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Preparing Untraditional Kishk Formula with Purslane as Natural Source of Bioactive Compounds

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ABSTRACT

Our study was carried out to increase the biological and nutritive value of traditional kishk product. Purslane kishk was prepared by adding varying concentrations of purslane powder (0.0, 0.25, 0.5, 1.0, 1.5 and 2%) to traditional kishk mixtures. Results showed that, the purslane powder is rich in K, P and Ca and it has a high content of protein, fat and ash while low content of moisture and pH values. Addition of purslane increasing the amount of protein, acidity and ash with increasing of purslane powder concentration 22.66±0.25 to 25.91±0.02%, 1.2 to 1.85% and 5.55±0.02 to 6.55±0.03%, respectively. Moisture, fat and pH value were decreased with the increasing of purslane powder concentration. Prepared purslane kishk had higher values of K, P, Ca and Na contents than those of control sample, specially potassium content which increased from 580.49±2.786 to 970.31±1.04 mg/100gm. The results indicated that prepared purslane kishk had higher values of water holding capacity and antioxidant activity, which increased from 459.19 to 519,51 pellet, g/kg and 24.11 to 46.70 %, respectively. Microbiological evaluation should an increase of total viable bacterial, Lactobacilli, Streptococci and spore forming bacteria counts with increasing amount of purslane powder. Whilst, coliform, yeasts and molds were not detected in all prepared kishk treatments. Overall, kishk which prepared by the addition of purslane powder provides highly nutritional and biological value.

***Keywords*:** Kishk; *Portulaca oleracea* L.; Bioactive components; Functional properties; Antioxidant activity and Microbiological quality.

INTRODUCTION

Kishk is a dried fermented dairy product, traditionally produced in rural areas in Egypt since the ancient time as well as the Middle East area. The Upper Egypt eras maintain produce Kishk and the manufacture method was inherited throughout generations. This method may be attacked some modification between regions, such as long fermentation time (4-5 days), drying in airily and shadow place and addition of some variable species. Kishk is dried mixture of fermented milk (Laban Zeer or Laban Khad) and crushed wheat, which is widely consumed in the region between the Eastern Mediterranean and the Indian sub-continent (Tamime and O'Connor, 1995). Kishk is a good source of protein, fiber, minerals and amino acids (Tamime *et al.*, 1999a and Tamime *et al.*, 1999b). Purslane (*Portulaca oleracea* L.) is widespread plant and it known in Egypt as Rigla, it has a safe ancient history in food and folk medicine. *Portulaca oleracea* is a medicinal and edible plant, so it's considered important plant to the food industry and human health. Natural products have become a popular research area due to their health promoting in recent decades. Among them, high polyphenol content agents are especially important due to its health promoting effects (Moon *et al.*, 2018). Common purslane (*Portulaca oleracea* L.) is an invasive species, worldwide ranked with the eight most common weed (Petropoulos *et al.*, 2016). Purslane has been recognized as "functional food" because of its high nutritional value (Rana, 2016). Purslane contains numerous bioprotective compounds such as antioxidants, omega-3 fatty acids, essential amino acids and several minerals, especially potassium (Gonnella *et al.*, 2010). This plant contains carbohydrates, proteins, minerals, vitamins and fatty acids (Uddin *et al.*, 2012). Also, it's a rich source of Omega-3 fatty acids, which play an important role in the enhancement of immune system (Abd el Moneim, 2013), Includes linoleic acid and α-linolenic acid (Elkhayat *et al.*, 2008). Moreover, it is rich in minerals such as manganese, calcium, phosphorus, iron and selenium (Mohamed and Hussein 1994), and amino acids like isoleucine, proline, leucine, lysine, phenylalanine, methionine, cystine, valine, threonine, and tyrosine (Palaniswamy *et al.*, 2002). It also has antioxidant and anti-inflammatory actions (Dkhil *et al.*, 2011, Lee *et al.*, 2012). This plant is also was studied for its pharmacologically properties such as antifungal, anti-inflammatory, antioxidant, antimicrobial and wound healing properties (Rashed *et al.*, 2003). The objective of this study amid to enhancement and improve nutrition value, functional and biological properties of traditional rural kishk by mix Purslane (*Portulaca oleracea* L.) powder with kishk mixtures during manufacture and evaluate the physiochemical, microbiological and sensory properties of the final product.

