

Determination of technologic and sensory properties of cookies prepared with corn flour

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Abstract

The effect of corn flour with different combination of shortening and glucose syrup (GS) on cookie quality was studied. Cookies were prepared with three different levels (20, 30 and 40%) of shortening. At each level of shortening 0, 50, 100% of the flour and 0, 25, 50, 75 and 100% of the sugar substituted with corn flour and GS, respectively. Cookies were tested for diameters, thicknesses, spread ratios and sensory evaluations. Cookie thicknesses decreased, spread ratios increased with increasing amount of corn flour. High shortening ratios increased the thickness, diameter and spread ratios of cookies. Improved cookie diameters and spreads were observed at 25% GS level. However, spread ratios of the cookies were the same ($p < 0.05$) above 25% addition of GS. Of all the shortening addition levels, 20% shortening level gave the highest cookie diameter values at 50% corn flour-25% GS ratios. The best cookie colour was obtained in cookies formulated with 100% corn flour – 20% shortening – 25% glucose syrup level. Cookies at 50% corn flour + 30% shortening + 25% GS level received the highest tenderness acceptability scores. Overall acceptability of cookies was best at 50% corn flour + 30% shortening + 25% GS level.

Key words: Corn, cookie, sensory, shortening, glucose syrup.

Introduction

Corn is one of the abundant cereal with its increasing production in the world. In many countries corn is main food cereal and its products are used in a wide range of foods. One of corn product is corn flour and it is not desired product of dry corn mill. With high content of fat and β -carotene, corn flour imparts flavor and colour to baked goods. It is also an alternative produce for individuals suffering from coeliac disease. Corn flour can be used in baked goods as an economic, nutritive and tasty additive. The particular amino acid in corn, leucine, is important in the incidence of pellegra. Corn flour has a yellow color and when blended with wheat flour it gives a rich appearance to baked goods like implying the incorporation of egg¹. Corn flour, soy flour, cotton-seed flour, legume flour and protein isolates can be used to enrich and diversify cookies¹⁻⁴. Addition of corn flour to baked goods prepared with wheat flour reduces the tendency for the shrinkage¹. Badi *et al.*⁵ found that cookies prepared with water-treated corn flour produced cookies with increased diameter and improved top grain⁵. The addition of corn flours improved the cookie spread factor⁶. In this research, it is attempted to investigate effects of corn flour as a substitution for wheat flour in cookie produced with different level of shortening and glucose syrup.

Materials and Methods

Materials: Wheat flour, corn flour, skimmed milk powder, all-purpose shortening, sodium bicarbonate, salt, powder sugar and glucose syrup were procured from local market in Konya, Turkey.

Corn flour and wheat flour analysis: Moisture, ash, protein and fat content of corn flour and wheat flour were determined

according to AACC standart methods⁷.

Cookie baking and evaluations: AACC Standart No:10-54 method was used for cookie preparation⁷. The recipe used for cookies is presented in Table 1. Three sets of experiments were performed, 20, 30 and 40% of shortening level characterized the sets. At each level of shortening, 0, 50 and 100% of the wheat flour was substituted with corn flour and 0, 25, 50, 75 and 100% of the sugar replaced with glucose syrup. All ingredients used for cookie preparation were kept at room temperature. Cookies were prepared in a Hobart mixer in triplicate and were examined for diameters, thicknesses, spread ratios and sensory evaluations. Cookies best for the technologic properties were subjected to sensory evaluation. Sensory properties of cookies were screened by 10 experienced panelists. Cookie samples were rated for the following parameters: color, odor, flavour, appearance, tenderness and overall acceptance. Characteristics of cookies were rated on a 0-7 scale, 7 being the most desirable.

Table 1. Cookie recipe.

Ingredient	Weight (g)
Wheat flour/Corn flour	0/100, 50/50, 100/0
Skimmed milk powder	2.0
All-purpose shortening	20, 30, 40
Sodium bicarbonate	1.0
Salt	0.25
Glucose syrup/ sugar	100/0, 75/25, 50/50, 25/75, 0/100
Deionized water	Variable

Table 2. Chemical analysis results of wheat and corn flour (% , dry basis).

