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Physicochemical, Textural And Sensory Characteristics Of Cup-Cake Fortified With A-Amylase And Carboxymethyl Cellulose

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ABSTRACT

This study examined the effect of α-amylase and Carboxymethyl cellulose on Physicochemical, textural and sensory characteristics of cup- cake; cup- cake was fortified with α-amylase in ratios of 0, 25, 30, and 35 PPM and Carboxymethyl cellulose in ratios of 0, 0.1, 0.3, and 0.5 %. Physicochemical, textural and sensory properties were evaluated. The results showed that

Protein value of cake fortified with Alpha amylase (AM) at higher ratio was higher than that of the other cake samples and the control. There was an increase in product moisture content by the addition of CMC. The highest ash value content of the prepared cake was obtained upon the addition of 0.50 CMC . There are non-significant ($p<0.05$) changes in the mean values of fat content among the prepared sample and the control. Addition of CMC and AM produced the greatest increase in loaf volume and specific volume. In the case of α-amylase, all three levels significantly increased volume compared to CMC. Supplementation with the high levels of α-amylase decreased crumb hardness and chewiness. While with the high level increased hardness. As the dosage level of AM increased in the bread dough formulation, reducing sugar formation was accelerated and the released sugars were utilized for the Maillard reaction. The resulting outcome displayed low L* values and led to a much darker crust formation. While as the dosage level of CMC resulting outcome displayed high L* and b values. Cake containing (AM) and CMC had higher significant ($p<0.05$) scores for all the evaluated characteristics: appearance, taste, aroma, texture and Overall impression as compared to the control. Moreover, cake fortified with (AM) had higher significant ($p<0.05$) score for sensory characteristics compared with CMC treatments at the same concentrate.

Kay words:

CMC= Carboxymethyl cellulose , **AM**= Alpha amylase enzyme, **TPA**= Texture profile analysis.

Introduction

Despite the associated health benefits of whole grains, consumption of whole grain products remains far below recommended levels. Whole wheat bread is often associated with many distinctive attributes such as low loaf volume, firm and gritty texture, dark and rough crust and crumb appearance, bitter flavor, and reduced shelf-life. There is a need to improve its quality and sensory characteristics so as to increase consumer appeal and, ultimately, increase the intake of whole wheat bread. The inclusion of various ingredients improves dough and bread properties. **(Tebben et al, 2018**).

Many attempts have been made for improved the bakery products properties quality. The enzymes addition to wheat flour is interesting replacement to generate changes in structure of the dough and in consequence, for improving functional properties of flour **(Shebl et al., 2018).**

Alpha-amylase used in conjunction with Beta-amylase to increase the level of fermentable sugars to ensure adequate gas production during fermentation and to modify dough rheological properties (**Palacios, 1998)**. The addition of fungal Alpha-amylase to flours decreased arrival, stability, times, development, valorimeter value and water absorption (**Maeda et al., 2003: Kim et al,. 2006 and Sundarram et al, 2014**).

Improvement of gluten properties by enzymes and hydrocolloids are widely used to improve bread quality in wheat bread **(Maria Eduard, 2014).**

Hydrocolloids used in small quantities (< 1% on flour base) and are expected to increase water retention and loaf volume and decrease firmness and starch retrogradation **(Collar et al., 1999).**

Carboxymethyl cellulose (CMC) is a sodium salt derivative of cellulose. Unlike cellulose, it is water soluble and can function as a suspending agent, stabilizer, film former or thickening agent. CMC finds use in gluten-free baking by providing dough with viscosity and bread with volume much like gluten proteins do. It also functions well in fillings as a thickener and in glazes as an agent to slow down sugar crystallization. (**Hoefler, 2019**).

Carboxymethyl Cellulose CMC had a combined effect with enzymes and emulsifiers on textural properties of both dough and fresh bread, for example, high volume and retarding of staling **(Collar et al., 1999; Rosell et al, 2001; Guarda et al., 2004).**

This study throws the light on the determine the optimum α-amylase and Carboxymethyl Cellulose concentrations can be used to prepare cup- cake using weak flour and studying the effect of treatment on the physicochemical , textural and sensory characteristics of cup- cake.