MATERIALS AND METHODS

Dry Wheat grains were purchased from local market (Sohag, Egypt), Fresh cow's milk was obtained from the Herd of the Animal Production Department, Faculty of Agriculture, Al-Azhar University (Branch of Assiut). Wild *Portulaca oleracea* was collected from Faculty of Agriculture farm, Al-Azhar University, Assuit, Egypt. Starter: Commercial Yoflex

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culture (Express 3.0) thermophilic yoghurt culture (mixed strain culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* 1:1) was obtained from Christian Hansen (Copenhagen, Denmark). Salt: Commercial sodium chloride was obtained from El-Nasr Company, for salt (Alexandria, Egypt).

Preparation of fermented milk:

Partly separated fresh cow milk (1% fat) was heated to 85-90 °C for 15 min., followed by rapidly cooling to 40-42 °C, milk was inoculated by commercial Yoflex culture (Express 3.0) thermophilic yoghurt culture (mixed strain culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* 1:1). The inoculated milk was incubated at 40-42 °C until full coagulation. fermented milk was kept overnight in domestic refrigerator at 4° C before manufacturing the kishk.

Manufacture of kishk:

Wheat was sorted from damaged grain and cleaned from extraneous

↓

Boiled for 60 min in hot water.

↓

Air dried (for 2-3 days under aseptic conditions)

↓

Cracked to small debris (Burghol)

↓

Addition of low-fat yogurt (1% fat)

1: 3 wheat burghol to low fat yogurt (w/w) were well blended

↓

Addition of salt (1.5%) and mixed well

↓

The mixture was divided into six equal portions

↓

Purslane powder was added with different ratio (Air drying powder)

(0.0, 0.25, 0.5, 1.0, 1.5 and 2.0%)

↓

Incubated at 42˚C for 24h.

↓

Formed the kishk dough into small balls

↓

Airily sun dried for 3 days

↓

Held at 6 ± 2 ˚C for analysis

Fig. 1. Scheme diagram for kishk preparing

Images of prepared kishk with Purslane

Chemical analysis:

Moisture content was determined according to Anon b (1987), Titratable acidity and Fat content were carried out according to AOAC (2000) methods. pH values were measured using a pH meter (model 68 ESD 19713), USA. Ash was determined according to AOAC (2007). Total nitrogen (TN) content was determined as described by Anon c (1993). Potassium and sodium Content were estimated by Flame Photometer (BWB XP Flame Photometer Technologies, UK LTD) according to the method of Page (1982). Phosphorus Content was determined according to Tiessen and Moir (1993). Calcium Contents were estimated by Flame Photometer according to the method of Villanueva *et al.*, (2000). Water holding capacity (WHC) was carried out according to Shevade *et al.*, (2019). The 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay was carried out according to the method described by Lee *et al.*, (2003).

Microbiological analyses:

The total bacterial count was determined according to Marshal (1992). Lactobacilli count was estimated on the selective medium for lactobacilli (MRS) and streptococci count on M17 agar medium respectively Anon d (1997). Coliform bacteria were enumerated according to Anon a (1985). Moulds and Yeasts were enumerated according to FDA (2002). Spore forming bacterial count was determined according to APHA (1992).

Sensory Evaluation:

Sensory property was carried out according to the scheme of Clark *et al.*, (2009). The samples were subjected to organoleptic analysis by well-trained members of the Dairy Science Department and Food Science and Nutrition Department (Fac. Agric. Sohag Univ., Egypt). The sensory attributes evaluated were: flavor (1-10 points), body and texture (1-5 points) appearance and colour (1-5 points).

Statistical Analysis:

Analysis of variance was performed on the data using the software program; JMP Student Edition for Windows and Macintosh: The User's Guide to Statistics with JMP Student Edition. SAS Institute (2009).