Flour type	Moisture	Ash	Protein*	Fat
Wheat	12.40	0.66	12.32	0.50
Corn	14.00	0.45	10.20	1.55

*Protein : Nx6.25 (corn flour); Nx5.70 (wheat flour)

Table 3. Effects of corn flour, shortening and GS addition on cookie properties*.

	N	Thickness (mm)	Diameter (mm)	Spread Ratio
CF addition (%) **				
0	30	6.88 a	54.35 b	7.89 c
50	30	6.83 a	55.64 a	8.15 b
100	30	6.12 b	54.27 b	8.99 a
Shortening (%)				
20	30	6.39 b	54.45 c	8.15 b
30	30	6.68 a	54.82 b	8.24 a
40	30	6.76 a	54.98 a	8.65 a
Sugar:GS				
100:0	15	6.73 a	54.75 c	8.19 b
75:25	15	6.60 ab	54.94 a	8.37 a
50:50	15	6.56 ab	54.89 b	8.43 a
25:75	15	6.62 ab	54.63 d	8.37 a
0:100	15	6.55 b	54.54 e	8.37 a

*Means followed by the same letter in column are not significantly different.

** CF : Corn flour GS: Glucose syrup

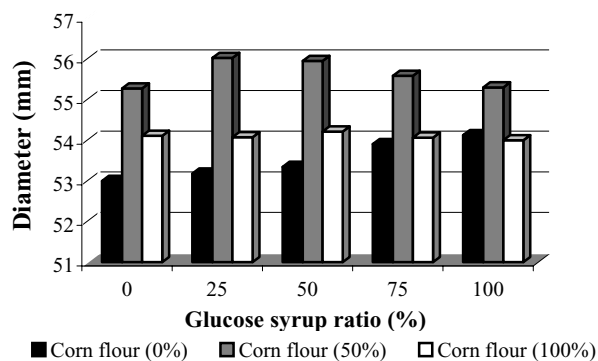


Figure 1. The effect of corn flour and glucose syrup additions on cookie diameter at 20% shortening ratio.

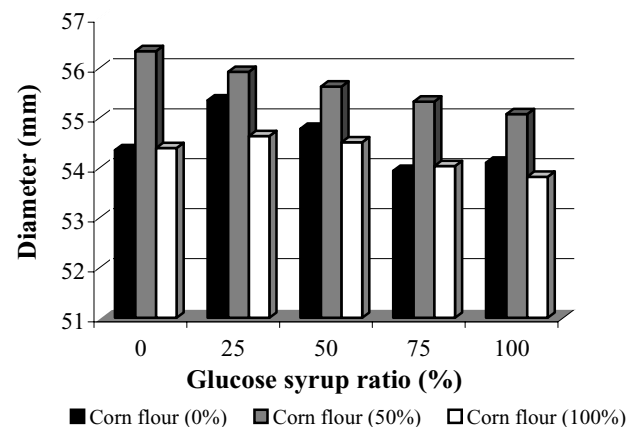


Figure 2. The effect of corn flour and glucose syrup additions on cookie diameter at 30% shortening ratio.

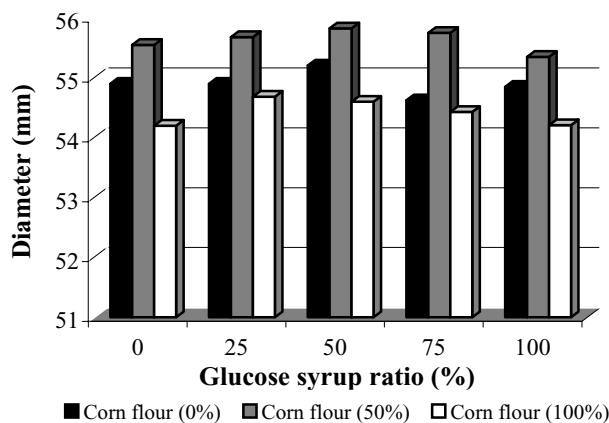


Figure 3. The effect of corn flour and glucose syrup additions on cookie diameter at 40% shortening ratio.

Statistical analysis: Thickness, diameter and spread ratio values analyzed by variance analysis method using TARIST statistical software ver. 4.0 (Tarist-Izmir). Duncan's Multiple Range Test was applied when the analysis of variance indicated significant differences in mean values.

