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Preparation and Evaluation of Oat-Kishk Flakes as a New Product

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Abstract: In the present study, Oat-Kishk flakes were produced from traditional fermented Kishk and oat. Oat was used as 10, 20 and 30% replacements of Kishk flour to produce Oat-Kishk flakes. Evaluated rheological, proximate composition, color quality and sensory attribute of control kick, control oat and Oat-Kishk flakes formulas made from Kishk and oat were investigated. Pasting profile of breakfast cereals formulas from Kishk and oat flours were measured by rapid Visco-analyzer. The chemical composition analysis of Oat-Kishk flakes formulas was in the following ranges: protein 165.6-182.8, fat 54.2-74.3 and carbohydrates 594.0- 621 g/kg. The energy contents were increased in Oat-Kishk flakes formulas with increasing of oat replacement. The moisture, ash and fiber content were decreased with addition oat to Oat-Kishk flakes formulas. Differences in sensory attributes were associated with oat concentration but there were no significant differences between formula 2 and 3 in color, taste and overall acceptability. Appreciable quantities of oat and Kishk formula were found in formula 2 and formula 3. The prepared Oat-Kishk flakes containing Kishk and oat showed satisfactory results.

Key words: Kishk · Fermented · Oat · Flakes · Traditional

INTRODUCTION

Kishk is the popular fermented dairy cereal dried in Middle East and Egypt. Kishk is a dried mixture of fermented milk and cereal, widely consumed in the North and the Upper Egypt especially in Upper Egypt. Kishk is usually reconstituted with hot milk or hot tea as breakfast meal. Kishk is made from a combination of wheat with natural local sour milk like Laban Khad, Laban Zeer or Laban Rayeb. The mixture is shaped then dried in the hot shade or sun. In addition, Kishk is rich in nutritive constituents of many vitamins and growth factors associated with the microbial fermentative processes [1], Kishk is good source of the amino acids composition of the protein, selenium and dietary [2]. Breakfast cereals have been defined as ‘‘processed grains for human consumption’’ corn, rice, wheat, oats and barley are the major grains used in manufacture Breakfast cereals [3]. Fermentation cereal is inexpensive way to increasing nutritional value, sensory properties and functional qualities of cereal might lack some basic components e.g. essential amino acids [4]. Peterson *et al*. [5] mentioned that oats contain large amounts of antioxidants such as vitamin E, various phenolic compounds and Phenolic amides (avenanthramides). For these high nutritional values, oat-based food products like breads, biscuits, cookies, probiotic drinks, breakfast cereals, flakes and infant food are gaining increasing popularity [6].

Oat-based breakfast cereals have a great interest as functional ingredient rich in b glucan, a bioactive component, which has been promoted as a means of reducing serum and plasma cholesterol levels [7, 8] and reducing the postprandial glycemic response [9-11]. Fermentation cereals extended products shelf life, also caused improvement in texture and flavor [12]. Consumption of high-cholesterol diet supplemented with various levels of Kishk for 8 weeks induced a significant protective effect reflected in the reductions of the serum levels of aspartate transferase and alanine transferase, as well as kidney functions (uric acid, urea and creatinine) [13]. Kishk had a slightly lower content of phytic acid this may be due to the catalytic action of phytase produced by micro-organisms during the Kishk fermentation period [14].

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All over the world breakfast cereals have become firmly established on breakfast tables. These products today have a wide variety of forms, tastes and colors. Many `new' products are based on traditional food, the old shape of Kishk has been not acceptable for the modern life because people nowadays prefer breakfast cereals than the traditional product. The aim of the study was the utilization of traditional product (Kishk) and the benefits of oats to produce the new breakfast cereals and studying rheological properties, sensory attributes and color quality of products. Proximate composition of the promising food products was assessed.

MATERIALS AND METHODS

Materials: Wheat, oat, Laban Khad, cuminum and salt were obtained from the local market, Assiut, Egypt.