MATERIALS AND METHODS

MATERIALS:

Wheat flour extraction of 72% (semi hard) was obtained from EL-Tayseer from Mills Company, kalubia, Egypt, Carboxymethyle Cellelouse was obtained from International Company for Backing Materials, Zagazig, Egypt, Alpha amylase enzyme was obtained from Copa comp Additive Food, skim milk powder was obtained from Nestle Company for food industries, 6 th October city, Egypt, Vegtabolian butter was obtained from Arma for Oils and soaps, 10 th Ramadan city, Egypt. Sugar sucrose was obtained from AL-Howamdia for sugar and Integrative Industries, Giza, Egypt, Mixing sodium bicarbonate with Aluminum pyrophosphate was obtained from Cook's company, 6 th October city, Egypt, Vanillin was obtained from Cook's company, 6 th October city, Egypt. Dry yeast of Saccharomyces cerevisiae sucrose were Angel

Yeast (Egypt) Co.,Ltd, Beni Suef, Egypt. Fresh egg yolk was local market. It was obtained from Arma for Oils and soaps, 10^{th} Ramadan city, Egypt.

METHODS:

Cakes preparation:

The cake batter was formulated from 100 g flour, 85 g whole fresh egg, 85 g sucrose, 55 g shortening, 3 g dry milk, 3.8 g baking powder, salt 1.0 g, and 0.6 g vanilla. Shortening, egg, vanilla, and sucrose powder were creamed together using a kitchen machine (Braun Multiquick 5 K7000) for 5-10 min. Flour, dry milk, and baking powder were mixed together. This mixture was added gradually to the previously prepared cream and beaten for 3 min using the mixing machine (Braun Multiquick 5 K7000) at low speed. The batter was scaled at 100 g into baking pans, baked at 180˚C for 35 min, left to cool for 1.0 hr at room temperature until analysis.

Table (1): Cake formula and cake treatments:

Cake formula		**Cake treatments**	
Components	**Weight (g)**	**Treatments**	**Component**
Semi-hard wheat flour (72% ext)	100	Control	Cake formula
Margarine	85	AM 25 PPM	Cake formula + 25 PPM AM
Sugar	85	AM 30 PPM	Cake formula + 30 PPM AM
Powder milk	3	AM 35 PPM	Cake formula + 35 PPM AM
Baking powder	3.8	CMC 0.1%	Cake formula + 0.1% CMC
Vanillin	0.6	CMC 0.3%	Cake formula + 0.3% CMC
whole fresh egg	85	CMC 0.5%	Cake formula + 0.5% CMC
Salt	1	Control	Cake formula

AM= Alpha Amylase CMC= Carboxymethyle cellelouse

Methods of analyses:

Chemical analysis:

Moisture, ash, protein, fats and falling number (FN) were determined according to **AOAC, (2000).**

Falling Number:

Falling Number was performed according to AACCI Approved Method 56-81.03.

Physical properties:

Determination of specific volume

Specific volume was obtained by dividing the volume of sample by their weight according to ACCC 10-05 method (**AACC, 2000**).

Gluten index:

Wet and dry gluten were determent according to **(Anon, 1985)**

Texture profile analysis (TPA)

TPA was conducted for control and treated samples as described by **Guadarrama- Lezama et al. (2016)** and **Soleimanifard et al. (2018).** Texture Analyzer (Brookfield Texture Pro CT V1.6 Build, USA) was used for analyses the texture of control and treated cupcake samples. The apparatus equipped with a 10000 g load cell and cylindrical probe (36 mm diameter) at a test speed of 4.00 mm/s, this equipment was used for the double compression Texture Profile Analysis (TPA) tests. Cylindrical crumbs of cupcake with 50 mm diameter and 25 mm height were compressed to 50%. A number of textural parameters (hardness1, hardness 2, Cohesiveness, Springiness, Gumminess and Chewiness) were extracted from the resultant force-time curve. The experiment was performed in triplicate.

Determination of color by Hunter Lab:

The color of samples was measured using Hunter lab (Model 45/0 Color Felx Ez, USA) based on three color coordinates: L* (luminosity), a* (redness/greenness), b* yellowness/blueness) . The measurement for each sample was replicated and the average value was recorded for each color parameter.