RESULTS AND DISCUSSION

Chemical and Microbiological Analyses of purslane powder:

Data present in Table (1) illustrate the chemical composition of purslane powder. Results shows that purslane powder was characterized by low moisture and fat (3.40±0.08 and 2.01±0.03%) respectively and high protein and ash contents (34.21±0.95 and 22.51±0.17%) respectively. Purslane contained variable components that have antioxidant activity such as vitamin C Viana *et al*., (2015), α-Tocopherol Uddin *et al.*, (2014), α-Carotene Dias *et al*., (2009), β-Carotene Viana *et al*., (2015), Glutathione Alam *et al*., (2014), Melatonin Hormones Ren *et al*., (2011), Polysaccharides YouGuo *et al*., (2009), α-linolenic acid Alam *et al*., (2014), Polyphenols, Flavonoids Lim and Quah (2007) and Phenolic acids Erkan, (2012). Data showed that the antioxidant activity of purslane powder was 58.96±1.34%. Purslane powder was rich in calcium, potassium, sodium and phosphorus. The greatest amount of minerals found in the purslane plant was potassium (8441.55±238.92 mg/100gm). The total bacterial count of purslane was 3.32±0.14 log cfu/gram; while, moulds & yeasts were 2.26±0.12 log cfu/gram. The low moisture

content permitted better conservation of date purslane powder and inhibited the development of bacteria.

Table 1. Chemical and microbiological analyses of purslane powder.

Components in air drying purslane powder %		
Moisture		3.40±0.08
Fat		2.01±0.03
Protein		34.21±0.95
pH		5.19±0.01
Ash		22.51±0.17
Total antioxidant activity (DPPH%)		58.96±1.34
Minerals (mg/100 gm)	Calcium (Ca)	1053.42±42.19
	Potassium (K)	8441.55±238.92
	Sodium (Na)	941.84±19.67
	Phosphorus (P)	2570.47±125.39
Total bacterial count (Log cfu/g)		3.32±0.14
Moulds and yeasts counts (Log cfu/g)		2.26±0.12

Data are the mean ± SD, *n* = 3.

pH values: Results in Figure 2 showed significant differences ($p<0.05$) in pH values among all Kishk treatments and pH values ranged between (4.73 and 4.92). Data evident, control samples had the higher pH values contrary other treatments, while the treatment contains 2% purslane had the lower pH values. There were decrease in pH values with increase of purslane powder concentration. The pH values of kishk in the present study were higher than reported by Tamime *et al*. (1999c) and in agreement with those reported by Gadallah and Hassan (2019) and Abd-Rabou *et al*., (2020).

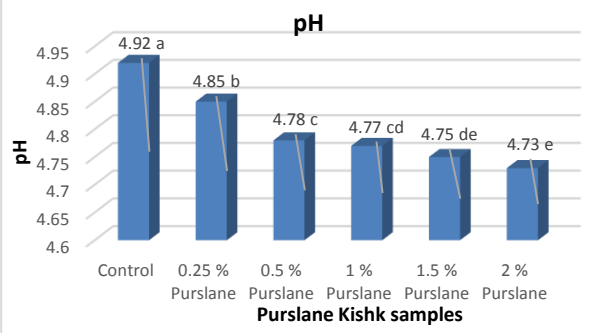

Figure 2. pH values of prepared Kishk samples treated with purslane powder.

Titratable acidity (TA%) of prepared Kishk: Data present in (Figure 3) clarify that titratable acidity values (as lactic acid %) of prepared purslane kishk treatments, which ranged between (1.20 and 1.85 %). There was a significant decrease in TA % among all kishk treatments and it was clear that, treatment which contained 2 % purslane had the highest values in compare with the others.

Moreover, the increasing of purslane concentration led to an increasing in TA % values in sequence order. Higher values of titratable acidity in purslane kishk treatments related to the purslane may be simulate the growth of lactic acid bacteria which produce organic acids. These results are in harmony with those reported by Damir, *et al*., (1992), Gadallah and Hassan (2019) and Abd-Rabou, *et al*., (2020).

***Chemical composition of prepared purslane kishk*:**

Data presented in Table 2 show the chemical composition of kishk enrichment by purslane (*Portulaca oleracea* L) powder. Data indicated that, the chemical composition of prepared purslane kishk was affected by the percentages of additive purslane powder.

