THE EFFECTS OF SWEET AND ACID WHEY SOLIDS AND THEIR SOME FRACTIONS ON DOUGH AND BREAD

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Summary

In this study, as conclusion of the mixing studies on farinograpph, lactose and the high lactose involving whey products have an increasing effect on mixing requirement and mixing tolerance. The whey proteins decreased the mixing tolerance but whey acidity did not.

Proof time was prolonged by the acid and sweet whey solid but not by their fractions. Also, the acid whey and its protein had a depressing effect on loaf volume. Lactose was the superior to the others in crumb grain score. The sweet lactose and the high lactose involving products increased bread crust color pigmentation but the acid whey protein affected it inversely. In respect to crumb firmness, lactose addition gave the most satisfactory results.

When compared to single bread, shortening and SSL addition into formula while decreesing the dough pH just after mixing, increased loaf volume, specific volume, crumb grain and softness and crust color lightness. Additionaly, 6 % sugar caused further satifactory results in all bread properties. However, the crust color of the bread was darkened contradictory to the effects of shortening and SSL.

Introduction

In this study we aimed to exert the effect of sweet and acid whey solid and their some factions together with shortening, SSL and sugar on dough and bread properties comperativelly, In a similar study conducted by Guy et al. (1971). they examined 3% lactose and equivalent amount sweet and acid whey comparing their effects on dough and bread In another work by Henika and Zentner (1960) used whey alone and together with other ingeredients (L-cystein and Bromate) employing basic straight dough formula with the regular ingredients, and obtai-

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ned somewhat satisfactory results for whey, sugar, shortening and surfactant combination.

Material and Method

Flour as a material had been used in this work was HRW patent flour of 11.65% (14 % m.b. and F= 5.7) protein content. Whey products and their fractions were ohtained from Foremost Food Company-San Fransisco, and their characteristics were as given below;

Whey products	Protein %	Lactose %	Ash %	Moisture %	Acidity %
Sweet Whey	12.0	73.0	8.50	4.0	6.5
Acid whey	12.5	62.0	12.2	4.5	4.6
Protein (acid)	80.5	8.0	1.5	4.0	4.7
Permeate-I	5.0	68.0	11.5	4.5	4.5
Lactose (sweet)	0.1	95.0	0.2	5.0	6.5

For each betch, 60 ppm L-ascorbic acid and sufficient amount malt flour (500 BU) were added (AACC, 1971). The sweet and acid whey solids were used of 5 % level based on flour, and acid whey protein and permeate-I were in the the equivalent amount to acid whey and the sweet whey levels.

In Farinograph experiments, constant flour method was used. Whey products and L-ascorbic acid were the variables (AACC, 1971.).

Baking method employed in this study was basic on straight dough procedure with 3.5 minutes mixing time, using the method has been employing in the Department of Grain Science and Industry of Kansas State University with at 425°F for 25 minutes in baking.

Ingredient added into sample batches were shortening at 2 % Sodium Steroeyl 2-Lactilate (SSL) as a surfactant at 0.5 %, sucrose at 6 % levels versus control. The bread types mentioned involve the ingredients: a. Flour, yeast (2.5)%) and salt (2%) for Bread type-I (BT-1), b. Additionally shortening (2 %) and SSL (0.5%) for Bread type-2 (BT-2), and c. Additionally sugar (6%) over BT-2 for Bread type-3 (BT-3).

The crust and crumb color of the breads were measured by Agtron Refectance Spectrometer (Tsen, 1980). The measurements of the crumb firmnes was done on Instron with 2000 g cell as gram resistance.

The effects of the wheys, their fractions and bread type were established by analysis of Variance and Duncan's Multiple Range test, satistically (Steel and Torrie, 1960). Statistically significant interactions were illustrated by the aid of Figures ($P<0.05$).

Results and Discussions

Farinograph Experiments

Table 1 shows the comparison of the means of farinogram characteristics these are significant for variable whey products by Duncan's Multiple Range Test. As seen, compared to control, apart from the protein in equivalent amount to acid whey, other whey products decreased water absorbtion of flour. In this case, the lactose content is playing dominant role by decreasing the absorbtion of flour. Also Barnes et al (1973) found a decrease in water absorbtion with lactose and acid whey addition in a previous study.

In mixing time, Sweet whey, lactose and permate-I prolonged mixing time significantly. Acid whey and its protein gave the same value of the control. Acidity is not a cause of mixing requirement according to Barnes et al (1973). Also, here, acid whey protein was not a factor in increasing the mixing time. Thus lactose and high lactose involving whey products have a major increasing effect on mixing requirement of dough beside the decrease in water absorbtion.

