

Research Notes

Process Optimization of Ricotta Cheese According to Iranian Preferences

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ABSTRACT

In this study, the optimum combination of major factors affecting the acceptability of whey-based Ricotta cheese i.e. fat at three levels (0, 5, 10%), salt at three levels (0, 1, 2%), and starter culture at two levels (0, 3%) was determined in a complete randomized design method with a factorial experiment. Ricotta cheese trials made by mixing whey and milk in a ratio of 5:1 were then organoleptically judged on the basis of the main attributes such as color, flavor, texture, and overall acceptability. The collected data were then statistically analyzed using a seven point hedonic method. The results show that the addition of fat had a significant effect on all sensory attributes ($p < 0.05$). The incorporation of salt in the formulation also had a significant effect on flavor, color, and overall acceptability ($p < 0.05$) as well as on texture ($p < 0.01$), whereas the addition of starter culture had a significant effect only on texture ($p < 0.01$) and overall acceptability ($p < 0.05$). It was concluded that a combination of 5% fat, 2% salt, and 3% starter culture gains a higher score and could be recommended as the preferred formulation for Iranian consumers.

Keywords: Formulation, Process optimization, Ricotta cheese, Whey.

INTRODUCTION

Over the past 15 years, cheese production in Iran has increased tremendously due to steps taken by the Government to support milk and cheese production in both small to medium scales. Such a strategy has led to a reduction in cheese importation and, in addition, has left some side-effects particularly on the environment. The most troublesome effect is the disposal problems related to whey. Subsequent processing of whey in the dairy industry could solve this issue and add considerable value to the component of whey [5,6,7]. The utilization of whey in production of whey-based cheeses in small cheese factories (<200000 L/day) is one such recommendation [4,7]. Ricotta cheese

is a soft creamy cheese which is normally prepared from whole sweet whey, a mixture of whey and whole milk, skimmed milk, or skimmed milk powder in different ratios [8].

The objective of this study was to apply the latest developments in the preparation of Ricotta cheese with an emphasis on the formulation suited to consumer attitudes in Iran in order to encourage cheese manufacturers to carry out the subsequent processing of this valuable by-product.

MATERIALS AND METHODS

Bovine sweet whey, skimmed milk, and cream were obtained from a local cheese plant. Untreated whey and skimmed milk

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were delivered to the pilot plant the day of experiment and were immediately blended to a ratio of 5:1 and used for cheesemaking. Pasteurized cream was purchased in bulk. The fat content was first determined according to the Gerber method [1,2] and was then divided into small quantities (~75 g) before being stored at (-18°C). The required amount of cream was taken each time and was thawed in a refrigerator before being used in the formulation. Fresh plain yogurt containing *streptococcus thermophilus* and *lactobacillus salivarius* ssp. *Bulgaricus* in a ratio of 1:1 was obtained from the Razavi dairy plant the day of the experiment and used as starter culture.

Cheesemaking

Ricotta cheese was prepared according to the procedure outlined in Figure 1 based on Modler [9] with slight modifications taking account of the local cheese plants facilities. Immediately after each batch, trial samples were formulated and then pressed to form blocks. Proximate analysis of the whey, Ricotta cheese and deproteinized whey was then carried out according to Iranian Standard No. 2344 [1] which is developed from an internationally accepted method [2]. The main attributes such as flavor, texture, color, and overall acceptability were then evaluated by panel of eight judges and the data were statistically analyzed using a seven point hedonic method [3,11] with 1 being devoid of attributes and 7 being extremely strong. Judges were selected by their ability to differentiate the a forementioned attrib-



Figure 1. Process for the production of Ricotta cheese.

utes using sequential triangle tests on dairy produce [3].

RESULTS AND DISCUSSION

Proximate analysis of whey, Ricotta cheese, and deproteinized whey is given in Table 1.

Effect of Fat

A: Flavor

It is obvious that fat incorporation in the formulation improves the flavor and this was the case in our study as shown in Table 2. From the economic stand-point the level of 5% fat is recommended because there was no significant difference between 5 and 10% fat ($P < 0.05$) while such a difference exists between 5% and the non-fat trials.

Table 1. Proximate analysis of whey, Ricotta cheese, and deproteinized whey. ^{a,b}

Product	Moisture	Protein	Lactose	Fat	Ash	PH
Constituent :						
whey	93.60	14.06	75.0	2.34	8.59	5.99
skim milk	90.61	36.05	50.90	4.26	8.77	6.68
ricotta	76.33	67.62	17.01	11.0	4.63	6.39
Deproteinized whey	94.70	7.42	81.62	1.0	9.27	5.62

^a All constituents are calculated on a dry basis.

^b Values are the means of three replications.