Kishk Preparation: The Kishk was prepared according to Abou-Donia [15]. Concentrated salted sour buttermilk, called laban zeer was prepared by processing milk directly into butter. In summer, under hot weather, milk naturally coagulates because of bacterial multiplication. The coagulated milk was stored in earth ware pots (zeer). The pores in the zeer's walls are semi permeable and thus the moisture was liberated from the milk. The sour buttermilk was concentrated and salt was added. The final pH of the buttermilk reached 3.5-3.8 and titratable acidity was between 1.3 and 1.6%. The concerted buttermilk was thoroughly mixed with moistened wheat which was boiled until it became soft. Cooking the wheat grains gelatinized the starch (called Belella). The cooked wheat was dried in the sun, crushed using a stone hand mill and sieved in order to remove the bran. Fermentation was allowed to proceeding forward a further 24 hours. Subsequently, the mass was thoroughly mixed and formed into small, round or irregular pieces and dried in the sun on straw mats for 2 or 3 days [1].

Preparation of Oat-Kishk Flakes: Oat-Kishk flakes were prepared from traditional Kishk and oat. Manufacture Oat-Kishk flakes 10, 20 and 30% (w/w) replacement of Kishk with oat. There were control1 Kishk (100% Kishk) control2 oat (100% oat) and formulas as followed: formula 1 (90% Kishk and 10% oat), formula 2 (80% Kishk and 20%oat) and formula 3 (70% Kishk and 30%oat). The dough was prepared according to Zwer [16] and Hussein *et al*. [17], cut into small pieces, spread into thin layers on a tray, cut into flakes, then placed in the oven at 250ºC for 4 min. The formulas of different concentrations of oat and Kishk are shown in Table 1.

Table 1: Formulation of Oat-Kishk flakes formulas from Kishk and oat flour

Samples	Kishk (g)	Oat flour (g)
Control 1	100	0
Control 2	0	100
Formula 1	90	10
Formula 2	80	20
Formula 3	70	30

1 = control Kishk sample (100% Kishk flour), 2 = control oat sample (100% oat flour), formula 1 Oat- Kishk flakes= (90% Kishk flour, 10% oat flour), formula 2 Oat- Kishk flakes = (80% Kishk flour, 20% oat flour) and formula 3 Oat- Kishk flakes = (70% Kishk flour, 30% oat flour)

Sensory Attributes of Oat-Kishk Flakes: Organoleptic characteristics of Oat-Kishk flakes were evaluated according to Zabik and Hoojjat [18]. Each panelist was asked to assign scores 0–10 for color, odor, taste, texture, crispness, appearance and overall acceptability. A sensory score of 5 or above was deemed acceptable and a sensory score below 5 was considered unacceptable.

Chemical Composition: Moisture, protein, crude fibers, fat, ash and total carbohydrates were determined according to the methods outlined in A.O.A.C. [19].

Measurement of the Color of Oat-Kishk Flakes: Hunter color parameter: Changes in Hunter color parameter (L, a &b) of different blends (flours) were followed up using Tristimulus Color Analyzer (Hunter, Lab Scan XE, Reston, Virginia) with standard white tile.

Rheological Properties: Rapid Visco Analyzer (RVA): flours pasting properties were determined by subjecting a starch suspension of 2 g starch in 25 ml distilled water to a controlled heating and cooling cycle under constant shear using a Rapid Visco Analyzer - 3 series (Newport Scientific Pvt Ltd, Australia). Pasting parameters were measured over time. These parameters included onset of pasting to peak viscosity (Ptime); temperature at which peak viscosity was reached (Ptemp); peak viscosity (PV); viscosity at the end of the holding time at 95°C or hot paste viscosity (HPV) and viscosity at the end of the holding time at 50°C or cold paste viscosity (CPV). From these parameters, breakdown, stability ratio and setback ratio were calculated.

Statistical Analysis: Statistical analysis of experimental data was performed by analysis of variance (ANOVA) producers using SPSS version 9.0 program to examine statistical significance differences of sensory analysis means of experimental data. Results were considered statistically significant when $p < 0.05$. Mean ± standard deviation values were also presented.