Results and Discussion

Corn flour and wheat flour analysis: Moisture, ash, protein and fat content of both corn and wheat flours are presented in Table 2. Corn flour showed higher fat content. Since corn kernel contains a larger germ high in fat than other cereals, this may have been responsible for high fat content in corn flour. Wheat flour showed higher protein and ash contents than corn flour. The difference in ash and protein content may be due to difference in environmental and genetic effects.

Cookie properties: Effects of addition of corn flour (0, 50, 100%) on thickness, diameter and spread ratios of cookies are shown in Table 3. The spread ratios of cookies increased with the addition of corn flour. The thicknesses of cookies at the 0 and 50% level of corn flour addition were the same. However, there was considerable decrease in thickness of cookies prepared with 100% corn flour. The effects of 0 and 100% corn flour addition on diameters of cookies were same and lower than those of cookies made with 50% corn flour addition. The decrease in thicknesses and increase in diameters and spread ratios of cookies may be attributed to reduction in shrinkage of doughs¹. Thickness, diameter and spread ratio of prepared cookies increased with addition of shortening. The amount of shortening influences cookie spread⁸. Addition of 25% glucose syrup (GS) increased spread ratio of cookies considerably. Increasing glucose syrup levels decreased the thickness of cookies. Replacing 25 and 50% of sugar with GS increased the diameter of cookies. The effects of interaction of corn flour - GS - shortening on diameters of cookies were statistically significant ($p < 0.05$). The increase in diameters of cookies was more obvious in cookies prepared without corn flour. The diameters of cookies prepared without corn flour significantly increased with increased shortening levels compared with those of cookies made with 50 and 100% corn flour (Fig. 1-3). The diameters of cookies made without corn flour increased with glucose syrup addition ratios at 20% shortening level (Fig. 1). There was decrease in diameters of 0% corn flour cookies after

Table 4. Sensory properties of cookies.

Cookie type	Color	Odor	Flavour	Appearance	Tenderness	Overall acceptance
0 % CF + 20 % S + 25 % GS *	3.5	5.1	4.0	4.6	4.5	5.0
0 % CF + 30 % S + 25 % GS	3.8	5.0	4.5	5.6	4.6	5.6
50 % CF + 20 % S + 25 % GS	4.5	5.3	4.8	6.1	5.3	6.0
50 % CF + 30 % S + 25 % GS	5.3	5.1	5.8	6.0	5.8	6.4
100 % CF + 20 % S + 25 % GS	5.8	5.0	5.3	5.1	5.1	6.0
100 % CF + 30 % S + 25 % GS	5.6	5.3	5.5	5.5	5.7	6.1

* CF : Corn flour S: Shortening GS: Glucose syrup

the addition of 25% GS at 30% shortening level (Fig. 2). Slight decrease was observed in diameters of 0% corn flour cookies above 50% GS at 40% shortening level (Fig. 3). It was realized that the diameters of 50% corn flour cookies decreased after the addition of 25-50% GS at each levels of shortening (Fig.1-3). Cookies with 100% corn flour showed no significant differences in diameters with increasing GS levels at 20% shortening level (Fig. 1). Shortening levels of 30 and 40% led to decrease in diameters of 100% corn flour cookies after addition of 25% GS (Fig. 2 and 3).

Results of sensory evaluations are presented in Table 4. Of all the cookies tested for sensory properties, cookies prepared with 50% corn flour + 30% shortening + 25% GS combination received the highest scores for flavour, appearance and overall acceptance. The acceptability of cookie colour was the best at 100% corn flour + 20% shortening + 25% GS level. Cookies at 50% corn flour + 30% shortening + 25% GS and 100% corn flour + 30% shortening + 25% GS levels received the highest tenderness acceptability scores.

Conclusions

The different combination of shortening and GS had considerable effects on technologic and sensory properties of corn flour cookies. Spread ratios of cookies improved with increasing levels of corn flour and shortening. Similar results were observed in cookies prepared with 25% and higher levels of GS additions. Although 100% corn flour cookies received high color scores, the higher odor, appearance and tenderness values were obtained in cookies made with 50% corn flour. However, overall acceptance of cookies was the best at 50% corn flour, 25% GS and 30% shortening. It can be concluded that technologic and sensory properties of cookies can be improved with minimum 25% GS and 30% shortening addition at 50% corn flour level.

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