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Preparing and Evaluation Pies to Feed the Elderly

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ABSTRACT
The purpose of this research is to study the effect of replacing wheat flour 82% ext. with oat flour (OF), white sweet potato flour (WSPF), sesame seeds flour (SSF). And replacing corn oil with sesame oil to produce pie for the elderly. The results showed that the four mixtures substituted for the farinograph increased the rate of water absorption and arrival time, while the dough development time and dough stability decreased. As for the extensograph, resistance to extension (R) and extensibility (E) decreased, on the contrary, the Proportional number (R/E) increased. In terms of chemical composition, it was found that of substitutions led to an increase in protein, ash, and fiber, while carbohydrates decreased. The minerals also increased in potassium (K), calcium (Ca) magnesium (Mg), manganese (Mn), iron (Fe) and zinc (Zn). In terms of sensory characteristics, it was found that the percentage of replacement with natural materials used led to significant differences between the replaced samples and the control sample, the control sample was the least sensory. It was also found that the replacements affected the physical characteristics. The pie was stored for six days at room temperature (27±3°C), it was observed that both weight and volume decreased in all samples, the control sample recorded the highest percentage of decrease, while the specific volume increased in the replaced pie samples. also, showed results that, compared to control, the best samples were C and D of pies with the added sesame flour had higher water-absorbing ability in the process of storing, indicating their decreased staling, a significant amount of the daily requirements were found to be satisfied by the pies substitute.

Keywords: Elderly, wheat flour 82% ext., oat flour, white sweet potato flour, sesame seeds flour, pie, rheological properties, stored and RDA.

1. Introduction
The world's population is aging, and many elderly people experience age-related malnutrition, Malnutrition in the elderly is a serious condition when the nutritional needs of the elderly do not match their food intake (Mustofa *et al*. 2023).

This condition can also be referred to as malnutrition or unbalanced nutrition in the elderly, leading to the following two conditions: malnutrition (not getting enough nutrients) and excess nutrition (getting more nutrients than needed) (Das *et al.,* 2021).

The population of elderly worldwide is increasing unnoticed as time goes by it is estimated to reach 500 million with an average age of 60 years and is expected to reach 1.2 billion in 2025, and will continue to increase with an estimate of reaching more than 2 billion in 2050 (Vural *et al.,* 2020).

The concept of functional foods is about consuming foods with benefits beyond basic nutritional needs or nutritional adequacy. Functional foods are designed to improve the metabolic functions in the human body and help in preventing noncommunicable diseases such as cardiovascular diseases (CVDs), cancer, diabetes type 2, and osteoporosis (Martirosyan and Singh, 2015).

Functional foods are that have been identified to offer therapeutic functions besides their nutritional roles in diets Galanakis (2021), functional foods are, in addition to providing basic nutrients, have health-promoting effects when ingested consistently over a period of time. a lot of attention has

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been drawn to its consumption as a cheaper and safer remedy for the prevention, treatment, and management of several health-related conditions, Consumption of prescribed functional foods can alleviate functional disorders of the body tissues. (Kayode *et al.*, 2023).

Oats stand out among other cereals for their high content of highly digestible quality potein with good amino acid balance, lipids, minerals, vitamins such as Vitamin E, avenanthramides (antioxidants) and phenolic compounds. Health benefits associated with oats include glucose lowering effects (Makinen *et al.,* 2016) and reduction of cholesterol and risk of heart disease attributed to its soluble dietary fiber content of beta-glucan (European Food Safety Authority, 2011).

Sweet potato is one of the most economically important crops for addressing global food security and climate change issues, especially under conditions of extensive agriculture, such as those found in developing countries. Sweet potato often called "almost perfect nourishing food" contains vitamins, minerals, and many other nutrients in favourable ratios. Therefore, promoting the utilization of sweet potato in various food preparations could provide affordable source of nutrients that can improve malnutrition. (Sapakhova et al. 2023)

According to Singh *et al.* (2016), sesame seeds are an excellent source of calcium and a fantastic supply of omega-6 and vitamin E, as well as having a significantly higher calcium content than dairy products.

Sesame is one of the rich sources of phytosterols which are groups of steroid alcohols and esters had the health benefits to lower total and Low Density Lipoprotein (LDL) blood cholesterol by barring cholesterol absorption from the intestine Abilasha *et al.,* (2016). Sesame oil is the most stable vegetable oil with a long shelf life resistant to deterioration which contains natural antioxidants such sesamin, sesamolin, and sesamol, (Pusadkar *et al.,* 2015; Ali and Batu, 2020).

The aim of the study was preparing a novel, high-nutritional product to address the demands of a specific (the elderly) and improve their overall health, as there is currently no product of this kind available on the market.

2. Materials and Methods

2.1. Materials

Wheat flour (82% extraction) was obtained from North Cairo Mills Company El- Salam city, Cairo, Egypt. Other ingredients: (oat grains, whit sweet potato, sesame seeds), instant dry yeast, sugar (sucrose), salt, dry milk and corn oil, obtained from the local market, Cairo, Egypt.

