made from whey and coagulated with acetic and lactic (1:1) during storage.

Properties	Storage Period (days)	Treatments						
		control	Skim milk			retentate		
			1%	2%	3%	1%	2%	3%
Flavour (40)	Fresh	33.0	32.5	30.0	28.5	28.5	28.5	25
	7	30.3	32.2	31.8	33.0	32.0	31.2	28.8
	14	29.5	33.0	32.5	31.0	33.4	31.8	30.4
	21	29.0	34.0	34.0	34.0	34.0	30.3	26.3
Body & Texture (30)	Fresh	27.0	23.5	25.5	24.5	24.5	24.5	24.0
	7	24.3	25.2	25.4	24.8	24.8	24.6	23.4
	14	24.0	24.5	24.75	24.5	25.8	23.0	25.0
	21	24.0	23.3	25.0	25.0	27.3	22.6	22.0
Appearance (30)	Fresh	24.5	24.0	26.0	25.5	25.5	24.5	22.5
	7	23.3	26	25.6	24.0	24.2	24.6	21.4
	14	23.0	23.5	23.0	23.75	22.4	23.0.	22.8
	21	22.5	22.7	24.6	25.3	25.0	22.6	21.6
Total (100)	Fresh	84.5	80	81.5	78.5	78.5	77.5	71.5
	7	77.9	83.4	82.8	81.8	81	80.4	73.6
	14	76.5	81	80.25	79.25	81.6	80	78.2
	21	75.5	80	83.6	84.3	86.3	77.5	69.9

Data presented in Table (9) showed that the cheese manufactured by the use of a mixture of acetic and lactic acid(1:1) and with the addition 2% skim milk powder as well as, addition olives had the highest total scores points compared with other treatments. These result were contrast with those reported by Tarakc, et al. (2005)

Table (9): The effect of flavour compounds to Ricotta cheese manufacture with addition of 2% skim milk powder and coagulated with {acetic: lactic(1:1)} on Organoleptic properties.

Treatment		Organoleptic properties			
		Flavor (40)	Body& Texture (30)	Appearance (30)	Total (100)
	control	26.8	23.8	21.8	72.4
1.5	A	32.7	24.1	24	80.8
	B	33.7	24.4	25	83.1
	C	34.4	24	24.4	82.2
	D	35.25	24	24.25	83.5
2.5	A	33.4	24.4	23.5	81.3
	B	34.7	25	22.7	82.4
	C	34.25	23.25	23.75	81.25
	D	32.5	23	23.5	78.5
3.5	A	30.1	24.3	24.5	78.9
	B	35.4	24.7	23	83.1
	C	34.5	23.5	24.25	82.25
	D	34	23.25	24.75	82
1.5:2.5	A:B	33.7	23.8	24.8	82.3
	C:D	35.25	23.5	22.5	81.25
2.5:1.5	A:B	30.8	24	25.7	80.6
	C:D	33	22.5	21.25	76.75
2: 2	A:B	34.1	23.8	25.1	83
	C:D	33.25	22.75	20.25	76.25
0.5	G	33.5	21.75	22.75	78
	H	36	24.5	22.5	83
0.75	G	34.25	21.5	23	78.75
	H	36.5	24.25	21.5	82.25
1	G	33.75	22	22.5	78.25
	H	35.5	23.75	21	80.25
0.25:0.5	G:H	34.25	24.75	22.5	81.75
0.5:0.25	G:H	35	24.5	23	82.5
0.5:0.5	G:H	34.75	23.75	21.25	79.75

A _____ Parsley B _____ Capriole C _____ Green pepper
D _____ Olives G _____ Black cumin H _____ Black pepper

Results in Table (10) It was observed that the cheese manufactured and coagulated with {acetic, lactic acid (1:1) and the addition of 1% retentate, and with green pepper had the highest total scores points compared with other treatments. These result were contrast with those reported by Tarakc, et al. (2005)

Table (10): The effect of flavour compounds to Ricotta cheese manufacture with addition of 1% retentate and coagulated with { acetic: lactic(1:1)}