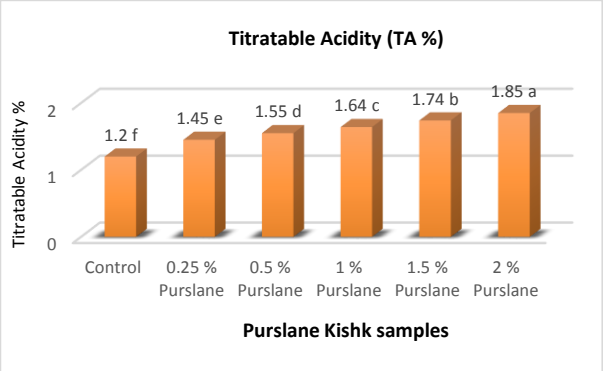

Figure 3. Titratable acidity (as lactic acid %) of the prepared Kishk samples treated with purslane powder

Moisture content (%): Data in Table 2 showed that, the moisture content of prepared kishk has significantly decreased ($p<0.05$) with increasing of additive purslane powder percentage in sequence order at all treatments. The control samples had higher values of moisture content than the others, while kishk treated with 2% purslane had the lower moisture content. The moisture content of prepared purslane kishk samples ranged from 5.03±0.26 to 6.66±0.23 %, the lower moisture content of Kishk was resulted via drying process that used during preparation of Kishk. Moreover, the low moisture content is considered one of the factors responsible for preservation of Kishk during the shelf life. these results are in the line with those reported by Abd-Alla *et al*., (2020) and slightly higher than those evident by Tamime *et al*. (1999c).

Protein content: Kishk prepared from purslane powder exhibited clearly significant ($p < 0.05$) increase in the protein content (T1; 23.89±0.44, T2; 24.57±0.11, T3; 25.08±0.13, T4; 25.45±0.35 and T5; 25.91±0.02) compared with control (C; 22.66±0.25). the increment of protein content of treated samples may related to the high protein content of purslane powder (34.21±0.95, Table 1). These results were higher than that found by O'Callaghan *et al*., (2019) in a comparative study between different mixtures of cereals and fermented milk showed an average of (18.9 % protein) and Abd-Rabou, *et al*., (2020). However, the high protein content of purslane kishk samples increase the nutrient, functional and biological properties of prepared kishk. The protein content of all kishk treatments including control are enough to meet the needs and exceeds the requirements that reported by the World Food Program for wheat soy cereals mixture, which contains a minimum of 16% protein, World Food Program (2015).

Table 2. Chemical composition of kishk prepared from different ratio of purslane powder.

Treatments	Moisture %	Protein %	Fat%	Ash%
Control	6.66± 0.23 ^{a}	22.66±0.25 ^{e}	3.46±0.48 ^{a}	5.55±0.02 ^{b}
T1 (0.25 % Purslane)	6.28± 0.16 ^{b}	23.89±0.44 ^{d}	3.45±0.36 ^{a}	5.96±0.04 ^{ab}
T2 (0.5 % Purslane)	5.94± 0.10 ^{c}	24.57±0.11 ^{c}	3.32±0.09 ^{ab}	6.04±0.04 ^{ab}
T3 (1 % Purslane)	5.75± 0.13 ^{cd}	25.08±0.13 ^{b}	3.22±0.08 ^{ab}	6.10±0.05 ^{ab}
T4 (1.5 % Purslane)	5.47± 0.06 ^{d}	25.45±0.35 ^{ab}	3.20±0.11 ^{ab}	6.43± 0.05 ^{a}
T5 (2 % Purslane)	5.03± 0.26 ^{e}	25.91±0.02 ^{a}	2.98±0.01 ^{b}	6.55±0.03 ^{a}
LSD	0.304	0.461	0.445	0.701

Data are the mean ± SD, *n* = 3. Means with the same letter are not significantly different at $p \geq 0.05$ between rows.

Fat content: Data in Table 2 revealed that, the fat content of prepared kishk samples decreased and slightly significant differences with increasing the concentration of additive purslane. While, the fat contents of control samples had higher values of fat than that of prepared kishk treated with purslane powder. This may be due to lower fat contents in purslane powder (2.01±0.03 Table 1). These results are in the same with those reported by Tamime *et al.* (1999c) and less than that illustrated by Abd-Rabou *et al*., (2020) who reported that fat content ranged from 5.36 to 8.57%.