But in further farinogram characteristics, with compared to controle, acid whey and its protein fraction decreased the stability and the mixing tolerance relating to MTI and 20 minutes drop. In this respect, acid whey protein was more effective than that of the whey to decrease the mixing tolerance in spite of higher pH of whey protein than that of acid whey. Thus, it would be said that whey proteins are more effective to decrease the mixing tolerance than pH acidity. In contrast to this effect, lactose fraction has an increasing effect on mixing requirement and the mixing tolerance of dough. Also permeate-I with the lowest pH after mixing had increasing effect on mixing time, stability and mixing tolerance due to its high lactose involvement.

Table 1. Comparison of the means of the data of mixing experiments that significant for variable whey product by Duncan's Multiple Range Test ($P<0.05$). 1

Whey products	Absorbtion N (%)	Mixing time(min)	Stability (min)	MTI (BU)	20 min drop(BU)	Dough pH after mixing
Controle	4 61.0 a	7.3 b	11.3 d	26.3 c	41.3 c	5.41 a
Sweet whey	4 56.7 c	9.4 a	14.8 b	21.3 cd	32.5 d	5.39 a
Acid whey	4 57.2 bc	7.3 b	8.7 c	35.0 ab	47.b	4.64 c
Protein	4 61.6 a	7.0 b	9.0 a	38.8 a	63.8 a	5.15 b
Bermeate-I	4 48.5 c	9.5 a	23.9	16.3 d	27.5 c	4.15 d
Lactose	4 58.1 b	8.8 a	13.0 c	32.5 b	43.8 c	52.20 b

(1) Means with the same letter are not significantly different

Baking Experiments

In Table 2, the comparison of the means of the data of breadbaking experiments which are significant for variable whey products by Duncan's Multiple Range Test are given. When compared to control only acid whey and its protein fraction gave the lower dough pH after mixing procedure, but before oven in only acid whey solid was effective alone.

Proof time was affected and increased only by acid and sweet whey solids as found by Guy et al. (1971), but not by their fractions. Acid whey and its protein fraction had a detrimental effect on loaf volume. The finding of Guy et al. (1971) was approved for only acid whey addition but not for sweet one. Apart from acid whey protein, the other whey products increased loaf weight. Merely, did not give harmful effect on specific volume and was superior to the others and control in crumb grain score.

The sweet whey, acid whey and lactose increased the crust color pigmentation, but acid whey protein affected it inversely. Except for lactose the other whey products increased crumb firmness after 24 hour shelf-time, but after 72 hours, only acid whey and its protein were the more effective when compared with that of the control.

The comparison of the effect of shortening addition is discussed by the help of Table 3. Shortening addition of 2 % , while increasing pH acidity after mixing, loaf volume, specific volume and grain score; decreased crust color intensity and crumb firmnes for the both shelf-times. SSL supplementation had the some effect of shortening on the same bread properties except for dough pH, in contrast to former, SSL addition decreased pH a little but at significant level statistically (Table 3).

There was no any significant interaction between whey product and the other ingredients. A significant interaction between shortening and SSL was shown in loaf volume, specifiic volume, SSL addition alone inereased both of them, but the SSL addition together with shortening did not have different effect than that of shortening alone. However in crumb grain, both ingredients together had better effect than they did alone (Table 4).

According to the results of Duncan's Multiple Range Test for variable bread type (Table 5), shortening and SSL addition over single bread formula (BT-1), while decreasing dough pH, increased loaf volume, specific volume, crumb grain, crust lightness, crumb softness for both 24 and 72 hours shelftime. Additional 6 % sucrose (BT-3) caused further increase in acidity of dough, loaf volume, specific volume, crumb grain and crumb softness; proof time was shortened and crust color was darkened contradictory to the effect of shortening and SSL (Table 5).

The bread type x whey product interaction was significant for crust color and crumb firmness for 24 hour shelf-time. According to graphical presentation of this interaction (Figure 2), in single bread (BT-I), the acid and sweet whey had more color increasing effect on bread crust than that of lactose alone, where as the acid whey protein alone decreasing it slightly. With shortening and SSL addition in BT-2 the decrease in crust color pigmentation was remarkable for single and acid whey protein added breads. Sugar addition (BT-3) evercame this effect and caused further pigmentation and browning in crust than that of single formula bread (BT-1).

In a second significant whey products x bread type interaction in crumb firmness for 24 hrs, the shortening and SSL adddition (BT-2) provided softer bread crumb for the all whey products than they gave for BT-1. But, with sucrose addition (BT-3), only the lactose added bread showed a decrease in crumb softness in contrast to the others (Figure 3).