Tables 1: The formulas ingredients for preparing pies.

Ingredients (gm)	Samples				
	Control	**A**	**B**	**C**	**D**
Wheat flour 82% (WF)	100	40	30	20	-
Oat flour (OF)	-	10	20	40	60
Whit sweet potato flour (WSPF)	-	40	30	10	10
Sesame seeds flour (SSF)	-	10	20	30	30
Sugar (sucrose)	10	10	10	10	10
Dry milk	4	4	4	4	4
Corn oil	16	10	5	-	-
Sesame seeds oil	-	5	10	10	10
Instant dry yeast	3	3	3	3	3
Salt	0.75	0.75	0.75	0.75	0.75
Water	As required farinograph				

Control = 100% WF,A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF.

2.2. Methods

2.2.1. Preparation of raw materials:

2.2.1.1. Oat grains

Oat grains were milled by Hammer mill to pass through 110 um (21 mesh) to produced oat flour and preserved was ground into fine powder packed in polyethylene bags and stored in deep freezer until use.

2.2.1.2. Whit sweet potato

Roots were washed, peeled, and chopped fairly finely. The pieces were dried in cabinet dryer at 60 – 65 ºC temperature 80 m /h air flow rate for 24 h. After drying the pieces were ground separately using a laboratory mill (Athelzion, HZ: 50, H: I, V: 220, Italy) and sieved to produce the grade of flour required.

2.2.1.3. Sesame seeds

The sesame seeds is also purified from impurities, then ground well in a laboratory mill (Athelzion, HZ: 50, H: I, V: 220, Italy) and packed in polyethylene bags until used.

2.3. Preparation of pies

Pies samples were prepared according to the method of A.A.C.C. (2016), with some modification. The ingredients in pies production are presented in Table (1). For pie preparation, 100 g Wheat flour 82% ext. was replaced with different proportions (10-20-40 -60 %) of Oat flour (OF), (40-30-10-10 %) Whit Sweet Potato flour (WSPF), (10-20-30-30 %) with Sesame Seeds flour (SSF), 10 g sugar, 3 g yeast, 4 g dry milk 0.75 g salt and (16g Corn oil as control), and replaced with Sesame Seeds oil (5, 10,10,10 %), and water as required by Farinograph. All ingredients were mixed well, and were kneaded for 10 min at low speed in Chef Premier (Braun M1000) to make the dough. The dough was kept in a fermentation cabinet for 30 min at 30°C and 80% relative humidity (RH), then it was divided into small pieces (40 g) and formed, then the pieces of dough were left once again for fermentation at 30°C for 30 min. then baked at 180°C for 20 min in an oven, and the pies were cooled at ambient temperature (27±3°C) for 1 h before quality evaluation.

2.4. Chemical analysis

Crude protein, moisture content, ash, fats and crude fibers were determined according to the methods described in the A.O.A.C. (2016). Total carbohydrate was determined by difference.

2.5. Calculation of energy (Kcal/100g sample)

According to Chaney, (2006), the energy value (EV) was calculated for different pies samples as follows:

Energy value (Kcal/100 gram sample) = (Carbohydrates% + proteins %) x 4 + (fats% x 9).

2.6. Mineral profile

Samples were processed and the determination of minerals were analyzed. Microwave digestor (Multiwave GO Plus 50 HZ) was used prior to spectrophotometric analysis of the samples by MPAES(Microwave Plasma -Atomic Emission Spectroscopy) (Agilent, Mulgrave, Victoria, Australia), according to the method of (Agilent Technologies, Inc. 2021).

2.7. Rheological properties

The farinograph instrument was used to determine the water absorption (%), arrival time (min), dough development time (min), dough stability (min) and dough weakening (B.U) were determined according to the methods described in A.A.C.C. (2016).

Extensograph test was carried out according to the method described by A.A.C.C. (2016). Resistance to extension (R) (B.U), extensibility (E) (mm), Proportional number (R/E) and dough energy (cm^2).

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2.8. Sensory evaluation of pies samples

Ten skilled panellists from the Baking and Pastry Department of Food Technology Research Institute, Agricultural Research Centre, were chosen based on their interests, lack of dietary allergies, and nonsmoking status to do a sensory analysis of pie samples. The sensory analysis was carried out in a daylight room, according to Lee (2015), the following criteria were used to develop the grading scheme: color (7), flavor (7), taste (7), softness (7), and overall acceptability (7) degrees.

2.9. Physical characteristics of pies

Pies samples were cooled at room temperature before their quality features were evaluated. The pies was weighed, and from each blend, the height and diameter of each piece were calculated. Piece volume was calculated using the lucerne seeds displacement method (Hallen *et al.,* 2004). This involved placing a known mass of sample (weight of pie) in a container, covering it completely with lucerne, and noting the rise in volume. This equation was used to compute specific volume: Specific volume (cm^3/g) = piece volume (cm^3) / piece weight (g).