RESULTS AND DISCUSSION

Proximate Composition: The Proximate compositions of Oat-Kishk flakes formulas from Kishk and oat (Table 2) was within the following ranges: moisture content (78.0-89.0 g/kg), ash (50.2-68.3 g/kg), fiber (10.5-11.7 g/kg), protein (165.6-182.8 g/kg), fat (54.2-74.3 g/kg) and carbohydrate (594.0-621.4 g/kg). There were significant differences ($p \leq 0.05$) among the formula 1, 2 and 3 in terms of moisture, ash, protein and fat. The moisture content of the Oat-Kishk flakes decreased with increasing addition of oat flour to formulas that indicated the Formula 3 would have better storage stability than the formula 2 and formula 3. Decreasing in moisture content of a food increases shelf life of products because that inhabit microbial activities, enzymatic and none enzymatic reactions which cease spoilage [20]. There was decrease in protein content of Oat-Kishk flakes with increasing addition of oat flour that due to the Kishk has high protein than oat. El-Gendy [1] recorded high protein contain in dried Kishk reached to 230 mg/kg. Nutritionally mixture of two protein proportions results in complementary protein such milk proteins have lysine which is deficient in wheat in addition the essential amino acids that are useful for the consumers [21, 22]. The fat content of the Oat-Kishk flakes decreased with increasing addition Kishk flour because oat cereal contains 2 or 3 times more fat than wheat [23]. Higher ash content in Oat-Kishk flakes was an indication of higher contents of minerals [20] and differences in ash content was influenced by the type of cereal used [23]. Fibre has been known as reduce of cholesterol and maintenance of human health [24]. The fibre content of the Oat-Kishk flakes decreased with increasing oat flour addition because reflecting de-husking efficiency [23]. Generally, there were an increase in protein and fibre content with increasing levels of Kishk flour. The carbohydrate content increased in Oat-Kishk flakes with increasing addition of oat flour that may be due to the fat content in oat was high [23] (Table 2). Oat-Kishk flakes energy values were ranged from 3595.0 to 3816.7 kcal in the formulas. This result indicated that the Oat-Kishk flakes formulas have varied energy values increased with increased oat added.

Pasting Properties: The pasting properties (peak 1, trough, breakdown, final viscosity, setback, peak time pasting temperature) of Oat-Kishk flaks dough of different formulas of Kishk and oat are shown in Table 3. The pasting characteristics of dough samples prepared from Kishk containing 10, 20, 30 % oat replacement determined with rapid Visco-Analyser- 3 series. The peak viscosity is a measure of the ability of Oat-Kishk formulas paste on cooking. Peak viscosity occurs at equilibrium between granule swelling which increases viscosity and granule rupture and alignment, which cause its decrease [25]. The peak viscosity of formulas ranged from 358-856 RVU reducing as substitution Kishk with 10, 20 and 30% oat. The pasting temperature of formula 3 (89.65C) was lower than that of formula 2 (92.80C). The peak time taken to reach pasting temperature of formula 3 was 5.60 m was lower than that of formula 1 (5.30) that mean increasing of oat adding 10, 20 and 30 % to Kishk flour increased the peak time and decreased the pasting temperature needed sample to get cooked. Decreasing in the peak, trough, breakdown, final and setback viscosity values decreased and peak increased in the time and pasting temperature values with increasing in Kishk concentration in the Oat-Kishk formulas that may be due to the fiber type of Kishk. The differences in pasting temperatures of the Oat-Kishk formulas indicate the substitution of oat at these levels had effect on initial pasting temperature of the Kishk formulas [26]. Regarding the effect of fiber type on the pasting viscosity, oat fiber although it was lower concentration but it was most effective in increasing these viscosity values [27]. Final viscosity is an important parameter in predicting and defining the final textural quality of foods. The current study reported that the adding oat to Kishk formulas recorded high final viscosity value. The formula1 observed low final viscosity that indicates low tendency of retrograde [28]. The disintegration degree stability was measured during heating using breakdown viscosity [25]. That indication of this observation was formula 1 the lowest breakdown value (115RVU) was more heat resistant and shear force during heating and that there was less starch granule rupture which could therefore guarantee a more stable cooked paste [29]. Setback viscosity is an indication of the stability of cooked paste against retrogradation it can be used to predict the product prepared storage life from the formulas [26]. The setback viscosity was increased with increasing of oat flour these results are in agreement with Berski *et al.* [30] also, for domestic products the high setbacks viscosity value is useful.