Ash contents: The ash content of prepared purslane kishk are illustrated in table 2. There were significant differences ($p<0.05$) in ash values among treatments and the ash content was increase with increasing of purslane powder concentration, kishk sample contained 2 % purslane had the highest values of ash, while the control samples had the lowest values. The increasing of ash values with increase of purslane concentration, mainly related to the high minerals content of purslane powder, specially potassium (8441.55±238.92 mg/100gm, Table 1). Highly concentrate of minerals in purslane powder will be increased the nutritional, biological and functional value of purslane as well as resultant kishk.

Minerals content of kishk prepared with different ratio purslane powder: Minerals content of prepared purslane kishk samples were determined and the obtained results are shown in Table 3. From obtained data it was clearly notably that the high amount of sodium content in control and other treatments which ranged between 1886.31±74.33 and 2005.32±15.47 mg/100gm. These results agreed with Tamim *et al*., (1999b), who reported that, sodium content in kishk samples ranged between 836.3 and 2418.8 mg/100gm. High content of sodium in prepared kishk due to the salting process during kishk manufacture, (addition 1.5% of sodium chloride) for all treatments including control samples.

Table 3. Minerals content (mg/100 gm) of kishk treated with purslane powder.

Treatments	Minerals content			
	Na	K	Ca	P
Control	1886.31±74.33 ^{b}	580.49±2.79 ^{e}	495.95±20.57 ^{d}	351.5±16.68 ^{d}
T1 (0.25 % Purslane)	1888.03±78.57 ^{b}	630.16±5.53 ^{d}	523.89±12.03 ^{cd}	434.2±11.11 ^{c}
T2 (0.5 % Purslane)	1904.71±24.82 ^{b}	828.65±5.65 ^{c}	546.96±34.67 ^{bc}	457.7±9.41 ^{bc}
T3 (1 % Purslane)	1922.06±19.22 ^{ab}	836.28±61.74 ^{c}	558.56±11.08 ^{ab}	480.2±13.38 ^{b}
T4 (1.5 % Purslane)	1998.72±24.92 ^{a}	915.20±9.47 ^{b}	573.42±9.72 ^{ab}	542.6±2.42 ^{a}
T5 (2 % Purslane)	2005.32± 15.47 ^{a}	970.31±1.04 ^{a}	580.24± 10.60 ^{a}	566.4±22.25 ^{a}
LSD	84.522	45.776	33.279	24.844

Data are the mean ± SD, $n = 3$. Means with the same letter are not significantly different at $p \geq 0.05$ between rows.

Data were appeared high sodium content in purslane treatments samples because additive purslane powder contain about of 941.84±19.69 mg/100gm sodium and on contrast control sample had low sodium content.

Results in the same Table showed that the potassium content of kishk samples and it significant that the increase in potassium content among all kishk treatments. Treatment contain 2% purslane had the highest values (970.31±1.04 mg/10gm), while the control samples were had the lower values (580.49±2.786 mg/100gm). The potassium content of kishk in the present study were higher than those reported by Tamime *et al*. (1999b) and Gadallah and Hassan (2019). From data in (Table 1) potassium is exhibited the highest amounts of purslane minerals being 8441.55±238.92 mg/100 gm, so the increase of purslane concentration led to an increase in potassium content in sequence order of treatments and therefore increasing in nutritional and functional value of resultant kishk. World Health Organization (WHO) strongly recommends in Guideline: "Potassium intake for adults and children", an increase in potassium intake from food to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease in adults, also WHO suggests a potassium intake of at least 3510 mg/day for adults WHO (2012). In our product each 100gm kishk of the treatment contain 2% purslane served about 27.64% of daily potassium intake.

Data in Table 3 also evident that calcium content in prepared kishk and the results have significant differences ($p<0.05$). Calcium content also, increased from 495.95±20.57 mg/100gm in control sample to 580.24±10.60 mg/100gm in the samples which have highest level of purslane additive (treatment contain 2% purslane). This increase of calcium content related to the addition of purslane which rich of calcium (1053.42±42.19mg/100g). Increasing the calcium content of treatment's samples compared with control sample will be led to increasing in nutritional, biological and functional aspects of prepared kishk. These results are higher than that evident by Tamime *et al*. (1999b).