2.10. Determination of pies staling

The staling of pies were tested by alkaline water retention capacity (AWRC) determination according to the method of Kitterman and Rubemthaler (1971).

2.11. Statistical analysis

The SAS (1987) programme was used to perform analyses of variance (ANOVA) in order to determine the significant differences towards the different means at the 0.05 level.

3. Results and Discussion

3.1. Chemical composition (%) and Minerals content of raw materials (mg /100g).

Results are shown in Table (2) refers to the chemical composition of raw materials, the data indicated that there are significant differences between all of raw materials. The highest level of protein, ash, fat content scored in sesame seed flour at 34.55, 8.04 and 45.71 %, respectively, while, the lowest level of protein content was found in sweet potato flour at 3.45 %. followed by wheat flour ext. 82% at (12.50%), then oat flour (13. 70%).

Table 2: Proximate chemical composition of Wheat flour, Oat flour, Whit Sweet Potato flour and Sesame Seed flour (% on dry weight basis).

Parameters	Chemical composition (%)			
	Wheat flour 82%	**Oat flour**	**Whit sweet potato flour**	**Sesame seed flour**
Moisture	10.50 ^{b}±0.8	9.97^b±0.5	12.40^a±0.1	8.50^c±0.2
Protein	12.50^c±0.17	13.70 ^{b}±0.27	3.45^d±0.3	34.55 ^{a}±0.01
Ash	1.80^c±0.2	3.10 ^{b}±0.14	3.15^b±0.99	8.040 ^{a}±0.55
Fat	1.54^c±0.13	8.90^b±0.7	1.14 ^{c}±0.22	45.71 ^{a}±0.04
Fibers	2.14 ^{c}±0.71	7.70 ^{a}±0.09	2.49^c±0.42	3.730^b±0.01
carbohydrates*	82.02^b±.33	66.60^c±.25	89.77 ^{a}±0.12	7.97^d±0.13
Minerals content (mg/100g on dry weight basis)				
K	0.80^d ± 0.1	370.0^b ±2.3	129 ^{c} ±1.1	382^a ±2.2
Ca	1.75 ^{d} ±0.03	80.52 ^{c} ±0.9	107 ^{b} ±2.1	430 ^{a} ±2.0
Mg	10.70 ^{d} ±0.2	115.0^b ±2.3	89.0 ^{c} ±2.1	210 ^{a} ±2.3
Mn	0.34 ^{d} ±0.1	5.26 ^{a}±0.1	0.71 ^{c} ±0.1	1.51 ^{b} ±0.02
Fe	0.750 ^{d} ±0.2	18.8 ^{a} ±0.41	2.50 ^{c} ±0.3	6.17 ^{b} ±0.02
Zn	0.190 ^{d} ±0.01	3.90 ^{a} ±0.1	1.20 ^{c} ±0.1	2.70 ^{b} ±0.2

*Calculated by difference, each value represents the average from three replications. *Means in the same row with different letter are significantly different ($P \leq 0.05$).

While the highest of fiber was obtained in oat flour followed by sesame seed flour then sweet potato flour, finally wheat flour ext. 82% (12.50, 1.80, 1.54 and 2.14 %, respectively. These results are consistent with the El Khier *et al.* (2008) found that the protein, ash, fat and fiber content of sesame seed flour (32.50 to 35.94 %), (8.00 to 11.83 %), (45.69 to 50.70%) and (3.60 to 4.60 %), respectively. Mousa *et al.* (2022) said that oats contain a high percentage of fiber (7.96 %.), protein, ash and fat (13.45, 3.00 and 8.09%), respectively, and these results are consistent with the results in Table (2). On the other hand, the mineral analysis of the raw materials, which are represented in (potassium(K), calcium(Ca), magnesium(Mg), manganese(Mn), iron(Fe) and zinc(Zn)) used in the research, it was found that sesame seed flour outperformed the rest of raw materials in K, Ca, and Mg, where they were recorded (382, 430 and 210 mg /100g).

These results are consistent with Hahm *et al.* (2009) that it was found that sesame contains (K 385, Ca 421 and Mg 412 mg / 100gm) respectively, while oatmeal is distinguished over the rest of the raw materials in manganese, Iron and zinc, where they were recorded (5.26, 18.8 and 3.90 mg / 100g), the least of them in minerals were whit Sweet Potato then Wheat flour, 82% ext., and we find that potato flour came in third place.

3.2. Rheological properties of dough.

Data presented in table (3) show the effect of replaced Oat flour, whit Sweet Potato Flour (WSPF) and Sesame Seed flour (SSF) at four treatment to Wheat flour 82% on the rheological properties of flour as evaluated by farinograph. As shown in table (3), water absorption increased from 65% for control sample (100% wheat flour 82% ext.) to 70, 78, 80 and 85% respectively as a result to the replace of oat flour, whit Sweet Potato flour and Sesame Seed flour. This finding could be attributed to the higher fiber content of Oat flour. These results are in agreement with those obtained by Zaki, and Hussien (2018) who reported that absorption increase as Oat flour level increased in dough.