Sensory assessments:

Sensory properties of cake treatments were evaluated by ten members from the staff of Food Sci. Dept., Fac. Agric., Zagazig Univ., Cake treatments were cooled for 1-2 h at room temperature (25°C) in a sealed plastic bag. The following parameters were evaluated in the acceptance analysis: appearance, aroma, taste, texture, and overall acceptance, using a 9-point hedonic scale (1 = disliked immensely; 9 = liked immensely). The results were expressed as the mean of the scores. A 5-point scale was used for purchase intention (1 = would certainly not buy; 5 = would certainly buy).(**Bedoya-Perales and Steel ,2014**).

Statistical Analysis:

The obtained results were evaluated statistically using analysis of variance as reported by **Mc Clave & Benson (1991).** In addition the other reported values were expressed as mean ±SD and ±SE, two – tailed Student's t test was used to compare between different groups. P value less than 0.05 was considered statistically significant. SPSS (Chicago, IL, USA) software window Version 16 was used.

RESULTS AND DISCUSSION

Physical and Chemical composition of semi-hard wheat flour:

Physical and chemical composition of semi-hard wheat flour is shown in Table (2). The results show that flour contained 13.9 % moisture, 11.4% protein, 0.61% ether extract, 0.65% crude fibers, 0.57 % ash, and 86.93 % total carbohydrates. Also, wet and dry gluten were 25.8% and 10% respectively. Falling number and gluten index were 612 sec. and 86.4%. Similar results were recorded by **Shebl et al. (2018).**

Table (2): Chemical composition and properties of semi-hard wheat flour (72% ext.)

Components	Percent
Moisture	13.9±0.60
Ash	0.57±0.04
Protein	11.4±0.36
Crude fat	0.52±0.02
Crude fiber	0.65±0.60
Carbohydrates	86.93±4.12
Wet gluten content	25.8±1.74
Dry gluten content	10±0.22
Gluten index	86.4±5.42
Falling number	612±52.2

Effects of addition CMC and AM enzyme to semi -hard wheat flour on chemical composition of cake:

Data presented in Table 3 showed that, the main values (%) of carbohydrate, protein, moisture, ash and fat of control cake were found to be 37.72, 17.52, 25.0, 1.64 and 18.12, respectively. Moreover, there was slight difference in protein value (%) content of cake treatments with different additives: Am and CMC at different concentrations compared with control cake. However, protein value of cake fortified with Alpha amylase (AM) at higher ratio was higher than that of the other cake samples and the control.

There was an increase in product moisture content by the addition of CMC. CMC caused an increase in bread moisture content when being added individually or in cake and other leavened bakery products, produces dough with constant functional properties and good water holding characteristics (**Sanderson, 1996: Nasef et al, 2016)**.On the other hand, moisture content of the fortified samples with additives such as alpha amylase (AM), decreased compared with CMC treatments.

The highest ash value content of the prepared cake was obtained upon the addition of 0.50 CMC individually (1.86), while the unfortified sample (control) showed to contain (1.64%) ash. Generally, the study revealed that cake fortified with CMC under the present experimental conditions had higher values of ash as compared to the other prepared samples.

Results presented in Table (3) also showed that there are non-significant ($p<0.05$) changes in the mean values of fat content among the prepared sample and the control. These results are in the same line with (**Bedoya-Perales and Steel, 2014 and Nasef et al, 2016).**

Table (3): Effects_of addition CMC and AM enzyme to semi -hard wheat flour on chemical composition of cake

Treatments	Moisture	Protein	Fat	Ash	Total carbohydrates
Control	25.0±1.12^{b}	17.52±0.66^{cd}	18.12±1.16^{a}	1.64±0.04^{d}	37.72±1.86^{a}
AM 25 PPM	25.20±1.16^{b}	17.76±0.72^{c}	18.04±1.22^{a}	1.56±0.08^{e}	37.44±1.82^{a}

AM 30 PPM	25.20±1.11^{b}	18.30±0.58^{b}	18.08±1.10^{a}	1.52±0.06^{e}	36.90±1.96^{ab}
AM 35 PPM	25.10±1.06^{b}	18.72±0.56^{a}	17.96±1.40^{a}	1.66±0.04^{d}	36.56±1.90^{ab}
CMC 0.1%	25.91±1.12^{b}	17.64±0.70^{c}	17.98±1.35^{a}	1.72±0.02^{c}	36.75±1.94^{ab}
CMC 0.3%	28.40±0.96^{a}	17.78±0.76^{c}	17.14±1.40^{a}	1.80±0.04^{b}	34.88±1.96^{b}
CMC 0.5%	28.72±1.00^{a}	17.82±0.52^{c}	17.10±1.42^{a}	1.86±0.02^{a}	34.50±1.98^{b}

*** Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$). AM= Alpha Amylase CMC= Carboxymethyle cellelouse**

<u>Effects of addition CMC and AM enzyme to semi -hard wheat flour on physical properties (Loaf volume and specific volume) of cake:</u>

Addition of CMC and AM enzyme produced the greatest increase in loaf volume and specific volume. AM enzymes tested significantly increased the loaf volume and specific volume (Table 4). In the case of α-amylase, all three levels significantly increased volume compared to control. In cake, the effect of maltogenic α-amylase on loaf volume has been inconsistent (**Bedoya-Perales and Steel, 2014**). Our studies showed an increase in volume due to maltogenic α-amylase, depending on the dose.

Instead, the increase in loaf volume due to α-amylase may be related to a decrease in dough viscosity during starch gelatinization, hence prolonging oven rise (**Goesaert et al., 2009)**. This reasoning could explain the increased loaf volume observed for both conventional α-amylase, which generates low molecular weight α-dextrins and oligosaccharides of varying length, and for maltogenic α-amylase.

With the exception of CMC hydrocolloids increased specific volume of the cake for at least one of the levels evaluated (Table 4). The findings for CMC and hydrocolloids are in accordance with published works on cake (**Noorlaila et al, 2020**). The most noticeable improvements were for the high level of CMC (0.50 %) and all levels of CMC (0.10 and 0.30% increase). Volume improvements can be related to increases in dough development and gas retention (**Rosell et al., 2001)**.

The ability of hydrocolloids to improve loaf volume is often attributed to a strengthening effect on the gluten network and an improvement in gas retention (**Linlaud et al., 2011).**

Table (4): Effects of addition CMC and AM enzyme to semi -hard wheat flour on physical properties of toast bread

Treatments	Loaf Volume (cm³)	Weight (g)	Specific Volume (cm³/gm)
Control	92.00±0.88^{c}	27.80 ±0.66^{b}	3.30 ±0.22^{cd}
AM 25 PPM	95.90 ±0.72^{b}c	27.04 ±0.52^{c}	3.54±0.18^{ab}
AM 30 PPM	96.52±0.77^{b}	26.36 ±0.48^{d}	3.66±0.20^{ab}

AM 35 PPM	97.70±0.82^{a}	25.84 ±0.60^{e}	3.78±0.16^{a}
CMC 0.1%	95.44±0.90^{b}c	27.92±0.42^{b}	3.41±0.18^{b}
CMC 0.3%	96.40±0.78^{b}	28.00±0.40^{a}	3.44±0.20^{b}
CMC 0.5%	97.24±0.70^{a}	28.14±0.44^{a}	3.44±0.22^{b}

*** Values (means ±SD) with different superscript letters are statistically significantly different (P ≤ 0.05). AM= Alpha Amylase CMC= Carboxymethyle cellelouse**

<u>Effects of addition CMC and AM enzyme to semi -hard wheat flour on texture profile of cake:</u>

Supplementation with the high levels of α-amylase decreased crumb hardness and chewiness as measured on the first week after baking (Tables 5). The enzymes produced little effect on the TPA parameters, except for α-amylase, which decreased crumb resilience, cohesion, springiness, and chewiness. Loaf volume is a major contributor to hardness, but the nature of the crumb material is also involved (**Armero & Collar, 1996a).**

The lowest hardness value was obtained with the highest dose of α-amylase produced compared to control cake. Several other researchers have reported significant reductions in crumb hardness for bakery products supplemented with enzymes (**Fadda et al., 2014: Bedoya-Perales and Steel, 2014)**. The textural change is most often attributed to the increase in volume. A reduction in starch crystallization and crystal growth, based on Avrami analysis, has also been suggested (**Ghoshal et al., 2013**).

Conventional α-amylase is commonly used to improve loaf volume, and a decrease in crumb hardness for bakery products has been reported (**Matsushita et al., 2017)**. Although staling involves changes in several quality parameters including moisture migration and loss, loss of aroma, and textural changes (**Hug-Iten et al., 2003**), perhaps the most important characteristic of staling is an increase in crumb hardness over time, which is also referred to as firming. Data displays the rate of firming as defined by the slope of the increase in hardness during storage. The plot of this firming data a pronounced decrease in firming rate was obtained for α-amylase at the medium and high levels.