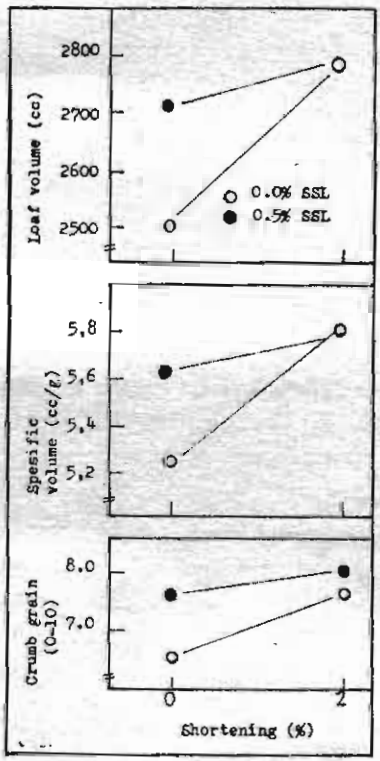

Figure 1. Shortening x SSL interaction in sene bread preporties.

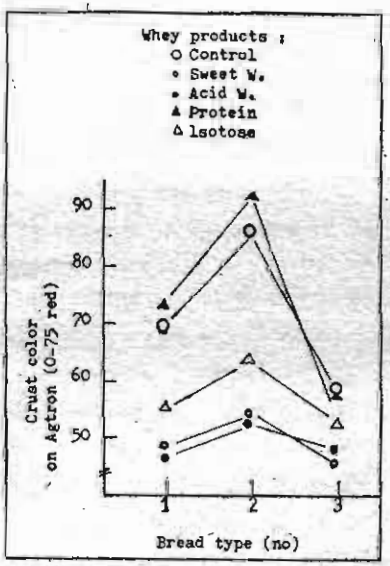

Figure 2. Whey products x Bread type interaction in crust color.

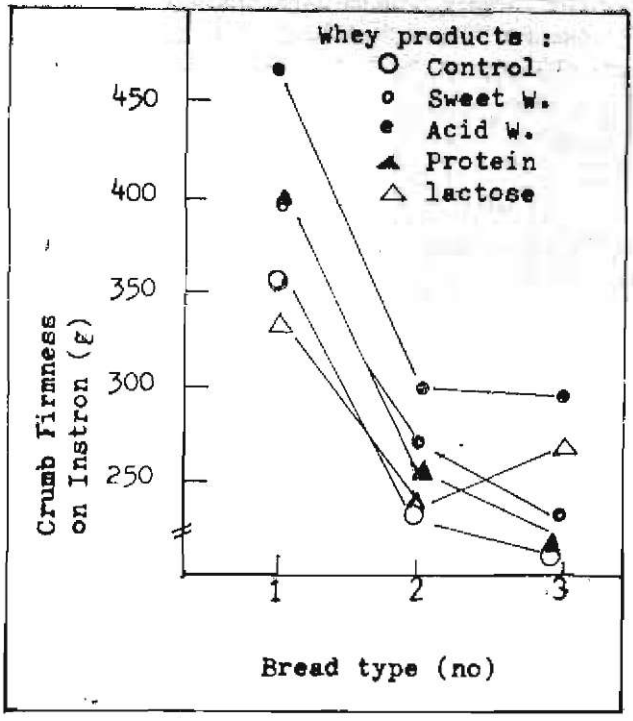

Figure 3. Whey products x Bread type interaction in crumb firmnes (24 hrs)

Özet

Tatlı ve Asit Peynir Altı Suyu Tozu ve Bazı Fraksiyonların Hamur ve Ekmek Özelliklerine Etkisi

Bu araştırmada, farinografta yapılan yoğurma çalışmalarında, laktoz ve yüksek laktoz içeriğine sahip peynir altı suyu tozu (PAST) türevleri, hamurun yoğurma ihtiyacı ve toleransını artırıcı etkide bulunmuştur. Protein muhtevası yoğurma toleransını düşürmüş, asitlik ise etkili olmamıştır.

Tatlı ve asit PAST hamurun son fermentasyon süresini uzatırken, PAST fraksiyonlarınca etkilenmemiştir. Asit PAST ve bunun protein fraksiyonu ekmek hacmını düşürmüştür. En iyi ekmek içi yumuşaklığını ve gözenek yapısını laktoz sağlamıştır. Beraberinde laktoz ve yüksek laktoz içerikli ürünler en cazip ekmek kabuğunu sağlarken, asit PAST ve bunun protein fraksiyonu olumsuz etkide bulunmuştur.

Yavan formulasyona göre, şortening ve SSL katkısı yoğurma sonrası hamur pH'sını düşürürken; ekmeğin hacım verimini, spesifik hacmını, gözenek yapısını, yumuşaklığını artırmış, kabuk renk intensitesini düşürmüştür. İlave şeker katkısı olumlu etkileri daha da artırırken, kabuk renk intensitesini yükseltmiştir.

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