Table 3: Rheological properties of wheat flour extracts (82%) with (oat, white potatoes, and sesame) flour.

Parameters dough samples	Control	A	B	C	D
	Farinograph				
Water absorption (%)	65	68	70	71	72
Arrival time (min)	1	1.5	1.5	2	2.5
Dough development time (min)	3	2.5	2.5	2	2
Dough stability (min)	4	3.5	3.5	3	2.5
Dough weakening (B.U)	100	110	120	130	140
	Extensograph				
Resistance to extension (R)(B.U)	140	120	120	130	135
Extensibility (E) (mm)	80	70	70	65	60
Proportional number (R/E)	1.75	1.71	1.71	2	2.15
Energy (Cm2)	24	20	18	16	12

Control = 100% WF,A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF

They added as the Oat level in the flour increase, the time needed for the preparation of a good dough (dough development time) was decreased, due to a weaker formation of gluten matrix. Since pentosans and ß-glucans benefit from high water binding capacities, their presence in the oat flour caused higher water absorption capacities, for dough made of oat as part of the formula, in comparison with control. Arrival time increased as Oat flour level increased in dough. It recorded for wheat flour 1.00 min the lowest time to reach for replacement samples (A, B, C and D) to 1.5, 1.5, 2.0 and 2.5 min, respectively. These results are in agreement with those obtained by Zaki and Hussien, (2018) who reported that arrival time (min) recorded for wheat flour 1.0 min the lowest time to reach for replacement samples with 25, 50, 75 and 100% to 1.5, 2.0 and 2.5 min, respectively, Abd El-Rasheed *et al.* (2015) who reported that arrival time (min) of wheat and oats flour and its mixtures (75% wheat flour + 25% oat flour) recorded that 1.0, 3.5 and 1.5 min, respectively. From the obtained data, it could be noticed that the development time decreased as oat flour increased. When replacement of A, B, C and D whit oat flour, sweet potato flour (WSPF) and sesame seed flour (SSF) in dough was recorded 3.0, 2.5, 2.5, 2.0 and 2.0 min, respectively. On the other hand, dough weakening were increased, while dough stability was decreased by adding oat flour and sesame seed flour to wheat flour at all levels replacement which recorded 4.0, 3.5, 3.5, 3.0 and 2.5 min, respectively. These results are in agreement with those obtained by Zaki and Hussien, (2018) which reported that dough stability was decreased by adding oat flour to wheat flour at all levels replacement 25, 50, 75 and 100% which recorded 10, 5, 2 and 2 min, respectively. From the obtained data, it observed that dough weakening (B.U) for the control smaple recorded the lowest value 100 B.U and sample recorded 100, 110, 120, 130 and 140 B.U, respectively. These results are in agreement with those obtained by Abd El-Rasheed *et al.,* (2015) who reported that dough weakening (B.U) recorded the lowest value in control sample contian 100% wheat flour 40 B.U and value increased when replacement to oat flour 100% recorded 100 B.U., also, from the data presented in table (3) showed the effect of adding oat flour to wheat flour on extensograph parameters, dough extensibility (E) (mm), Resistance to extension (R) (B.U), Proportional number (R/E) and dough energy (Cm^2) decreased as of level increased. That effect was related to the presence of fiber in oat flour that dilutes gluten content of dough. It was found that dough extensibility (E) (mm) decreased for the samples replaced with oat flour, whit sweet potato flour (WSPF) and sesame seed flour (SSF). The replacement samples, A, B, C and D recorded 70, 70, 65, and 60 (mm) compared to the control sample (80 mm). These results are in agreement with those obtained by El Shebini *et al.,* (2014) who reported that the extensibility (E) decreased from control sample 140 to 110 and 80mm, respectively, in sample contain (75%WF+25%OF) and (50%WF+50%OF). From the obtained data, it could be noticed that the resistance to extension (R) recorded the highest value 140 B.U for the control sample, but the replaced samples with oat flour, sesame flour and with sweet potato flour. The resistance to extension decreased for A, B, C and D samples, the results recorded, 120, 120, 130 and 135 compared with control sample (140 B.U.). The results in Table (3) recorded that, the proportional number for the control sample was 1.75, but the samples replaced with oat flour, white sweet potato flour and sesame seeds flour recorded 1.71, 1.71, 2.00 and 2.15 for the sample A, B, C and D respectively.

Concerning the energy of the experimented dough's, the results showed that the replacement of wheat flour with oat flour, sesame flour and whit sweet potato flour recorded 20, 18, 16 and 12 cm^2 compared to control sample (24cm^2). These results agreement with El Shebini *et al.,* (2014) who showed that the replacement of wheat flour with oat flour led to a decrease in the energy compared to the control sample (wheat flour, 82% ext.).