Phosphorus content of prepared kishk enrichment by purslane powder was listed in Table 3. Significant differences ($p< 0.05$) were observed between the treatments content of purslane powder. Phosphorus content in the prepared kishk ranged from 434.2±11.11 (at control) to 566.4±22.25 mg/100gm (at T5 contain 2% purslane), this increase of calcium content in the treatment samples sourced from additive purslane powder. Levels of calcium content in our study are higher than those results were evident by Tamime *et al*. (1999b) who reported that, calcium ranged from 321.9 to 447.7 mg 100 g^{-1} in the different kishk samples.

Water holding capacity (WHC): Water holding capacity is indicative of amount of water which absorption and swelling of the reconstituted powder (particles) during stirring and heating Wani *et al*., 2012.

Significant differences were observed in Figure 4 for WHC values after cooking of prepared kishk, with the mean value for treatment contain 2% purslane being significantly higher than those of control and other treatments. The higher WHC value of treatments which contain purslane most likely reflects its higher sticky consistency components which presented in purslane. Data in the same figure explain an increase of WHC with increasing of purslane content, and the results are consistent with those of other study which ranged from 509 to 565 g/kg Shevade *et al*., (2019).

Total Antioxidant activity (DPPH %) in purslane kishk: The importance in antioxidants has been increasing at the resent years, because of their high capacity in scavenging radicals related to various diseases Silva *et al*., (2007). The antioxidant activities of prepared kishk samples containing different ratio of purslane are shown in Figure 5. Data shows high significant differences ($p<0.05$) among treatments. Purslane containing

kishk samples had higher antioxidant activity than plain kishk (control) samples.

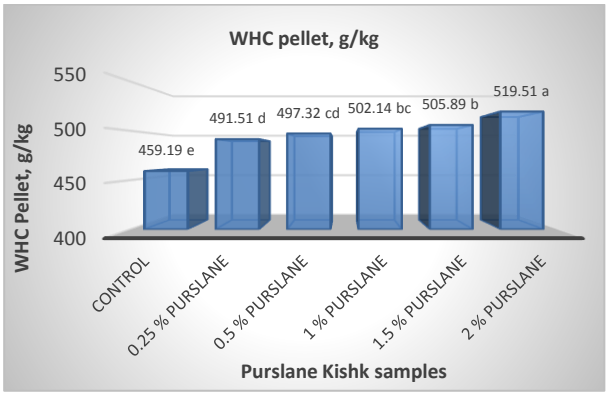

Figure 4. WHC of the prepared Kishk samples treated with purslane powder

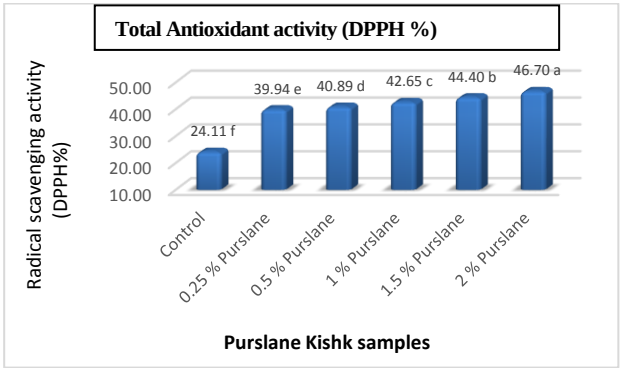

Figure 5. Radical Scavenging activity (DPPH %) of the prepared Kishk samples with purslane powder

The DPPH radical scavenging activity of control was 24.11 %, and DPPH radical scavenging activity of kishk increased in a purslane concentration dependent manner. The obtained results showed that, the addition of purslane powder to the prepared kishk samples resulted in higher antioxidant activity compared with control sample and increasing the biological components in the resultant kishk product.

***Microbiological evaluation*:** Data presented in Table 4 illustrate the microbiological evaluation (Total bacterial, Lactobacilli, Streptococci, Spore forming bacteria, moulds and yeasts and coliform bacteria counts) of prepared purslane kishk. The data observed that; total bacterial, Lactobacilli, Streptococci as well as spore forming bacteria counts of kishk were affected by the percentages of purslane concentrations in the purslane Kishk product.

