SENSORIAL AND NUTRITIONAL INFLUENCES OF SEVERAL TYPES OF HYDROCOLLOIDS IN BREAD

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Abstract: In this paper, four types of hydrocolloids were used to make breads with lower caloric values and higher fiber content. The hydrocolloids with lower capacity to bind water lead to breads with higher fiber content and higher caloric values than the hydrocolloids with higher capacity to bind water. At low level of gums the sensorial properties are even slightly better than the scores of control sample but at high levels the scores drops dramatically and the breads are at the lower limit of acceptability. The breads with xanthan had the lowest scores while the breads with alginate had the highest cores at 3 and 5% addition. At 10% addition the cellulose and guar gums showed superior scores. At 3 and 5% gums added the breads with xanthan and alginate had caloric values lower than the samples with cellulose gums while cellulose gums and alginate had the lowest caloric values at 10% adition.

Keywords: bread, dietary gums, xanthan, guar, alginate, carboxymetilcelullose, sensorial properties, caloric value, fiber content

INTRODUCTION

Bread is one of the cheapest basic foods. From caloric point of view bread is responsible for a great proportion of energetic daily intake. Having a caloric content ranging from 239 kcal/100 grams (rye bread) to 282 kcal/100 grams (white wheat bread), bread could provide up to 50% of daily recommended caloric intake (W.H.O., 2005).

The caloric content reduction of a food is a topic of dilution of those components of aliments which have caloric value. This target can be achieved using two methods: by replacing an amount of any raw material with bulking agents which have no energy content and by binding water as much as possible. The two ways could be use alone or in combination (Ognean et all, 2006).

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The greatest challenge for food technologist is that the consumer expects to find for the light variant of foods the same sensorial characteristics as those of that of the traditional food (Philips, 2000).
Some hydrocolloids were added to bread formula to improve the technological properties of dough and the final properties of breads (Ang, et all, 2005), (Ashgar, 2005), (Sharadant and Khan, 2003) but these hydrocolloids could improve the nutritional properties of breads.
This research was conducted in the context of both reducing the total energy of the outcomes product and preserving the sensorial properties of the bread.
One product which can be added is the gums (soluble dietary fiber) from different sources. The addition of gums determines increasing of dietary fiber content and decreasing of caloric value by "diluting" the content especially through increasing water content (Ognean et all, 2006).
This work intends to investigate in which manner is modified these properties when several gums are added to the dough – xanthan, sodium alginate, gum and cellulose gum. The gums addition modifies sensorial properties of bread so the acceptability of product is modified.

MATERIALS AND METHODS

Materials

The hydrocolloids investigated were xanthan gum (Pre-Hydrated® TICAXAN® Rapid-3), sodium alginate (Pre-Hydrated® Colloid 488 "T"), cellulose gum (Pre-Hydrated® TICALOSE® CMC 15) and guar gum (Pre-Hydrated® Nutriloid® 010) from TIC GUMS and its were added to dough in three, five and ten percent on flour basis.
The flour used for samples preparation was a commercial type from Baneasa Mill, 650 grade (0.65% ash), with wet gluten content 28.9%, the deformation index 6 mm, Falling Number 265 s. Fresh yeast was commercial type too, with 28% dry content and fermentation power 12 minutes, determined through dough ball method.

Methods

To investigate the influence on the bread quality we prepared some loafs adding the hydrocolloids in 3, 5 ant 10%, expressed at flour basis. The recipes are presented in the table 1.

The dough was prepared using a lab mixer, the water was added until the desired consistency (the same for all samples) was achieved. Bulk fermentation last one hour, after that the dough was molded, place into a pan and kept at 30ºC for proofing and than it was baked at 200ºC, without steam. External and internal characteristics were subjectively evaluated by 24 students from the bread making laboratory discipline and score on a scale of 1 (least favorable) to 10 (most favorable). Products were considered acceptable if their scores were above 5 (neither like nor dislike).

Table 1: Bread formula

Sample / Ingredients	Control	Xanthan*			Alginate*			CMC*			Guar*		
		X3	X5	X10	A3	A5	A10	C3	C5	C10	G3	G5	G10
Wheat flour, g	300	300	300	300	300	300	300	300	300	300	300	300	300
Fresh yeast, g	9	9	9	9	9	9	9	9	9	9	9	9	9
Salt, g	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Water, ml	190	253	324	353	256	317	572	216	274	759	223	233	271
Gums	0	9	15	30	9	15	30	9	15	30	9	15	30

*The samples noted with 3, 5 and 10 were prepared with gums in ratio 3, 5 and respectively 10% based on flour weight.

The nutritional properties of samples were calculated considering the recipe of samples and moisture raw materials and samples. The fiber content of hydrocolloids was considered to be equal with the dry contents of the hydrocolloids and we consider to the data provided by the producer. The fiber content of xanthan, alginate, CMC and guar is 85%, 70%, 80% and respectively 90%. Caloric values were calculated considering the caloric value of gums 2 kcal/g dry gums.