3.3. Chemical composition of pies.

Table (4) shows the chemical composition of pies prepared from wheat flour 82% ext., of which was replaced by (oat, white potatoes, and sesame) flour. It was found that sample D was the relatively best sample, as it was characterized by its high content of protein, ash, fat and fiber, which were recorded as (22.56, 5.56, 27.19 and 6.49 %) respectively, followed by sample C, then B and finally A compared to the control sample, where (11.40, 1.40, 13.10 and 1.50 %), respectively. This increase may be due to the high proportions of sesame and oat flour substituted, and these results are consistent with Sa *et al.* (2020) reported that oilseed protein (such as peanut protein, flaxseed, sesame, and sunflower) have been extensively researched and incorporated as protein supplement Klose *et al.* (2009), who said that Oat protein, commonly known as oats, is a highly sought cereal grain for human consumption. Recently, their exceptional health-related benefits have sparked greater interest in their consumption. Compared to other major cereal grains, oat has relatively higher protein content, ranging from 15 to 20%.

On the results presented in Table (4) show that, the composition of the mineral of the pies. It was found that sample D follows the same trend in the increase in mineral, as all mineral increased in it, followed by C, B then A compared to the control. This indicates an increase in mineral in the materials with which wheat flour was replaced. These results are in agreement with that obtained by Abbas *et al.,* (2022) they mentioned that, the Sesame seeds are a rich source of essential minerals such as calcium, iron, magnesium, and zinc. Fortification of sesame seeds in functional foods can help address deficiencies in these minerals, particularly in populations that have limited access to nutrient-dense foods (Desire *et al.,* 2021).

Table 4: Chemical composition of pies (% on dry weight basis).

Composition(%)	Samples				
	Control	A	B	C	D
Moisture	11.30 ^{b} ±0.30	11.90 ^{a} ±0.40	11.41 ^{b} ±1.10	11.55 ^{ab} ±1.10	11.24 ^{b} ±0.25
Protein	11.40 ^{e} ±0.70	14.70 ^{d} ±0.20	17.90 ^{c} ±0.39	21.04 ^{b} ±0.04	22.56 ^{a} ±0.53
Ash	1.40 ^{e} ±0.20	3.64 ^{d} ±0.10	4.44 ^{c} ±0.22	4.92 ^{b}±0.01	5.56 ^{a} ±0.11
Fat	13.10 ^{e}±0.10	19.98 ^{d} ±0.12	23.50 ^{c} ±0.19	25.30 ^{b} ±0.13	27.19 ^{a} ±0.18
Fibers	1.50 ^{e} ±0.17	2.98 ^{d} ±0.14	3.75 ^{c} ±0.18	5.14 ^{b} ±0.23	6.49 ^{a} ±0.33
Available carbohydrates*	72.60 ^{a} ±2.10	58.70 ^{b} ±2.00	50.41 ^{c}±2.28	43.60 ^{d} ±1.99	38.20 ^{e} ±1.88
Energy	453.9 ^{e} ±2.10	473.42 ^{d} ±1.98	484.74 ^{c}±2.23	486.26 ^{b} ±2.12	488.11 ^{a}±2.31
Minerals content of pie (mg/100g on dry weight basis)					
K	1.01^{d}±0.01	165.32 ^{d}±0.34	227.54^{c}±0.55	307.66^{b}±0.23	394.15 ^{a}±0.88
Ca	1.80 ^{e}±0.81	137.60 ^{d}±0.74	177.73^{c}±0.08	204.11^{b}±0.74	236.36 ^{a}±0.42
Mg	10.75 ^{e}±0.21	93.38 ^{d}±0.64	115.91^{c}±0.12	139.44 ^{b}±0.45	166.35 ^{a}±0.28
Mn	0.44 ^{c}±0.01	0.99 ^{bc}±0.02	1.82 ^{b}±0.72	2.85 ^{a}±0.48	3.03 ^{a}±0.71
Fe	0.80 ^{e}±0.01	4.41 ^{d}±0.06	6.22 ^{c}±0.56	10.06 ^{b}±0.78	13.92 ^{a}±0.15
Zn	0.22 ^{c}±0.01	2.17 ^{b}±0.07	2.52 ^{ab}±0.85	3.13 ^{ab}±0.97	3.6 ^{a}±0.81

Control = 100% WF, A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF, C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF. *Calculated by difference, each value represents the average from three replications. *Means in the same row with different letter are significantly different ($P \leq 0.05$).