Color Attributes of Oat-Kishk Flakes: Color attributes of Oat-Kishk flakes formulas are shown in Table 4. The lightness "*L*" values of the tested samples decreased in formulas containing high Kishk content compared with oat content, this due to the content of Belella in Kishk [31]. The values of "*a*" (degree of redness) indicated that Oat-Kishk flakes prepared using Kishk at different levels were more red than those of oat formula. The high "*a*"

Table 2: Proximate of Oat-Kishk flakes formulas from Kishk and oat flours

*Samples	Moisture g/kg	Ash g/kg	Crude Fiber g/kg	Crude Protein g/kg	Crude Fat g/kg	Carbohydrate g/kg	Energy (kcal)
Control 1	91.8±1.02[a]	69.8±1.02[a]	11.7±1.85[a]	194.4±1.15[a]	56.9±1.87[a]	575.4±474[a]	3591.3±4.42[a]
Control 2	76.2±1.43[b]	42.7±1.44[b]	6.5±0.73[b]	123.6±1.25[b]	75.4±0.63[b]	675.6±3.65[b]	3875.4±3.86[b]
Formula 1	89.0±1.21[c]	68.3±1.21[c]	11.7±1.40[a]	182.8 ±1.05[c]	54.2±1.85[c]	594.0±1.79[c]	3595.0±1.78[c]
Formula 2	85.2±0.85[d]	57.3 ±0.85[d]	11.1±1.85[c]	177.1±1.02[b]	58.3±1.58[d]	611. 0 ±3.40[d]	3677.1±4.76[d]
Formula 3	78.0±1.51[e]	50.2±1.51[e]	10.5±3.15[d]	165.6±0.86[d]	74.3 ±2.89[e]	621.4±1.41[e]	3816.7±4.53[e]

*Samples number matches formulas in Table 1

[abc] Values in the same columns having different superscripts are significantly different ($p<0.05$)

Table 3: Pasting profile of Oat-Kishk flakes formulas, Kishk and oat flours by rapid Visco-analyzer.

	Analytical parameter						
*Samples	Peak 1	Trough	Breakdown	Final Visco.	Setback	Peak Time	Pasting Temp.
Control 1	183	172	11	275	103	5.97	92.0
Control 2	3319	1169	2150	1967	798	5.27	75.05
Formula 1	358	243	115	417	174	5.33	92.15
Formula 2	509	322	187	549	227	5.60	92.80
Formula3	856	326	530	882	352	5.60	89.65

*Samples number matches formulas in Table 1

Table 4: Color quality of Oat-Kishk flakes formulas from Kishk and oat.

*Samples number	L*	a*	b*	ΔE
Control 1	65.21	9.46	30.36	72.55
Control 2	72.32	4.83	30.07	78.47
Formula 1	66.86	9.02	32.28	74.79
Formula 2	65.61	9.11	30.84	73.07
Formula3	67.19	8.33	31.37	74.62

*Samples number matches formulas in Table 1

L* degree of lightness

a* degree of redness

b* degree of yellowness

ΔE is a single value that takes into account the differences between the L, a and b of the sample and standard.

