

5. SUMMARY AND CONCLUSION

Dietary fat is a major energy source, essential for growth and development, and provides essential fatty acids needed for maintaining structure of cell membrane and for prostaglandin synthesis. Also, fat aids in the absorption of fat-soluble vitamins and other phytochemicals. Fats are responsible for the aroma and texture of many foods, thereby affecting the overall palatability of diet. Although fat in food may increase acceptance, high-fat foods and diets are also high in calories, which may be problematic for health, such as obesity, cancer, cardiovascular disease, and type 2 diabetes. So, new trends in food science take the reduction of the fat content of foods as an aim. Modification of the food supply through the use of fat replacers is often viewed as an efficacious way to achieve this goal. Several bakery products such as cakes and cookies are known for their high fat content. Therefore, the present study was carried out to investigate the effect of using some fat replacers on the physical, chemical and sensory properties of such products. Two types of fat replacers (flaxseed gum and okra gum) were used to replace 25, 50, 75 and 100% of fat (butter) used in the production of cakes and cookies.

The results obtained from the present study could be summarized as follows:

Effect of using flaxseed gum on cake characteristics:

1- The proximate chemical analysis showed that fat-replaced cakes had higher moisture and carbohydrate contents, while fat content was significantly lowered by increasing fat replacement level by percentages of 15.93, 32.92, 56.83 and 86.70% of original cake fat content at fat replacement levels of 25, 50, 75 and 100%, respectively. The associated reduction in caloric value was 3.84, 8.11, 13.82 and 21.22% for the above mentioned replacement levels, respectively.

2- Physical properties of cake indicated that replacing butter in cake formula with flaxseed gum caused a decrease in cake weight, volume, height and specific volume as fat replacement level increased. The pH of cake was not affected by fat replacement.

3- Texture profile analysis (TPA) showed that fat-replaced cake had significantly low hardness, gumminess and chewiness, while cohesiveness, springiness and resilience were not affected by the fat replacement levels.

4- The sensory evaluation results, of replaced cakes indicate that fat replacement did not have any significant effects on colour, whereas, flavour and texture and overall acceptance were highly accepted up to fat replacement levels of 75%.

Effect of using okra gum on cake characteristics:

1- Moisture content was higher in fat-replaced cakes when compared to the control cake, while fat content was significantly lowered by increasing fat replacement level by percentages of 19.19, 35.31, 52.99 and 74.59% than the control for fat replacement levels of 25, 50, 75 and 100%, respectively. The caloric value of cakes was decreased by 4.61, 8.35, 12.78, and 19.42% for the above mentioned replacement levels, respectively.

2- Replacing butter in cake formula with okra gum did not have any significant effects on volume of cake up to fat replacement level of 75%, while weight and height were significantly lowered by increasing fat replacement level.

3- Texture profile analysis (TPA) showed that fat-replaced cakes had significant low hardness, gumminess and chewiness, while cohesiveness, springiness and resilience were not significantly affected by fat replacement level.

4- Sensory evaluation results indicated that okra gum replacement did not have any significant effects on colour and flavour, as for texture and overall acceptance it was highly accepted up to fat replacement level of 75%.

Effect of using flaxseed gum on cookies characteristics:

1- Proximate chemical analysis results showed that cookies with flaxseed gum had higher moisture and carbohydrate, and lower fat contents. The caloric value of the produced cookies was lower than the control cookies by 3.49, 7.37, 13.41 and 18.98% than that of control cookies at fat replacement levels of 25, 50, 75 and 100%, respectively.

2- Cookies prepared with flaxseed gum as a fat replacer showed higher volume and specific volume, but on the other hand, the height and width of cookies were significantly different as compared to control.

3- Texture profile analysis (TPA) showed that hardness was not affected by fat replacement level up to 50%.

4- The sensory evaluation of cookies showed that, colour, flavour and overall acceptance were not significantly affected by fat replacement levels, and texture up to 75%.

Effect of using okra gum on cookies characteristics:

1- Cookies made with okra gum as a fat replacer had higher moisture, protein and carbohydrate contents than the control cookies. The caloric value of the produced low fat cookies was lower by percentages of 2.70, 7.59, 12.00 and 18.68% than the control cookies for fat replacement level of 25, 50, 75 and 100%, respectively.

2- Physical properties results indicated that low-fat cookies with okra gum had higher volume and specific volume, while their weight, height and width were lowered.