3.4. Amino acids content of pies (gm/100gm protein)

The data presented in Table (5) showed an estimate of the content of essential amino acids and non-essential amino acids in the pie prepared with wheat flour as 82%. Which has been replaced with oat flour, white sweet potato flour, and sesame seed flour. along with the amino acid score pattern for the FAO/WHO/ UNU (2007). Amino acid score is very important to evaluate the content of essential amino acids in food and also to be enough the nutritional requirements of protein. The results showed that the replaced samples were higher in the following amino acids: leucine, threonine, valine, phenylalanine, methionine, tryptophan, and tyrosine compared to the control. The results also showed that samples C and D were higher in lisine, recording (4.40 and 4.60 g/100 g protein), respectively, compared to the control sample, which recorded (3.99 g/100 g protein). It should be noted that the increase in essential amino acids in the mixtures may be due to the fact that the raw materials that were replaced in the pie are high in the percentage of amino acids, so this led to the production of a pie that is high in some amino acids. (FAO/WHO/UNU, 2007).

3.5. Organoleptic evaluation of pies.

Color, flavor, taste, softness, and overall preference of control pies and (OF-WSPF and SSF) replacement with wheat flour 82% ext. were evaluated, and the results are presented in Table (6). When evaluated by trained, statistically significant differences were detected in control of the sensory attributes evaluated. With regard to color, A, B, C and D were appreciated the most, followed by control received significantly lower scores than the other treatments, also significant difference was observed between the control in terms of flavor, softness, or overall preference. In addition, pies elaborated with (OF-WSPF and SSF) received the highest taste preference score. On a seven-point hedonic scale, replacement of wheat flour 82% ext. with (OF-WSPF and SSF), and replacement corn oil with sesame oil satisfactory. It was found that replacing with sesame oil may lead to a softer product and give a good taste and smell compared to the control. Ali and Batu (2020).

Table 5: Amino acids content of pies (gm/100gm protein).

Essential Amino acids	FAO/WHO/ UNU(2007)	Control	A	B	C	D
Lysine	5.8	3.99	3.61	3.84	4.40	4.60
Leucine	6.6	5.80	6.23	6.21	7.73	8.41
Isoleucine	2.8	5.30	5.43	5.75	6.01	6.13
Threonine	3.4	3.20	4.31	4.32	4.52	4.48
Histidine	1.6	4.99	5.00	4.87	4.53	4.02
Valine	3.5	5.55	5.61	5.87	6.52	6.76
Phenylalanine	-	4.50	4.75	4.94	5.52	5.83
Tyrosine	-	4.58	5.21	5.40	5.88	6.28
Methionine	-	4.99	6.66	6.08	5.38	5.12
Cysteine	-	3.60	3.29	3.28	3.22	3.16
Tryptophan	1.1	1.00	2.20	2.00	2.08	2.13
Total essential amino acids	24.8	47.50	52.30	52.56	55.79	56.92
	Non-Essential Amino acids					
Glutamic acid	-	13.20	9.95	10.31	10.25	10.10
Aspartic acid	-	7.80	7.2	7.72	7.34	7.04
Proline	-	7.00	7.22	6.92	6.64	6.59
Serine	-	6.90	6.55	6.14	6.3	5.3
Glycine	-	6.55	5.6	5.58	5.54	5.02
Alanine	-	5.90	6.16	5.79	4.12	5.01
Arginine	-	5.15	5.02	4.89	4.02	4.02
Total non-essential amino acids	-	52.50	47.7	47.35	44.21	43.08

Control = 100% WF, A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF

Table 6: Sensory evaluation of pies made using different formulas

Pies	Colure (7)	Flavour (7)	Taste (7)	Softness (7)	Overall Acceptability (7)
Control	$6.10^{b}\pm0.05$	$6.00^{b}\pm0.28$	$5.50^{b}\pm0.35$	$5.30^{b}\pm0.10$	$5.80^{b}\pm0.20$
A	$6.50^{ab}\pm0.23$	$6.61^{a}\pm0.21$	$6.70^{a}\pm0.45$	$6.79^{a}\pm0.67$	$6.90^{a}\pm0.16$
B	$6.50^{ab}\pm0.60$	$6.75^{a}\pm0.81$	$6.75^{a}\pm0.13$	$6.80^{a}\pm0.64$	$6.95^{a}\pm0.18$
C	$6.70^{a}\pm0.25$	$6.80^{a}\pm0.21$	$6.90^{a}\pm0.25$	$6.90^{a}\pm0.43$	$6.99^{a}\pm0.03$
D	$6.80^{a}\pm0.15$	$6.72^{a}\pm0.55$	$6.80^{a}\pm0.51$	$6.93^{a}\pm0.14$	$6.95^{a}\pm0.22$

Control = 100% WF,A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF. Each value represents the average from three replications. Each value represents the average from three replications. *Means in the same row with different letter are significantly different ($P \leq 0.05$).

3.6. Physical properties of produced pies

Physical properties of pies like weight, volume and specific volume of produced pies were illustrated in table (7). From these data, it could be observed that weight, volume and specific volume in all samples of pies increased by replacing wheat flour 82% ext. by different ratios of (OF-WSPF and SSF).The weight, volume and specific volume of pies increased about 10, 30 and 12% for the samples contained of, WSPF and SSF comparing with control sample. The highest increase of volume and specific volume were found in samples C and D, comparing with another samples.