RESULTS AND DISCUSSIONS

Several sensorial properties of loaves (taste, flavor, crust color, crumb color, mastication, crumb porosity, crumb texture and humidity) were determined. The results are presented in figure 1. Generally, the samples with lower gums contents have the better appreciation than the sample with higher gums contents. The samples with 3 and 5% sodium alginate gum, cellulose gum and guar gum have comparable appreciations and even slightly better appreciation (samples with sodium alginate gum). The samples with xanthan gum and sample with 10% sodium alginate have the lowest results. The addition of cellulose gum (TICALOSE® CMC 15) and guar gum (Pre-Hydrated® Nutriloid® 010) even in high proportion has little effects.

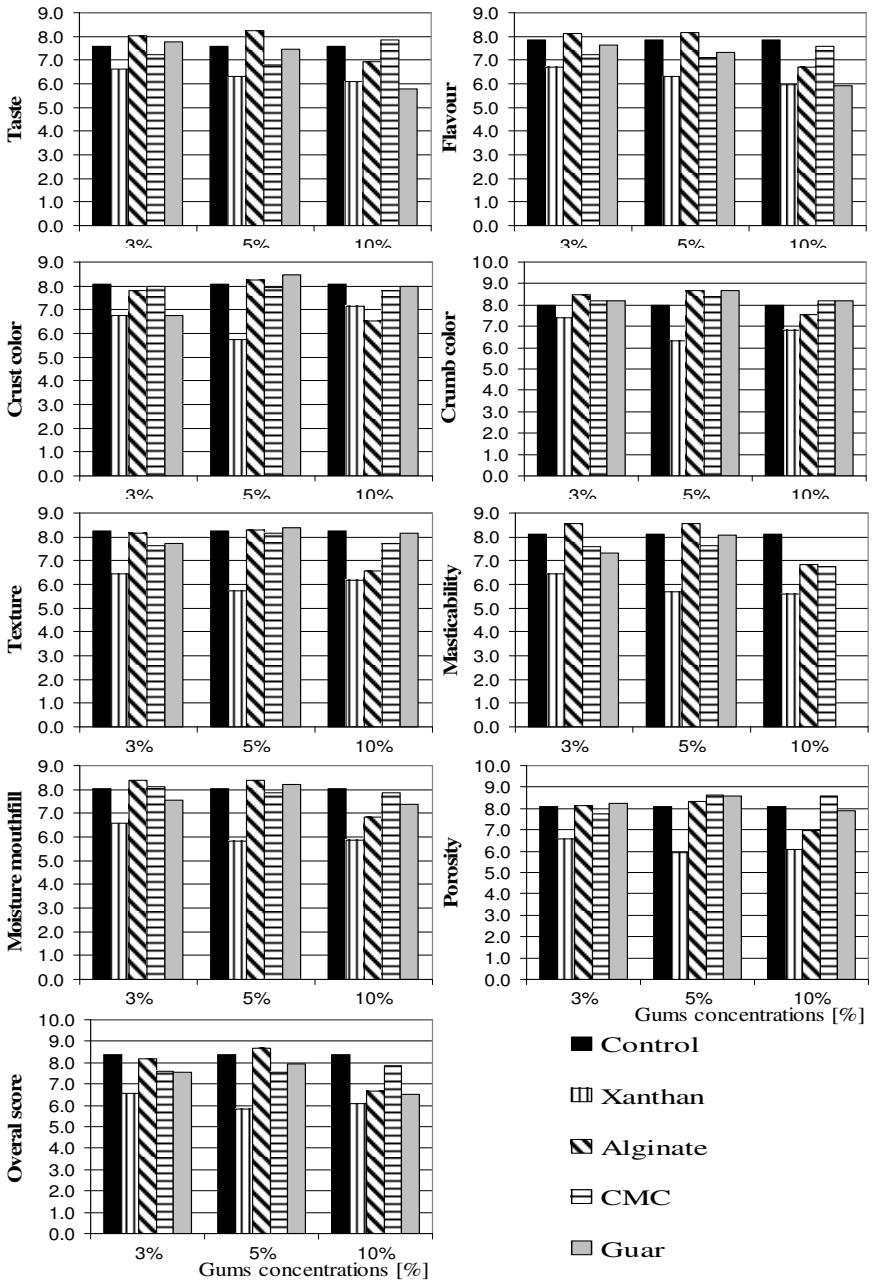

Figure 1. The sensorial appreciation of loaves with 3, 5 and 10% hydrocolloids added

The scores of flavor and the tastes of loaves with 10% gums were lower than the scores of control probably because the samples were more wet and

"diluted", the samples with xanthan and alginate having the lowest scores. The subjects of sensorial analyses indicate a strange taste and flavour at the samples with 10% hydrocolloid but nothing strange in to the samples with lower levels of hydrocolloids.
Crumb and crust color were very little changed at the samples with gums, a grayish nuance appear at the samples with 10% gums. The masticatory feels were most affected by addition of gums. The moister crumb forms sticky lumps which require a prolonged mastication when the level of gums is 10%. The moisture appearance perceived during the mastication was more significant at high level of gums but the samples with alginate and with guar were perceived more dryer than the samples with xanthan respective CMC, although its have similar capacity to retain water.
The fiber contents of different formulas are showed in the figure 2.