3- Texture profile analysis (TPA) showed that hardness was not affected by fat replacement level up to 75%.

4- The sensory evaluation results showed that fat replacement did not have any significant effects on colour, flavour, texture and overall acceptance.

Finally, it could be concluded that fat replacers under investigation (flaxseed gum and okra gum) can be used effectively to replace portions of fat up to 75% in cakes and cookies

while keeping the good sensory quality characteristics. Additionally, such replacement has achieved many economical, nutritional and health benefits when consuming the produced low-fat bakery products.

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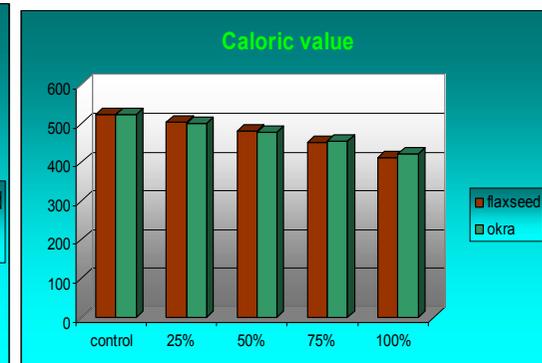
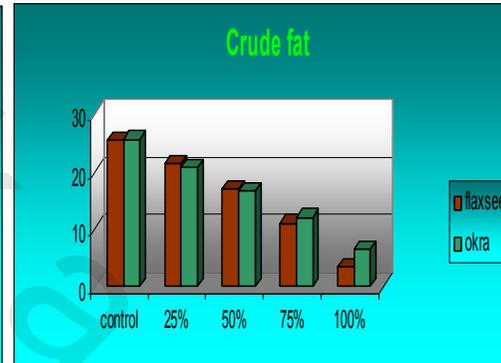
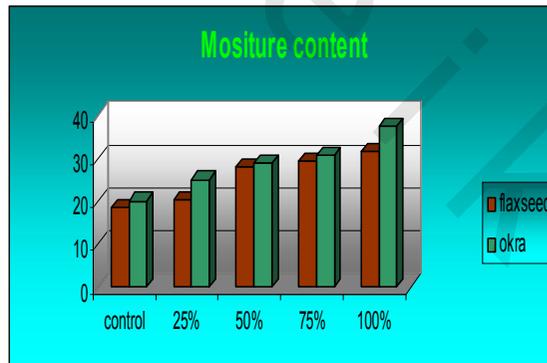
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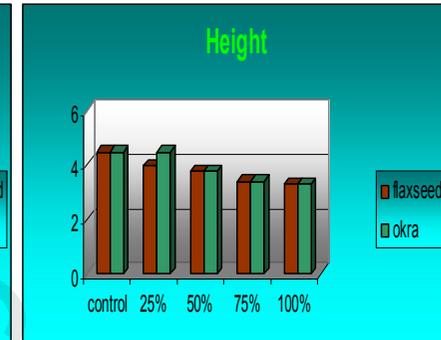
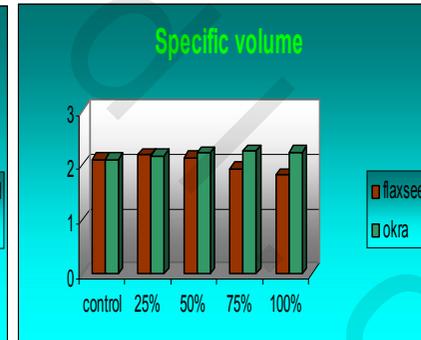
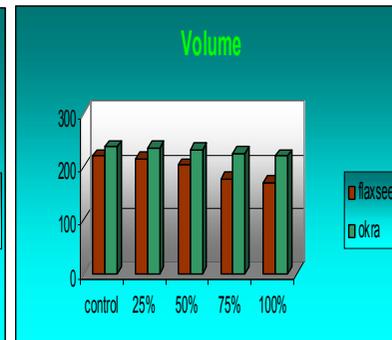
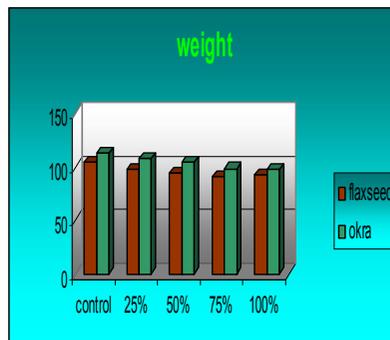
Zoulias, E.L., Oreopoulou, V & Tzia, C. **2002**. Textural properties of low-fat cookies containing carbohydrate or protein-based fat replacers. *Journal of Food Engineering*, **55** (4): 337-342.