Treatment		Organoleptic properties			
		Flavor (40%)	Body & Texture (30%)	Appearance (30%)	Total (100%)
1.5	control	32.5	24	24.5	81
	A	33.5	24	24.5	82
	B	31.5	24.5	24.5	80.5
	C	34.5	25	25.5	85
	D	33	24	25	82
2.5	A	32	24	23.5	79.5
	B	31.5	23.5	24	79
	C	35	24	25	84
	D	33	23.5	24.5	81
3.5	A	29	23	23	75
	B	33	25	24.5	82.5
	C	34	25.5	25	84.5
	D	33	24	24	81
1.5:2.5	A:B	32.5	24.5	24	81
	C:D	32	23.5	24	79.5
2.5:1.5	A:B	33.5	25	24	82.5
	C:D	31.5	24	24	79.5
02:02	A:B	32	24.5	25	81.5
	C:D	34	23	25	82
0.5	G	32	23	22.5	77.5
	H	34	22.5	23	79.5
0.75	G	33.5	24	23	80.5
	H	35	23	23.5	81.5
1	G	32.5	24	21.5	78
	H	32	23.5	24.5	80
0.25:0.5	G:H	33	23	23.5	79.5
0.5:0.25	G:H	33	23.5	24.5	81
0.5:0.5	G:H	32.5	24.5	23.5	80.5

A _____ Parsley B _____ Capriole C _____ Green pepper
D _____ Olives G _____ Black cumin H _____ Black pepper

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دراسة تأثير إضافة اللبن الفرز المجفف ومركز اللبن المجفف ومركبات النكهة أثناء تصنيع جبن الريكوتا

محمد شلبي جمعه , السيد شوقي السكري و محمود مصطفى محمد رفاعي
قسم الألبان - كلية الزراعة - جامعة المنصورة - مصر

في هذا الجزء من الدراسة تم تصنيع جبن الريكوتا من شرش الجبن الراس سواء الحلو أو المملح بواسطة التجبن الحراري أو الحراري الحمضي مع التحميض المباشر باستخدام حامض الخليك أو الستريك أو اللاكتيك لخفض الأس الأيدروجيني للشرش إلى ٥,٨ - ٥,٩ علي درجة حرارة ٨٧- ٨٨ °م . في هذا الجزء تم تصنيع جبن الريكوتا من الشرش المملح باستخدام مزيج من حمض الخليك واللاكتيك بنسبة (١:١) مع إضافة اللبن الفرز المجفف و مركز اللبن المجفف بنسب ١ & ٢ & ٣ % وكانت النتائج كالتالي:

- حقق الجبن التالي بإضافة ٢% لبن فرز مجفف و ١% مركز اللبن المجفف علي اعلي عدد درجات للتقييم الحسي. وجد انه بزيادة اللبن الفرز المجفف ومركز اللبن المجفف يزداد المحتوى البكتيري سواء عدد كلي للبكتريا أو بكتريا محله للبروتين أو الدهن أو فطر أو خمائر ولكنه اقل مقارنة بالجبن الناتج بدون إضافة اللبن الفرز أو اللبن المركز .
- بزيادة نسبة اللبن الفرز المجفف ومركز اللبن المجفف تزداد نسبة المواد الصلبة الكلية والبروتين والدهن والرماد والملح وكذلك ارتفاع الحموضة وانخفاض ال pH .
- لوحظ انه بزيادة نسبة اللبن الفرز المجفف أو مركز اللبن المجفف حتي ٣ % أدي إلي زيادة نسبة التصافي للجبن الناتج .
- من القسم الاول تم التوصل إلي أن إضافة ٢ % لبن فرز مجفف و ١% مركز اللبن المجفف أفضل نسبة من حيث التقييم الحسي لذلك تم تصنيعها وإضافة إليها بعض المواد المكسبة للطعم والنكهة بغرض تحسين صفات الجبن وهذه المواد كانت كالتالي :-
- الجبن المصنع بإضافة ١ % مركز اللبن المجفف مع اضافة الزيتون أعطي أعلي درجات للتقييم الحسي مقارنة بالكنترول . الجبن المصنع بإضافة اللبن الفرز المجفف مع اضافة الفلفل الاخضر أعطي أعلي درجات للتقييم الحسي مقارنة بالكنترول

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة
كلية الزراعة - جامعة القاهرة

أ.د / طه عبد الحليم نصيب
أ.د / منير محمود العبد