

Dedication

To my Father, Mother and my Husband

To my Kids, Ayman, Amgad and Aseel

Acknowledgements

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**Evaluation and utilization of starches from
different sources in some baked products**

Ph.D.

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Abstract

The objective of this study was to characterize and evaluate five starches from different local Sudanese Cereal Cultivars (wheat, sorghum, millet and rice), and from cassava and their use with wheat cultivar (Imam) and lentil flours for making biscuits and bread.

Ratios of starch used in wheat flour for making bread and biscuits were 5, 10 and 15% , and 10, 15 and 20% respectively, whereas ratios of lentil flour in wheat flour for making bread and biscuit was 5% and 10% respectively. Proximate composition, mineral content, functional properties and color were carried out for five starches. Flour characteristics and rheological properties were studied for wheat flour and wheat flour blends.

The results indicated that the five starches were significantly ($P \leq 0.05$) different in their chemical composition and mineral content. Wheat and cassava starches were found to be most acidic (0.03mg/100g) compared to sorghum, millet and rice starches (0.05mg/100g). Analysis of variance indicated that there are highly significant ($P \leq 0.05$) differences among the five starches in their falling number, water retention capacity (44.44 to 122.20 ml/100g), fat absorption capacity (50.00 to 95.00ml/100g), gelatinization temperature, cold and hot viscosity and amylose content. On the other hand, wheat and cassava starches gave significantly ($P \leq 0.05$) higher bulk density (0.67 and 0.63 gm/ml). Rice starch showed significantly ($P \leq 0.05$) low dispersibility (70%) compared to the other starches. Sorghum and cassava starches gave very strong gel, while wheat, millet and rice

starches gave strong gel at 10% concentration. The results indicated that cassava starch was whiter compared to other starches (95.71%). Millet starch showed high gelatinization temperature and low amylose content.

Addition of starches to the wheat blends resulted in increase in the falling number of wheat flour from 734.67 seconds to the range from 784.00 to 1079 seconds and significant ($P \leq 0.05$) decrease in wet gluten and gluten index. Water absorption decreased to the value range of 55.70 to 59.50% for the blends of 5%, 10%, and 15% wheat, sorghum and cassava starches blends and increased to 60.20% to 63.30% for rice starch blends. Addition of high percentage of starch results in low values of dough development time.

The energy and the extensibility of the dough of wheat flour decreased with addition of different starches percentages and the dough resistance to extension increased. Rice starch had the highest pasting temperature, gelatinization temperature and lower viscosity of amylograph. Pasting temperature increased in the blends, while gelatinization temperature and gelatinization maximum decreased. Addition of lentil flour to the blends resulted in increase of protein content of the blends in spite of presence of starch. Albumin and Globulin increased, while Glutenin and Gliadin decreased as a result of addition of starch and lentil flour in the blends.

From the results it could be concluded that quality attributes of sensory evaluation of bread made from the flour blend was found to be very good in spite of low bread specific volume. Spread ratio of biscuits increased with the increase in the percentages of starch. In general, panelists preferred 15% rice starch blend biscuit being the best in all quality attributes of sensory evaluation.

تقويم وإستخدام النشا من مصادر مختلفة فى بعض المخبوزات

رسالة دكتوراة

بواسطة إيمان جعفر حسن احمد

المستخلص

الهدف من هذه الدراسة تقييم ومعرفة خواص خمسة انواع من النشا من عينات الحبوب السودانية المحلية (القمح، الذرة الرفيعة، الدخن، الأرز) و الكسافا و استخدامها مع دقيق القمح (إمام) و دقيق العدس لصناعة البسكويت والخبز.

نسب النشا المستخدمة فى دقيق القمح المستخدم فى صناعة الخبز والبسكويت هى 5%، 10% و 15%، 10%، و 20% على التوالى، بينما نسب دقيق العدس فى دقيق القمح لصناعة الخبز والبسكويت هى 5% و 10% على التوالى.

التحليل التقريبي للعناصر الغذائية، تحديد العناصر المعدنية، الخواص الوظيفية و اللون قد تم لأنواع النشا الخمسة. خواص الدقيق ووظائفه الريولوجية تمت دراستها لكل من دقيق القمح و خلطاته.

أظهرت النتائج ان النشويات الخمسة تختلف ($P \leq 0.05$) معنوياً فى مكوناتها الكيميائية و محتوى المعادن. نشا القمح والكسافا وجدت اقل حامضية (0.03 ملجرام لكل 100 جرام) مقارنةً بنشا الذرة، الدخن و الأرز (0.05 ملجرام لكل 100 جرام). التحليل الإحصائى أظهر إختلافات ($P \leq 0.05$) معنوية عالية بين النشويات الخمسة فى رقم الإسقاط، مقدرة عالية للإحتفاظ بالماء (44.44 الى 122.20 مليلتر لكل 100 جرام)، إمتصاص الدهن (50.00 الى 95.00 مليلتر لكل 100 جرام)، درجة حرارة الجلتننة، اللزوجة الباردة و الساخنة و قيمة الأميلوز. من ناحية لخرى، نشا القمح والكسافا أعطيا معنوياً ($P \leq 0.05$) كثافة كتلة عالية (0.67 و 0.63 جرام لكل مللتر). نشا الأرز أوضح معنوياً إنتشارية منخفضة (70%) مقارنةً بالنشويات الأخرى.

نشا الذرة الرفيعة والكسافا أعطيا جل قوى جداً، بينما نشا القمح، الدخن و الأرز أعطوا

جل قوى عند التركيز 10%. أظهرت النتائج أن نشا الكسافا أكثر بياضاً (95.71%) مقارنة

بالنشويات الأخرى. نشا الدخن أوضح درجة حرارة جلتنة عالية وقيمة أميلوز منخفضة. إضافة النشالخلطات القمح نتجت عنها زيادة تدريجية فى رقم الإسقاط لدقيق القمح من 734.67 ثانية الى مدى يتراوح بين 784.00 الى 1079 ثانية ونقصان معنوى ($P \leq 0.05$) فى الجلوتين الرطب و جودة الجلوتين. إمتصاص الماء تناقص (الى مدى يتراوح فى قيمته بين 55.70 الى 59.50%) للنسب 5% ، 10% و 15% لخلطات نشا القمح، الذرة و الكسافا و زيادة الى 60.20% الى 63.30% لخلطات نشا الأرز.

أضافة نسبة عالية من النشا نتجت عنها قيمة منخفضة لزمن تطور العجينة. طاقة و مطاطية العجينة لدقيق القمح نقصت بإضافة نسب النشا المختلفة ومقاومة العجينة للمطاطية زادت. نشا الأرز أعطى أعلى درجة حرارة تعجن، درجة حرارة جلتنة و لزوجة أميلوغراف منخفضة درجة حرارة التعجن زادت فى الخلطات، بينما درجة حرارة الجلتنة و الجلتنة القصوي تناقصت. إضافة دقيق العدس للخلطات نتجت عنها زيادة فى محتوى بروتين الخلطات بالرغم من وجود النشا. الألبومين والقلوبيولين إزدادا، بينما القلوتينين و القليادين نقصا نتيجة إضافة النشا ودقيق العدس الى الخلطات.

من النتائج نستنتج ان صفات جودة التقييم الحسى للخبز المصنوع من خلطات الدقيق كانت جيدة جداً على الرغم من إنخفاض الوزن النوعى للخبز. معدل إنتشارية البسكويت زاد بزيادة نسب النشا. عموماً المقيمين فضلوا بسكويتخلطة 15% نشا الأرز وهو الأفضل فى كل صفات جودة التقييم الحسى.