Appendix

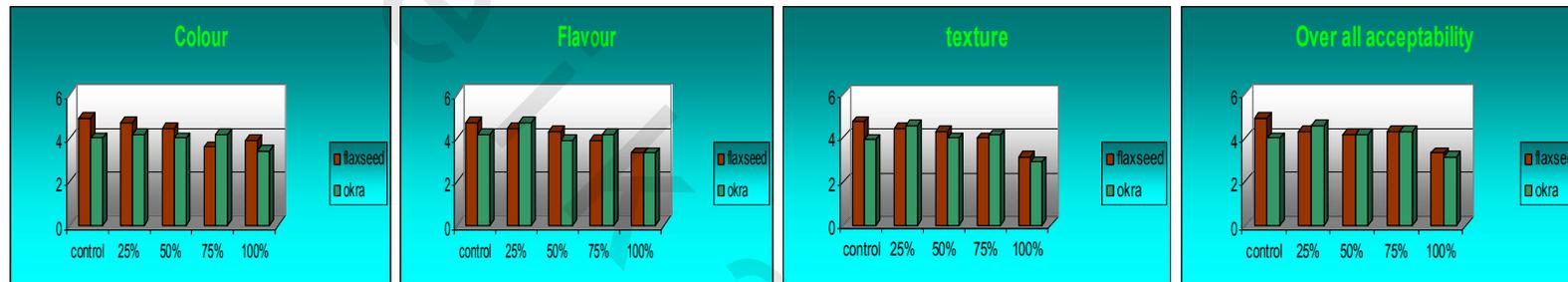
6. Chemical composition of cakes



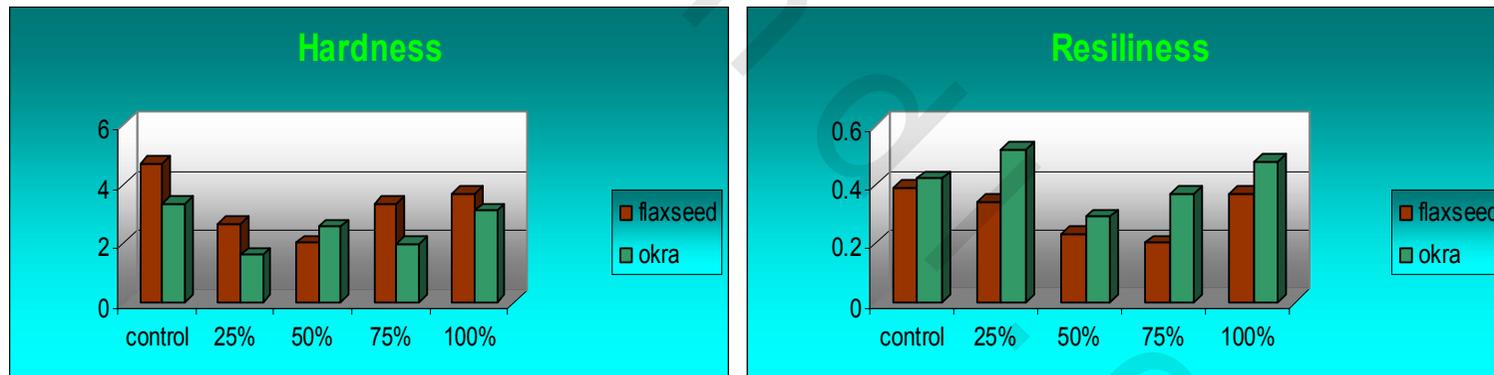
7. Physical properties of cakes



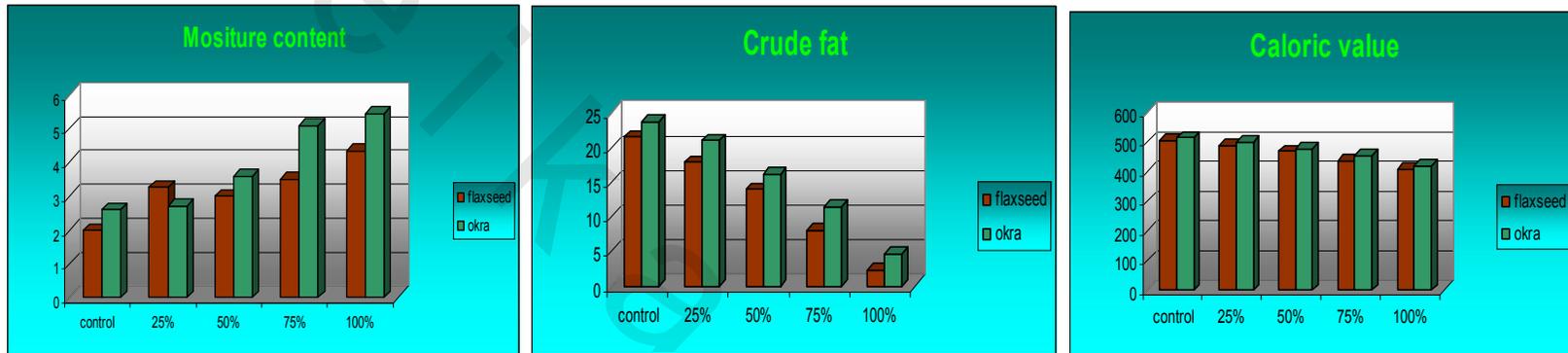
8. Sensory properties of cake



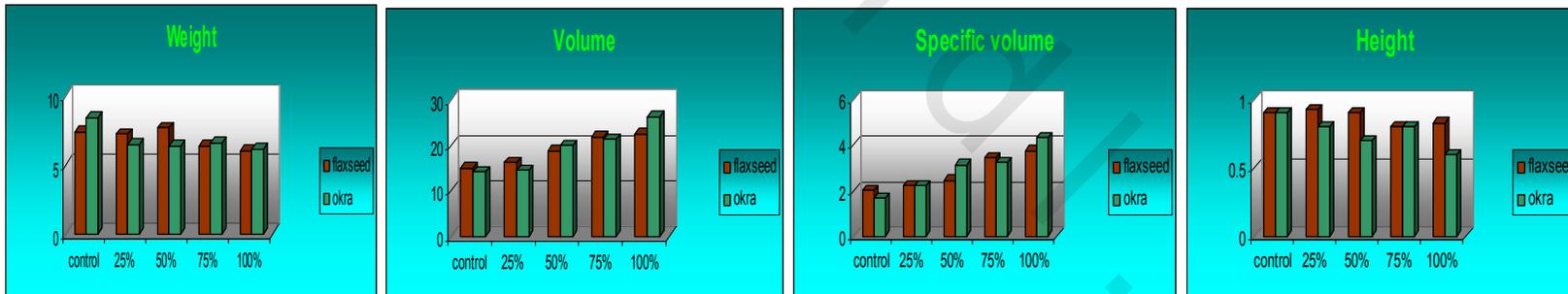
9. Texture profile analysis of cake



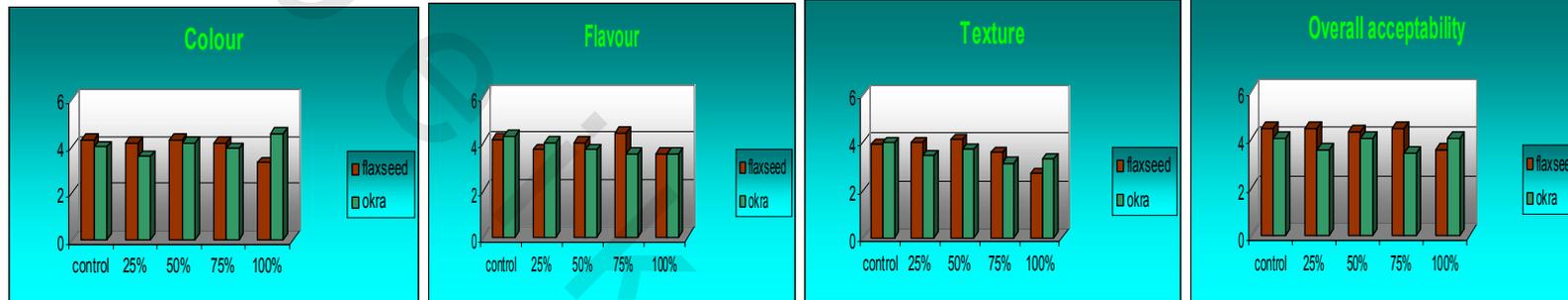
10. Chemical composition of cookies



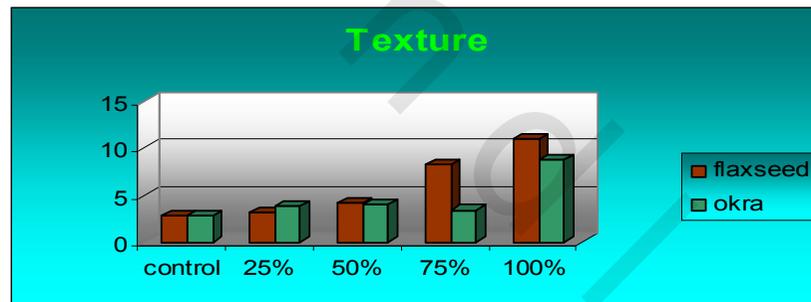
11. Physical properties of cookies



12. Sensory properties of cookies



13. Texture profile analysis of cookies



المخلص العربي

تأثير بعض بدائل الدهون على الخواص الكيميائية والفيزيائية والحسية فى المخبوزات عالية الدهن.

تعتبر الدهون أغنى مصدر للطاقة اللازمة لبناء ونمو جسم الإنسان، كما أنها مصدر إمداد للأحماض الدهنية الأساسية اللازمة لأنسجة الجسم. كما تعتبر الدهون مسئولة عن النكهة والقوام الناعم للعديد من الأغذية لذلك تؤثر على كون الأطعمة مستساغة. وبالرغم