TPA of cake revealed mostly non-significant reductions in crumb hardness as a result of hydrocolloids, except for significant reductions due to the medium level of CMC (Tables 5). The initial softening effect of CMC in cake has been previously reported (**Noorlaila et al, 2020).** The other textural parameters measured by TPA were also largely unaffected by hydrocolloid addition. The treatments that produced the largest loaf volume were not always the ones with the lowest values for crumb hardness, reinforcing the fact that although loaf volume is a major contributor to firmness (**Armero, & Collar, 1996 b**), gas retention capacity and increased water absorption of dough (**Zannini et al., 2014**) and the specific nature of the crumb also play a role in the resistance of crumb to compression (**Armero & Collar, 1996a).**

Differences in crumb hardness became more apparent with storage time. The increase in hardness with the high level of CMC could be caused by the low loaf volume compared to the low and medium treatments (**Noorlaila et al, 2020**). The increased hardness can also be caused by a lack of water for plasticizing the gluten network (**Goesaert et al., 2009**). CMC the low and medium levels showed a trend for decreasing the rate of staling based on the rate of increase in crumb hardness over time. The anti-staling effect of CMC could result from its ability to hinder interactions among the other components in the crumb by enveloping them in a polymer network (**Barcenas & Rosell, 2005**) and by its preferential binding to starch, which influences the interactions among lipid, starch, and gluten (**Collar et al., 1998**). Water retention capacity and starch interactions have also been proposed to explain the softening effects of hydrocolloids (**Collar et al., 1998; Guarda et al., 2004**).

Table (5): Effects of addition CMC and AM enzyme to semi -hard wheat flour on texture profile of fresh cake

Treatments	Hardness N1	Hardness N2	Adhesiveness	Resilience	Cohesiveness	Springiness	Gumminess	Chewiness
Control	11.37±1.42^{e}	9.83±1.02^{f}	1.10±0.46^{c}	0.31±0.01^{b}	0.74±0.04^{ab}	4.33±0.60^{c}	8.66±0.72^{f}	37.50±3.22^{e}
AM 25 PPM	11.94±1.34^{e}	10.53±1.06^{e}	0.70±0.58^{d}	0.33±0.02^{a}	0.78±0.02^{a}	5.83±0.55^{a}	9.24±0.68^{e}	54.10±3.04^{d}
AM 30 PPM	13.45±1.16^{d}	11.78±1.00^{d}	22.90±0.44^{a}	0.29±0.02^{bc}	0.76±0.04^{ab}	5.13±0.58^{b}	10.18±0.62^{d}	52.20±3.12^{d}
AM 35 PPM	10.53±1.58^{f}	9.15±1.12^{f}	2.20±0.42^{b}	0.26±0.02^{c}	0.73±0.04^{ab}	3.92±0.72^{d}	7.64±0.70^{g}	29.90±4.16^{f}
CMC 0.1%	20.01±1.12^{c}	15.93±0.98^{c}	0.30±0.58^{e}	0.23±0.01^{d}	0.63±0.05^{b}	0.65±0.82^{e}	12.69±0.60^{c}	82.20±3.11^{c}
CMC 0.3%	24.34±1.08^{b}	20.14±0.86^{b}	0.10±0.60^{e}	0.20±0.02^{e}	0.55±0.04^{c}	0.75±0.80^{e}	13.28±0.56^{b}	99.70±3.02^{b}
CMC 0.5%	25.62±1.11^{a}	21.77±0. 92^{a}	0.80±0.47^{d}	0.23±0.01^{c}	0.58±0.04^{c}	0.70±0.84^{e}	14.89±0.52^{a}	104.10±2.98^{a}

*** Values (means ±SD) with different superscript letters are statistically significantly different (P ≤ 0.05).**

AM= Alpha Amylase **CMC= Carboxymethyle cellelouse**

Effects of addition CMC and AM enzyme to semi -hard wheat flour on color properties of cake:

From data presented in Table 6 , it can be seen that, as the dosage level of AM increased in the bread dough formulation, reducing sugar formation was accelerated and the released sugars were utilized for the Maillard reaction. The resulting outcome displayed low L* values and led to a much darker crust formation. The crust color between light and dark brown was preferred by most consumers, and the flavor and taste of bakery products could be improved as the result of the Maillard reaction (**Kim and Yoo, 2020**). These results are agree with **Eugenia Steffolani et al, (2012)** and **Kim and Yoo, (2020**).