Table 5: Sensory attributes of Oat-Kishk flakes formulas from Kishk and oat

*Samples	Color	Odor	Taste	Texture	Crispness	Appearance	Overall acceptability
Control 1	7.9±0.85[a]	9.2±0.95[a]	8.9±1.91[a]	8.6±0.94[a]	8.0±4.02[a]	7.9±1.78[a]	7.3±2.07[a]
Control 2	8.6±1.42[b]	7.3±0.88[b]	7.6±0.84[b]	6.2±3.96[b]	7.7±1.23[b]	7.5±0.99[b]	6.1±2.57[b]
Formula 1	8.3±1.08[c]	7.6±2.56[c]	9.0±1.81[c]	7.1±1.68[c]	8.5±2.46[c]	8.3±1.51[c]	7.8±1.56[c]
Formula 2	8.9±0.82[d]	7.9±3.41[d]	9.4±2.86[d]	7.9±2.48[d]	8.8±1.84[d]	8.9±1.47[d]	8.0±2.15[d]
Formula3	9.0±2.03[d]	8.6±1.98[e]	9.5±1.56[d]	7.7±1.79[e]	8.7±1.08[e]	9.3±1.25[e]	8.0±3.06[d]

*Samples number matches formulas in Table 1

[abc] Values in the same columns having different superscripts are significantly different ($p<0.05$)

values may be attributed to the presence of the red to brown pigments naturally present in the fiber. Value of "*b*" (degree of yellowness) of Oat-Kishk flakes formulas was 32.28, 30.84 and 31.37 for formula 1, 2 and 3, respectively. Overall color quality (ΔE) was in lower levels in all Oat-Kishk flakes formulas contenting oat compared with Kishk formula This may be overcome by oat flour and the presence of bran particles in the flour [32, 33].

Sensory Attributes: Sensory attributes of Oat-Kishk flakes formulas from Kishk and oat are recorded in Table 5. There were significant differences ($p \leq 0.05$) among Oat-Kishk flakes formulas with increased of oat addition. Oat-Kishk flakes formulas showed that there were no significant differences between formula 2 and 3 in color, taste and overall acceptability attribute values. Formula 3 recorded the highest score value in color than formula 2 and 3 because it was light than the other Oat-Kishk flakes formulas. These results might be due to addition oat case which increased lightness "*L*" values which response of acceptably preference of formula 3, these results are in agreement with Popov-Raljiæ *et al*., [34]. Sensory attribute of taste showed preference for Oat-Kishk formulas containing 20 and 30% oat flour.

There were no significantly difference ($p \leq 0.05$) between formula 2 and 3 of taste. Appearance was significantly different ($p \leq 0.05$) among the Oat-Kishk formulas and formula 3 recorded highest appearance value than formula 2 and 3 which contained high content of oat. Crispness of Oat- Kishk formulas was significantly different ($p \leq 0.05$) among formulas and formula 3 recorded highest crispness than the other formulas. Finally, all sensory attributes has significant change with increased level of oat flour. It is worthy to record that addition of 20 and 30% oat to Oat-Kishk formulas elevated the scores of the sensory attributes. Salehifar and Shahedi [35] recorded that the produces with up to 20% oat flour were stable and with good quality as indicated by sensory evaluation flour had larger particle size in comparison to wheat flour. The present study showed the addition of oat to Kishk was modified accepted and attracted Oat-Kishk flaks product by the consumers.

CONCLUSIONS

Variations in the evaluated rheological, proximate composition, color quality and sensory attribute of Oat-Kishk flakes made from Kishk and oat were observed. Appreciable quantities of oat and Kishk formula were found in formula 2 and formula 3. Oat-Kishk flakes formula 2 is a good source of moisture, ash, protein and fiber, on the other hand Oat-Kishk flakes formula 3 is a good source of fat, carbohydrate and energy. Differences in sensory attribute were associated with oat concentration but there were no significant differences between formula 2 and 3 in color, taste and overall acceptability. In particular, differences in pasting profile of breakfast cereals formulas from Kishk and oat flours were associated with concentration of oat to Kishk. All The pasting properties (peak 1, trough, breakdown, final viscosity, setback and peak time) except pasting temperature were decreased as substitution of oat with Kishk. The increasing of oat flour in Oat-Kishk flakes formulas decreased overall color quality (ΔE) in formulas. It can be inferred that addition oat to Kishk for produced breakfast cereals can be very useful in the formulation of food component parts. Finally, it is possible to produce breakfast cereal using the Kishk and oat like formula 2 and 3 which recorded good technological properties.

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