من أن الدهون تحسن من تقبل الأغذية إلا أن الأغذية العالية فى محتواها الدهنى هى أيضا عالية السرعات الحرارية مما يسبب مشاكل صحية أساسية مثل السمنة والسرطان وأمراض ضغط الدم والسكري، وبالتالي فقد ظهرت اتجاهات حديثة فى مجال التغذية تهدف إلى تخفيض محتوى المنتجات الغذائية المختلفة من الدهون، وذلك باستخدام عدة أساليب كان من أهمها استخدام بدائل الدهون أقل فى محتواها من الطاقة. وهناك العديد من منتجات الخبيز معروفة بارتفاع محتواها من الدهن والذى من أمثلتها الكيك والكوكيز، ولذلك أجرى هذا البحث بغرض دراسة تأثير استخدام بعض بدائل الدهون على الخصائص الكيميائية والفيزيائية والقوام والحسية لهذين المنتجين. وقد تم استخدام نوعين إثنين من بدائل الدهون وهما: صمغ بذر الكتان وصمغ الباميا لإستبدال 25، 50، 75، 100% من الدهن المستخدم (الزبد) فى صناعة الكيك والكوكيز.

ويمكن تلخيص النتائج المتحصل عليها من هذه الدراسة فيما يلى :-

- تأثير استخدام صمغ بذر الكتان على خصائص الكيك:

1- أوضحت التحليلات الكيميائية للكيك الناتج إرتفاع المحتوى الرطوبى للكيك المعد باستخدام صمغ بذر الكتان وكذلك إرتفاع فى نسبة الكربوهيدرات الكلية، وقد أدى استبدال الزبد باستخدام صمغ بذر الكتان إلى انخفاض محتوى الكيك الناتج من الدهون بمقدار 15,93، 32,92، 56,83، 86,70% لنسب الاستبدال 25، 50، 75، 100% على التوالى مقارنة بالعينة المرجعية مع تحقيق انخفاض فى السرعات الحرارية للكيك الناتج بمقدار 3,84، 8,11، 13,82، 21,22% عن الكيك المرجعى لنسب الاستبدال السابقة على الترتيب.

2- أظهرت النتائج أن استبدال الدهن باستخدام صمغ بذر الكتان أدى إلى انخفاضاً معنوياً فى الوزن والحجم والإرتفاع والحجم النوعى للكيك.

3- أظهرت النتائج أيضا حدوث انخفاض معنوى فى كلاً من التحمل والصمغية والمضغية ، فى حين لم يحدث تأثير معنوى فى كلاً من الترابط والمرونة والقدرة على الإنكماش.

4- أظهرت نتائج التقييم الحسى للكيك تقبل المحكمين لاستبدال الدهن باستخدام صمغ بذر الكتان على كل من اللون والنكهة وكذلك فى كل من القوام والتقبل العام حتى نسبة استبدال 75%.