From the results presented in Table 4, it could be noticed that, total bacterial counts of kishk samples were ranged from 5.64±0.50 to 6.76±0.18 log cfu/g and there is an increase of total bacterial counts with increasing of purslane powder concentrations. The incorporation of purslane powder with kishk mixtures leads to stimulate growth of kishk microflora, these results correlate well with the changes in pH and titratable acidity during the fermentation process (Figure 1 and 2). These results agree with those reported by Damir *et al*., (1992) and Abd-Alla *et al*., (2020).

Lactobacilli counts does not appear to have any significance ($p > .05$) and its counts were ranged from 4.43±0.19 to 5.03±0.39 log cfu/g and it take the same manner of total viable bacteria where lactobacilli count increase with increasing of purslane powder additives. Also, present of purslane in kishk treatments my enhance the growth of lactobacilli and that is reflected to increase the secretion of organic acids in the prepared kishk which are contribute and responsible for preservation of kishk.

Table 4. Microbiological analysis of kishk prepared with different ratio purslane powder.

Treatments	Total bacterial count	Lactobacilli count	Streptococci Count	Spore forming bacteria	Yeasts and moulds	Coliform bacteria
Control	5.64±0.50 ^{b}	4.43±0.19 ^{a}	2.35±0.08 ^{e}	3.36±0.14 ^{c}	ND*	ND*
T1 (0.25% purslane)	5.73±0.35 ^{b}	4.62±0.42 ^{a}	2.60±0.06 ^{d}	3.54±0.28 ^{c}	ND	ND
T2 (0.5% purslane)	6.38±0.30 ^{a}	4.73±0.36 ^{a}	3.17±0.08 ^{c}	3.62±0.22 ^{bc}	ND	ND
T3 (1% purslane)	6.42±0.20 ^{a}	4.75±0.34 ^{a}	3.20±0.12 ^{bc}	3.90±0.0 ^{ab}	ND	ND
T4 (1.5% purslane)	6.61±0.35 ^{a}	4.86±0.26 ^{a}	3.32±0.03 ^{b}	4.00±0.09 ^{a}	ND	ND
T5 (2% purslane)	6.76±0.18 ^{a}	5.03±0.39 ^{a}	3.75±0.10 ^{a}	4.08±0.16 ^{a}	ND	ND
LSD	0.591	0.6043	0.1429	0.309	----	----

Data are the mean ± SD, $n = 3$. Means with the same letter are not significantly different at $p \geq 0.05$ between rows ***Not detected**

Streptococci and spore forming bacteria counts were listed in Table 4 show significant differences ($p<0.05$) and its count ranged from 2.35±0.08 to 3.75±0.10 and 3.36±0.14 to 4.08±0.16 log cfu/g respectively. Results also clarify T5 had the higher counts of Streptococci and spore forming bacteria while, control sample had the lower counts. Yeasts & molds and coliform bacteria are not detected in any of the prepared kishk treatments, these results in the line with **Tamime *et al*., (2000)** who reported that the yeasts & molds and coliform were not recovered in kishk samples at level of (10^{-1} dilution).

Organoleptic properties:

Data presented in Table 5 illustrate the organoleptic properties of prepared purslane kishk. The data revealed that, the sensory properties of prepared kishk was affected by the percentages of purslane powder concentrations. The plain prepared kishk had higher flavor than that in prepared kishk at any concentrations of purslane kishk treatments. In addition, flavor values of prepared kishk show significant differences ($p<0.05$) and decrease in sequence order.

Texture in Table 5 take have the same values of flavor, whereas the control sample had the higher score while the values of texture were decrease in sequences order in purslane-kishk treatments. Blends contained purslane with kishk mixtures may led to create a firm texture that responsible for gained less scores.

Regarding to appearance and color data revealed that, prepared purslane kishk was scored less in appearance and color values when compared with control sample in all treatments. The samples contain high concentration of purslane (2%) had lower scores than that in the other treatments. The higher level of purslane concentration was reduced the score for appearance and color. This may be due to samples were appeared greener when compared with control samples and reduction the traditional color of kishk.