During storage at (27±3°C), it was found that the weight decreased in all samples. However, the lowest reduction was the samples replaced with (OF-WSPF-SSF) and sesame oil compared to the control sample, which was found to have a noticeable decrease, volume and specific volume. This may be due to the increased water absorption rate estimated by the farinograph. Likewise, sesame oil works to maintain the moisture content in the sample and this reduces the rate of water loss. It maintains weight and size Rahmah and Sofyaningsih (2020). Also, Phenolic extracts from sesame oil meal display excellent antioxidant properties, and the phenolic antioxidant stability of sesame oil was not significantly lost due to heat treatment, Also, from the data illustrated in Table 7 show that the volume of control sample decreased about 12% after storage 6 days at (27±3°C), but the samples contained OF, WSPE and SSF decrease about 5 %. On the other hand the specific volume increased about 10 % of all samples. Senanayake *et al.,* (2019).

Table 7: Physical properties of produced pies

Samples	Baking quality of pies							
	Weight (g)				Volume (cm^3)			
	Zero time	2 days	4 days	6 days	Zero time	2 days	4 days	6 days
Control	30b±0.01	27b±0.24	24c±0.22	21c±0.21	63d±0.20	58c±0.02	53c±0.73	49d±0.54
A	33a±0.55	32a±0.02	30b±0.12	29b±0.50	82c±0.50	81b±0.40	80b±0.20	79c±0.21
B	33a±0.20	32a±0.10	30b±0.25	29b±0.30	83b±0.90	82a±0.60	81a±0.22	80b±0.06
C	33a±0.50	32a±0.66	31a±0.05	29b±0.23	84a±0.52	82a±0.13	81a±0.15	80b±0.22
D	33a±0.70	32a±0.40	31a±0.15	30a±0.14	84a±0.71	82a±0.25	81a±0.11	81a±0.03

Table 7: Cont.

Samples	Baking quality of pies			
	Specific volume (cm^3/g)			
	Zero time	2 days	4 days	6 days
Control	2.10c±0.001	2.15b±0.025	2.21c±0.002	2.33c±0.12
A	2.48b±0.05	2.53a±0.031	2.67b±0.05	2.72ab±0.33
B	2.52ab±0.021	2.56a±0.027	2.70a±0.55	2.77a±0.72
C	2.55a±0.015	2.56a±0.022	2.61b±0.072	2.77a±0.26
D	2.55a±0.002	2.56a±0.030	2.61b±0.28	2.70b±0.82

Control = 100% WF, A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF, D= 0%WF + 60% OF+10% WSPF+30% SSF. Each value represents the average from three replications. *Means in the same row with different letter are significantly different ($P \leq 0.05$).

3.7. Staling of produced pies

Results of the staling rate of fresh pies samples as well as control was followed using alkaline water retention capacity (AWRC %) method after pies production and during six days of storage at room temperature (27±3°C) and results are presented in Table (8). The results of Table 9 show that there was a reduction of AWRC% (low freshness) for all different pies samples during storage period.

Table 8: Alkaline water retention capacity (%) of produced pies during storage periods at room temperature.

Days	Alkaline water retention capacity (%) of produced pies				
	Control	A	B	C	D
0	240.19^{e} ±0.23	280.20^{d}±0.05	290.00^{c} ±0.15	320.10^{b}±0.71	330.00^{a}±0.63
1	230.18^{e} ±0.25	271.01^{d}±0.28	280.00^{c} ±0.33	311.90^{b}±0.43	324.80^{a}±0.38
2	205.30^{e} ±0.18	259.33^{d}±0.02	269.11^{c}±0.55	300.00^{b}±0.62	370.80^{a}±0.34
3	179.11^{e} ±0.13	235.21^{d}±0.25	255.60^{c}±0.03	293.80^{b}±0.56	300.17^{a}±0.40
4	156.01^{e} ±0.01	210.01^{d}±0.53	235.05^{c}±0.24	285.15^{b}±0.72	293.11^{a}±0.18
5	Nd	190.32^{d}±0.27	221.00^{c}±0.66	272.70^{b}±0.50	285.20^{a}±0.22
6	Nd	178.12^{d}±0.92	200.35^{c}±0.19	250.28^{b}±0.15	271.02^{a}±0.44

Nd = Not detected.
Control =100% WF, A=40% WF+10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF, C=20% WF + 40% OF+10% WSPF+30% SSF, D= 0%WF + 60% OF+10% WSPF+30% SSF.
Each value represents the average from three replications. *Means in the same row with different letter are significantly different ($P \leq 0.05$).