While as the dosage level of CMC resulting outcome displayed high L* and b values .The increased b values could be attributable to a more favorable water distribution due to the hydrocolloids, which affects Maillard browning reactions and caramelization (**Sciarini et al .,2010**). These results are agree with **Eduardo et al, (2015) and Shebl et al,(2018) .**

Table (6): Effects of addition CMC and AM enzyme to semi -hard wheat flour on color properties of cake

Treatments	l	a	b
Control	40.65 ±1.34^{cd}	11.22±0.66^{bc}	18.76±0.84^{f}
AM 25 PPM	42.20 ±1.28^{d}	11.73±0.52^{b}	20.69±0.82^{e}
AM 30 PPM	48.19±1.16^{b}	9.95±0.64^{d}	23.64±0.77^{c}
AM 35 PPM	42.39±1.26^{cd}	11.63±0.62^{b}	21.64±0.86^{d}
CMC 0.1%	43.54±1.14^{c}	10.85±0.70^{cd}	21.44±0.80^{d}
CMC 0.3%	47.58±1.12^{bc}	10.93±0.72^{c}	25.30±0.68^{b}
CMC 0.5%	50.22±1.10^{a}	12.30±0.50^{a}	26.71±0.62^{a}

*** Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$). AM= Alpha Amylase CMC= Carboxymethyle cellelouse**

Effects of addition CMC and AM enzyme to semi -hard wheat flour on sensory characteristics of cake:

Sensory evaluation results of cake containing each of AM and CMC individually and control sample after baked are shown in Table (7). It was found that cake containing (AM) and CMC had higher significant ($p<0.05$) scores for all the evaluated characteristics: appearance, taste, aroma, texture and Overall impression as compared to the control. Moreover, cake fortified with (AM) had higher significant ($p<0.05$) score for sensory characteristics compared with CMC treatments at the same concentrate. The present result agreed with the reported findings by **Bedoya-Perales and Steel (2014)** who stated that the appropriate levels of fungal α-amylase have been reported to improve the crumb structure and texture of the cake.

All additive treatments achieved significant ($p<0.05$) higher scores for all characteristics as compared to control after being backed .As reported by **Shebl et al , (2016)** who found that addition of enzymes and ascorbic acid to wheat pan bread enhanced the sensory characteristics of the final products. Also, **Noorlaila et al ,(2020)** found that fortification of wheat bread xanthan gum and hydroxypropyl methylcellulose enhancing the sensory characteristics of cake.

Table (7): Effects of addition CMC and AM enzyme to semi -hard wheat flour on sensory characteristics of cake

Treatments	Appearance 9	Taste 9	Aroma 9	Texture 9	Overall Impression 9
Control	7.0 ± 0.48^{b}	8.0 ± 0.52^{b}	7.0 ± 0.58^{c}	6.0 ± 0.88^{d}	7.00 ± 0.40^{d}
AM 25 PPM	7.0 ± 0.44^{b}	8.0 ± 0.48^{b}	7.0 ± 0.55^{c}	8.0 ± 0.72^{b}	7.50 ± 0.38^{c}
AM 30 PPM	8.0 ± 0.36^{a}	9.0 ± 0.48^{a}	9.0 ± 0.46^{a}	8.0 ± 0.70^{b}	8.50 ± 0.32^{a}
AM 35 PPM	8.0 ± 0.40^{a}	8.0 ± 0.50^{b}	8.0 ± 0.50^{b}	7.0 ± 0.85^{c}	7.75 ± 0.40^{bc}
CMC 0.1%	7.0 ± 0.50^{b}	7.0 ± 0.52^{c}	7.0 ± 0.55^{c}	7.0 ± 0.92^{c}	7.00 ± 0.42^{d}
CMC 0.3%	7.0 ± 0.52^{b}	8.0 ± 0.48^{b}	8.0 ± 0.52^{b}	9.0 ± 0.52^{a}	8.00 ± 0.35^{b}
CMC 0.5%	8.0 ± 0.48^{a}	8.0 ± 0.50^{b}	8.0 ± 0.56^{b}	9.0 ± 0.54^{a}	8.25 ± 0.32^{ab}

*** Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$). AM= Alpha Amylase CMC= Carboxymethyle cellelouse**

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