Regarding overall acceptability, as shown in Table 5 showed significant differences ($p<0.05$) and its score ranged from 10.97±2.08 to 16.44±1.67. Results also clarify control sample had the higher score while, treatment 5 scored the lower value.

Table 5. Organoleptic properties of kishk prepared with different ratio purslane powder.

Treatments	Flavor	Texture	Appearance and colour	overall acceptability
Control	8. 25± 0.93 [a]	4.00± 0.52 [a]	4.19±0.54 [a]	16.44±1.67 [a]
T1 (0.25% purslane)	7.13±1.03 [b]	3.66± 0.60 [ab]	3.53± 0.50 [b]	14.31±1.75 [b]
T2 (0.5% purslane)	6.313±1.08 [bcd]	3.38± 0.59 [bc]	3.34± 0.60 [bc]	13.03±1.85 [bc]
T3 (1% purslane)	6.38±1.31 [bc]	3.19± 0.81 [cd]	3.13± 0.62 [c]	12.69± 2.13 [c]
T4 (1.5% purslane)	5.69±1.25 [cd]	2.97±0.67 [cd]	2.66± 0.54 [d]	11.31±1.95 [d]
T5 (2% purslane)	5.53±1.46 [d]	2.91± 0.74 [d]	2.53± 0.56 [d]	10.97±2.08 [d]
LSD	0.835	0.465	0.394	1.342

Data are the mean ± SD, $n = 16$. Means with the same letter are not significantly different at $p \geq 0.05$ between rows.

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تحضير كشك الرجلة الغير تقليدى كمصدر طبيعى للمركبات النشطة حيوياً

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أجريت هذه الدراسة لزيادة القيمة الغذائية للكشك التقليدي. تم تحضير الكشك بإضافة تركيزات مختلفة من مسحوق نبات الرجلة (٠,٠ ، ٠,٢٥ ، ٠,٥ ، ١,٠ ، ١,٥ و ٢٪) إلى خليط الكشك التقليدي. حيث أظهرت النتائج أن مسحوق نبات الرجلة غني بالبوتاسيوم والفوسفور والكالسيوم ويحتوي على نسبة عالية من البروتين والدهن والرماد بينما يحتوي على قيم منخفضة للرطوبة والـ pH. وأظهرت نتائج التحليل الكيماوى أيضاً زيادة نسبة البروتين والحموضة والرماد في الكشك المحضر عند زيادة تركيز مسحوق الرجلة المضاف وتراوحت هذه القيم من ٢٢,٦٦ ± ٠,٢٥ إلى ٢٥,٩١ ± ٠,٠٢٪ و ١,٢ إلى ١,٨٥٪ و ٥,٥٥ ± ٠,٠٢ إلى ٦,٥٥ ± ٠,٠٣٪ على التوالي. بينما انخفضت نسبة الرطوبة ونسبة الدهن والـ pH بزيادة تركيز مسحوق الرجلة المضاف. تحتوي عينات كشك الرجلة المحضر على قيم أعلى من البوتاسيوم والفوسفور والكالسيوم والصوديوم مقارنة بتلك الموجودة في عينات الكنترول ، خاصة محتوى البوتاسيوم الذي زاد محتواه فى كشك الرجلة من ٥٨٠,٤٩ ± ٢,٧٩ إلى ٩٧٠,٣١ ± ١,٠٤ مجم / ١٠٠ جم. كما أن معاملات كشك الرجلة حازت على قيم أعلى للقدرة على الاحتفاظ بالماء عند طبخها فى وسط مائى وكذلك فى النشاط المضاد للأكسدة، واللتان زادتا من ٤٥٩,١٩ إلى ٥١٩,٥١ جم / كجم و ٢٤,١١ إلى ٤٦,٧٠٪ على التوالي. ومن الناحية الميكروبيولوجية، كانت هناك زيادة في العدد الكلى البكتيري و الـ Lactobacilli و الـ Streptococci والبكتريا المكونة للجراثيم عند زيادة تركيز مسحوق الرجلة المضاف. بينما لم يتم الكشف عن بكتريا القولون والخمائر والفطريات في جميع المعاملات. وإجمالاً فإن إضافة مسحوق نبات الرجلة الى الكشك المحضر أدى الى زيادة القيمة الغذائية والبيولوجية للكشك الناتج.