The significant lowest reduction in staling value in the fourth days was noticed in pies samples A, B, C and D (25.05, 18.95, 10.89 and 10.57%) respectively, in comparison with control (35.05%). At the end of storage period sixth days, the reduction percent of AWRC were (36.43, 30.91, 21.79 and 17.87%) for samples A, B, C and D, respectively, compared with sample control which were not detected (Bilyk *et al.,* 2018). It was established that products with the addition of sesame flour are better in retaining freshness, which was confirmed by a decrease in friability, they also contain more aromatic compounds than bread baked from wheat flour.

3.8. Percentage of the RDA of some nutrient provided from 100g pies for males and females (60-75 y)

The nutritional assessment of the pie products in these investigated together proteins, fat and energy with other essential five minerals (Ca, K, Mg, Fe and Fe) are strongly required through their comparison with the Recommended Dietary Allowance RDA (2004) and Chauhan, (2013) (for males and females 60-75 years) and the percentage of the RDA of some nutrients provided from 100gm pie for males and female (60-75 y). Results shown in Table (9) clarified that control pie covered 19.00, 53.67, 25.94, 0.18, 0.03, 2.56, 10.00 and finally 2.00% of the RDA for males in protein, fat, energy, Ca, K, Mg, Zn and Fe, respectively. Furthermore, they also covered 25.40, 53.67, 33.62, 0.15, 0.42, 3.36, 10.00 and 2.75% of the RDA for females in these nutrients, respectively.

Concerning sample pie A covered 24.50, 66.60, 27.05, 13.76, 4.86, 22.23, 55.13 and finally 19.73% of the RDA for males in protein, fat, energy, Ca, K, Mg, Zn and Fe, respectively. Moreover, they also covered 29.40, 66.60, 35.07, 11.47, 6.89, 29.18, 55.13 and 27.13% of the RDA for females in these nutrients, respectively.

Table 9: Percentage of the RDA of some nutrient provided from 100g pies for males and females (60-75 y).

Age group	Nutrient	RDA	% RDA from 100gm pies samples				
			Control	A	B	C	D
Male (60-75 years)	**Protein**	**60g.**	**19.00**	**24.50**	**29.83**	**35.07**	**37.60**
	Fat	**30g.**	**53.67**	**66.60**	**78.33**	**84.33**	**90.63**
	Energy	**1750 Kcal**	25.94	27.05	27.70	27.79	27.89
	Ca	**1000 mg**	0.180	13.76	17.77	20.41	23.64
	K	**3400 mg.**	0.030	4.86	6.69	9.050	11.59
	Mg	**420 mg.**	2.560	22.23	27.60	33.20	39.61
	Fe	**8 mg.**	10.00	55.13	77.75	125.75	175.00
	Zn	**11mg**	2.00	19.73	22.91	28.45	32.73
Female (60-75 years)	**Protein**	**50 g.**	25.4	29.40	35.80	42.08	45.12
	Fat	**30 g.**	**53.67**	**66.60**	**78.33**	**84.33**	**90.63**
	Energy	**1350 Kcal**	**33.62**	**35.07**	**35.91**	**36.02**	**36.16**
	Ca	**1200 mg**	0.150	11.47	14.81	17.01	19.70
	K	**2400 mg.**	0.042	6.89	9.38	12.82	16.42
	Mg	**320 mg.**	3.360	29.18	36.22	43.58	51.98
	Fe	**8 mg**	10.00	55.13	77.75	125.75	175.00
	Zn	**8 mg**	2.750	27.13	31.50	39.13	45.00

Control = 100% WF,A=40% WF + 10% OF +40% WSPF+10% SSF, B=30% WF + 20% OF+30% WSPF+20% SSF,C=20% WF + 40% OF+10% WSPF+30% SSF,D= 0%WF + 60% OF+10% WSPF+30% SSF. of RDA=Value of nutrient in sample tested x100 / RDA for the same nutrient.

Concerning sample B demonstrated that they covered 29.83, 78.33, 27.70, 17.77, 6.69, 27.60, 77.75 and finally 22.91% of the RDA for males in protein, fat, energy, Ca, K, Mg, Zn and Fe, respectively. Moreover, for females they also covered 35.80, 78.33, 35.91, 14.81, 9.38, 36.22, 77.75 and 31. 5% of the RDA in these nutrients, respectively.

In the same direction, also in samples C and D, it was found that they cover to some extent a large part of the recommended daily recommendations. Covering daily needs may be largely due to the diversity of selected raw materials included in the pie samples.

4. Conclusion

A new, successful formula was used to produce pies with (OF-WSPF and SSF) replaced with WF 82% ext. and replacing corn oil with sesame oil. It was a good alternative for the elderly, due to its high nutritional value and functional properties. The substitution had significant effects on the chemical, sensory and Physical properties of the pies. The substituted pies received the highest acceptable sensory scores. In general, OF-WSPF and SSF can be successfully combined into pies. It gives a sufficient level of acceptance among the elderly. Additionally, a significant amount of the daily requirements were found to be satisfied by the pies substitute.

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