1-2- تأثير استخدام صمغ الباميا على خصائص الكيك:

1- أظهرت نتائج التحليلات الكيميائية إرتفاع المحتوى الرطوبى للكيك المعد باستخدام صمغ الباميا عن الكيك المرجعى ، مع انخفاض فى المحتوى من الدهن بمقدار 19,19، 35,31، 52,99، 74,59% وكذلك انخفاض فى القيمة السعيرية بمقدار 4,61، 8,35، 12,78، 19,42% وذلك لنسب الاستبدال 25، 50، 75، 100% على التوالى.

2- بالنسبة لتأثير استبدال الدهن باستخدام صمغ الباميا على الخصائص الطبيعية للكيك ، فلم يحدث تأثير كبير فى الحجم حتى نسبة استبدال 75% ، فى حين حدث انخفاض نوعى فى كل من الوزن والارتفاع مع زيادة نسب الاستبدال.

3- كما أظهرت نتائج تحليل القوام حدوث انخفاض معنوى فى الكيك المستبدل بصمغ الباميا فى كل من التحمل والصمغية والمضغية، فى حين لم يحدث أى تأثير معنوى على كل من الترابط والمرونة والقدرة على الإنكماش.

4- أوضحت نتائج التقييم الحسى للكوكيز الناتج تقبل عالى لكل من اللون والنكهة حتى 100% فى حين تم تقبل القوام والتقبل العام حتى نسبة استبدال 75%.

- تأثير استخدام صمغ بذر الكتان على خصائص الكوكيز:

1- أوضحت نتائج التحليلات الكيمائية للكوكيز الناتجة ارتفاع محتواها من الرطوبة والكربوهيدرات كنتيجة لاستبدال الدهن بينما انخفض محتواها من الدهون وكذلك انخفضت القيمة السعرية لها بمقدار 3,49، 7,37، 13,41، 18,98% عن الكوكيز المرجعية لنسب الاستبدال 25، 50، 75، 100% على التوالى.

2- أظهرت نتائج القياسات الطبيعية ارتفاع حجم الكوكيز الناتجة بزيادة نسبة استخدام صمغ بذر الكتان كبديل للدهن وكذلك ارتفاع حجمها النوعى بينما قل ارتفاعها وكذلك قطرها.

3- أوضحت نتائج تحليل القوام أن الكوكيز الناتج من استبدال الدهن بصمغ بذر الكتان لم تتأثر معنوياً بالنسبة للتحمل حتى نسبة استبدال 50%.

4- بالنسبة للتأثير على الصفات الحسية، تم تقبل المحكمين لكل من اللون والنكهة والقوام والتقبل العام حتى نسبة استبدال 75%.

- تأثير استخدام صمغ الباميا على خصائص الكوكيز:

1- أوضحت التحليلات الكيمائية ارتفاع محتوى الكوكيز الناتجة من الرطوبة والبروتين والكربوهيدرات بينما حدث انخفاض فى محتواها من الدهون عند مقارنتها بالعينة المرجعية، مع تحقيق انخفاض فى السرعات قدر ب 2,70، 7,59، 12,00، 18,68% عن الكوكيز المرجعية عند إضاقه صمغ الباميا بنسب 25، 50، 75، 100% على الترتيب.

2- أظهرت نتائج القياسات الطبيعية ارتفاع حجم الكوكيز وكذلك حجمها النوعى ، فى حين حدث انخفاض نوعى فى الوزن والإرتفاع والقطر مع زيادة نسبة الاستبدال.

3- أظهرت نتائج تحليل القوام أن الكوكيز الناتج من استبدال الدهن بصمغ الباميا لم تتأثر معنوياً بالنسبة للتحمل حتى نسبة استبدال 75%.

4- بخصوص تأثير نوع البديل على الخصائص الحسية للكوكيز، فقد أظهرت النتائج عدم حدوث أى تأثير على كل من اللون والنكهة والقوام والتقبل العام مع زيادة نسبة الاستبدال.

وفى النهاية فقد خلصت الدراسة إلى امكانية استخدام بدائل الدهون محل الاختبار وهى صمغ بذر الكتان وصمغ الباميا بنسب استبدال تصل الى 75% من الدهن المستخدم فى صناعة الكيك والكوكيز، وذلك لإنتاج منتجات خبيز تتميز بجودتها الطبيعية والحسية مع انخفاض محتواها من الدهون وكذلك انخفاض فى قيمتها السعرية ، وذلك لتحقيق فوائد غذائية وصحية عديدة للمستهلك.