Table 2. Combined effect of fat, salt and starter culture on the sensory attributes of Ricotta cheese.^a

Treatment	Fat			SE ^b	Salt			SE	Starter Culture		SE
Attribute	F0	F5	F10	S0	S1	S2		C0	C3		
whey	692 ^d	.885 ^c	.958 ^c	.080	.094 ^d	1.260 ^c	1.479 ^c	.060	.8056 ^c	.09583 ^c	.085
skim milk	1.427 ^c	1.375 ^c	1.250 ^c	.070	1.458 ^c	1.398 ^c	1.197 ^d	.039	1.2431 ^d	1.4583 ^c	.057
ricotta	1.989 ^c	1.843 ^d	1.825 ^d	.039	1.854 ^c	1.927 ^c	1.947 ^c	.039	1.9028 ^c	1.9167 ^c	.039
Deproteinized whey	618 ^d	814 ^c	.906 ^c	.067	1.010 ^d	1.260 ^c	1.066 ^c	.067	.6361 ^d	.8889 ^c	.055

^a Means of three replicate trials.^b Standard error.^c Means within a row carrying the same superscript are not significantly different ($p < .05$).**B: Texture**

The level of fat in cheese has a direct effect on the texture. The incorporation of fat in the formulation decreases the granularity and increases the smoothness, homogeneity, and adhesive texture of this type of cheese in the absence of casein [4,6].

C: Color

A higher level of fat in the formulation tends to give a dark color. Statistically, there was no significant change in panelists scores up to 10% fat as shown in Table 2.

D: Total Acceptability

Statistical analysis revealed that the addition of fat had a significant effect on the overall acceptance of Ricotta cheese (Table 2). There was no significant difference between 5% and 10% fat and so, from an economical stand-point, we recommend using 5% fat in the formulation.

Effect of Salt**A: Flavor**

The addition of salt had a significant effect on the flavor of Ricotta cheese at the level of 1% but there was no difference between 1% and 2% ($P < 0.01$). The Iranian market is dominated by briney type cheeses such as Feta cheese and the consumers are used to salted cheese.

B: Texture

Theoretically, the more total solids in a cheese, the better texture is obtained [12]. Practically, salt addition had no significant

difference at a level of 1%. This is probably due to the fact that the cheese trials in this study were made using a mixture of skimmed milk and whey in a ratio of 1:5 and already had a high level of total solids and a firm texture. Our previous study on Ricotta cheese made using whole whey showed the significant effect of 1% salt on the texture (data not given).

C: Color

There was no significant difference on the color due to salt addition at this level (Table 2).

D: Overall Acceptability

Results from Table 2 show that the addition of salt had a significant effect on the overall acceptability at the level of 1% ($p < 0.1$) and this is the recommended level for the formulation.

Effect of Starter Culture

The addition of a yogurt starter culture at 3% had a significant effect only on the texture and consequently on the overall acceptability ($p < .0.1$). This is probably due to a pH reduction in the curd caused by lactic acid accumulation from the metabolic activity of starter culture. Our preliminary experiments indicated that the addition of a starter culture at a level above 3% leads to a yogurt-like taste in a final formulation and was not acceptable (data not shown).



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بهینه‌سازی فرآوری پنیر ریکوتا مطابق ذائقه ایرانی

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چکیده

در این پژوهش به منظور بهینه‌سازی شرایط فرآوری و فرمولاسیون پنیر ریکوتا از مخلوط آب پنیر و شیر پس چرخ به نسبت ۵ به ۱ نمونه‌هایی در قالب طرح کامل تصادفی تولید گردید. عوامل اصلی موثر در قابلیت پذیرش یعنی چربی در سه سطح (۰، ۵، ۱۰ درصد)، نمک در سه سطح (۰، ۱، ۲ درصد) و مایه کشت در دو سطح (۰ و ۳ درصد) به عنوان متغیر در نظر گرفته شدند. صفات مورد ارزیابی در آزمون حسی، عطر و طعم، بافت، رنگ و پذیرش کلی بود. داده‌های بدست آمده از ارزیابی داوران آموزش دیده به روش هدونیک هفت نقطه‌ای سپس با روش‌های آماری مورد تجزیه و تحلیل قرار گرفتند. نتایج نشان داد که افزودن چربی اثر معنی‌داری بر پذیرش عطر و طعم، رنگ و پذیرش کلی دارد ($P < 0/05$). تاثیر افزودن نمک بر پذیرش عطر و طعم، پذیرش کلی ($P < 0/05$) و پذیرش بافت پنیر ($P < 0/01$) معنی‌دار بود. افزودن مایه کشت بر بافت ($P < 0/01$) و پذیرش کلی ($P < 0/05$) اثر داشت. ارزیابی آماری سطوح مختلف متغیرها نشان داد که به کار گرفتن ۵ درصد چربی، ۲ درصد نمک و ۳ درصد مایه کشت در فرمولاسیون پنیر ریکوتا موجب تمایل بیشتر مصرف کننده ایرانی به فرآورده مذکور است.