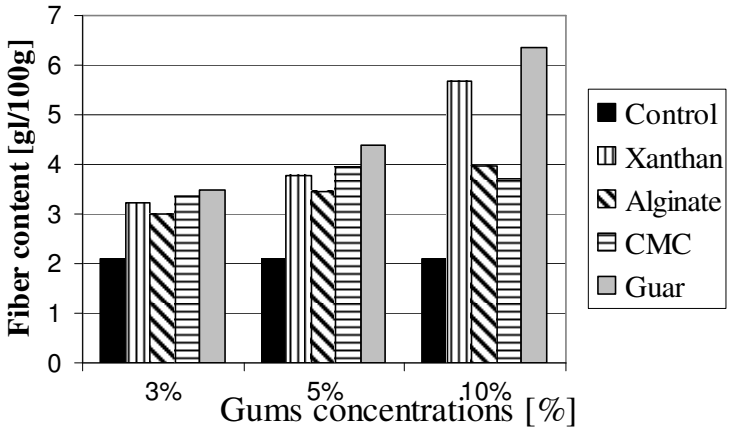

Figure 2. The fiber content of breads prepared with gums

The dietary fiber content of sample increases proportionally with gums addition and is lower for samples with high water content (samples with sodium alginate and xanthan gum) than samples with low water content (samples with cellulose and guar gums). The best results were achieved when we used guar gum (a gum which formed solution with low viscosities at high level of addition). At 10% xanthan and CMC in the formula the fiber content was similar to the formula with 5% hydrocolloids because water dilution.
The caloric values and the variation of this are presented in figure 3. The caloric values were calculated considering the caloric value of gums (soluble dietary gums) 2 kcal/g as indicated for soluble fiber. The same value was taken for CMC too. So the caloric value reduction is high for the samples

with high water content (samples with 10% gums added and samples with xanthan gum and sodium alginate gum). The sample with 5% cellulose gum show good results – a reasonable appreciation, high content of fibers and low caloric value.

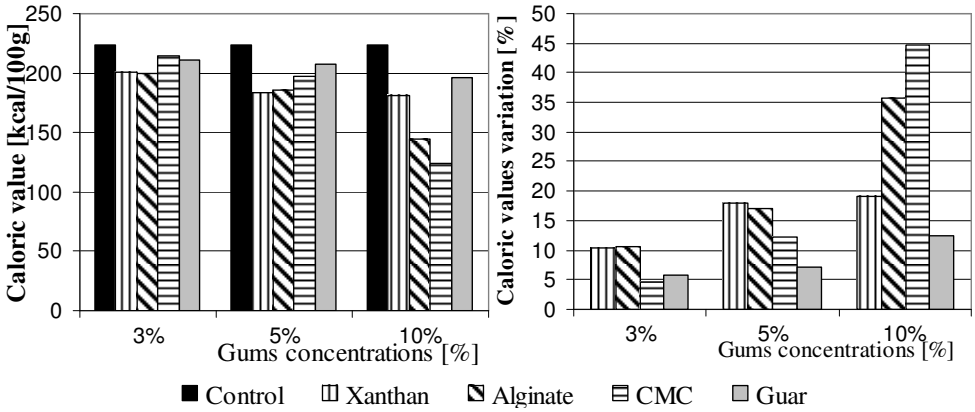

Figure 3. The caloric values of breads with different proportion of gums added

CONCLUSION

At low levels of hydrocolloids the sensorial properties of breads were influenced in a positive way but at high levels the properties were influenced dramatically in a negative way. Different hydrocolloids had different impact. The breads prepared with hydrocolloids which can bind high levels of water have scores lower than the breads prepared with hydrocolloids with lower capacity to bind water.

For increasing the fiber contents of breads it is recommended to use hydrocolloids which form solutions with low viscosities at high concentration while for reducing the caloric content must be used hydrocolloids who can bind great quantity of water. The hydrocolloids or gums are considered by nutritionist soluble fiber so its have the caloric values 2 kcal/g. The CMC is a soluble gum but aren't metabolized so the caloric values must be considered 0. Into the light of these the caloric values of breads prepared with CMC are smaller than the caloric values of breads prepared with other gums – at the same levels of water added.

If we consider the results obtain previously (Ognean et all 2006), (Ognean at all, 2007) breads with reduced caloric contents and increased levels of fiber and a good acceptability could be obtain when the hydrocolloids are added at maximum 5 % on flour basis.

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