# Chemical and Technological Studies of Yogurt Fortified by some fruits

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**Abstract:**

The fermented dairy products (such as yogurt drink or zabado) are the most prefect food for human especially children, but all dairy products are poor in iron (Fe) and it hasn't a fiber. This investigation used Buffalo's skim milk to process the yogurt and aimed to fortification yogurt drink by some fruit as natural sources of iron and fiber. So, this study chooses fresh kiwifruit, semi dried date and dried apricot in order to fortification yogurt drink (zabado). Then, fruits under study were added by different percentages (2, 5, 7 and 10%) each them alone. The current investigation was studied the effect of addition of fruit to yogurt drink on physiochemical composition, some phytochemical contents and sensory evaluation of products after process and storage period for 14 days. Generally, additional fruits caused to improved yogurt drink which increase in fiber, carbohydrates, energy, Fe, Zn and phytochemical contents (total phenols, total flavonoids and antioxidant activity). But, the yogurt drink had decrease in protein and pH-value both after process and end of storage period. Moreover, yogurt drink fortified by fruit had higher scores of sensory properties than

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control. Conclusion: using fruits with fermented milk improved of chemical composition, antioxidant activity contents and sensory properties.

***Key words:*** yogurt drink- kiwifruit – semi dried date – dried apricot – physicochemical composition.

## Introduction:

Anemia is a state of an insufficient of red blood cells to meet the body's physiological needs. Anemia is caused by iron (Fe) deficiency in general. As well as, several factors can cause anemia such as malnutrition (vitamin $B_{12}$, folate, A and C), acute and chronic inflammation, and acquired abnormalities affect the synthesis of hemoglobin and red blood cells production **(WHO, 2011).** Iron-deficiency anemia (IDA) is caused by inadequate intake of iron, chronic blood loss, or a combination of both **(Baker and Greer, 2010).** According, **Abdullah et al. (2021)** concluded the Fe from food sources is more bioavailable than synthetic sources and effectively used in anemia state.

Fermented milk products (as yogurt) are highly desired and valued by consumers due to their health advantages, convenience, and ease of portability. Moreover, beverage yogurts contain probiotics that enhance the characteristics of the natural microorganisms in the human gut (**Sobti et al., 2021**). Previous studies investigated the fortification yogurt drink by some fruits purée. Results indicated fruits purée caused to increasing of total solid, total phenol contents and antioxidant activity. As well as, making a healthy flavored yogurt drink (as functional food) can be acceptable taste and had the highest acceptability compared with control yogurt (**Soliman and Shehata, 2019; Blassy *et al*., 2020; Zaher *et al*., 2023 and Sobti *et al*., 2023**).

Dates are a source of nutrition containing energy, tryptophan, omega-3, vitamin C and $B_{6,}$ some minerals and fiber (**Baliga, *et al*., 2011**). Minerals in date have a vital role in hemoglobin and bone make up (**Saryono and Rahmawati, 2016**). Moreover, dates, dates seeds and their extracts have a pharmacological activity, antioxidant, anti-diabetic and anti-cancer. Dates could improve the neurological functions and maintain good health of blood (**AbdelKhalek, *et al*., 2022**).

Apricot fruits have important nutritional properties; it has a very good and high quantity of vitamins both fat-soluble vitamins (A, E and K) and water-soluble vitamins ($B_1$, $B_2$, $B_3$, $B_5$, $B_{6,}$ $B_9$ and C). Also, apricot contains some elements (Zn, Ca, Fe, Mg and P). Moreover, dried apricot has containing more quantity of chemical composition (dietary fiber, vitamins, minerals, sucrose and glucose, organic acid and phenolic compounds) than fresh apricot fruits (**Semwal *et al*., 2023**).
Apricot is rich source of Fe, K and β-carotene. So, it is useful for bone, teeth and Hb synthesis (**Yilmaz *et al*., 2012**). Apricot can be used as medicinal treatment for anemia, prevents cancer and improves vision and heart health (**Semwal *et al*., 2023**).

Kiwifruit contains a high level of pectin polysaccharides and dietary fiber (**Anell and Drummond, 2011).** So, it could be improve the immune system and relieve chronic constipation (**Menard *et al*., 2010**). Also, kiwifruit has a high ascorbic acid level as healthful attributes (**Pal *et al*., 2015**). Kiwifruits based ingredients containing naturally bioactive compound such as polyphenols (**Sun-waterhouse *et al*., 2009**). According, **Leontowicz *et al*. (2016)** bioactive substances in kiwifruit like polyphenols, flavonoids and vitamin C have additive and synergistic effects.

The present study aimed to the possibility of making a good quality yogurt drink from buffalo's skim milk, using some fruits (semi dried dates, dried apricot and fresh kiwifruits). As well as, effect of added them on chemical composition and antioxidant contents (total phenol and total flavonoids) in product yogurt and their sensory qualities. Also, it improving of Fe content in flavor and prolong self-life of yogurt drink.

## MATERIALS AND METHODS

### MATERIALS:

Standardized Buffalo's skim milk (0.9 % fat) obtained from the Faculty of Agriculture, Cairo University, Giza, Egypt. Fruits (semi dried date, dried apricot and fresh kiwifruit) were obtained from the local market.

Yoghurt culture comprising *Streptococcus salivarius subsp., Thermophilus* EMCC104 and *Lactobacillus delbruekii subsp. bulgaricus* EMCC1102 were obtained from the Microbiological Resources Center (MIRCEN), Faculty of Agric., Ain Shams Univ., Egypt.

### Methods

### Preparation of fruits

Fruits (semi dried dates, dried apricot and fresh hiwifruit) were washed, cleaned, cut to slices and pasteurized. Consequently, the fruits were pulped by a high-speed electric mixer.

### Manufacture of yoghurt drink.

Different treatments of yoghurt drink (YD) were manufactured according to the procedure of (**Thomas and Wansapala, 2017)** with some alterations as follows: standardized Egyptian buffalo's skim milk (0.9 % fat) was heated at 85ºC for 10 min, then cooled to 42±1ºC, before adding the yoghurt culture comprising *Streptococcus salivarius* subsp.,

*Thermophilus and Lactobacillus delbruekii* subsp. *bulgaricus* (1:1) as percent 3% and incubated at 42±ºC until the pH reached 4.65. The developed yoghurt samples were cooled for 24hrs at 5±1ºC. Then, 6% sugar was added to the pain yogurt. Yogurt samples were distributed into 5 parts for each fruit. The first part was earmarked as a control yogurt without adding of fruit (C). The samples T1, T2, T3 and T4 were manufactured by addition 2%, 5%, 7% and 10% (w/w) each fruit, respectively as shown in Table (1). The drinking yoghurt mixtures were located in100-g plastic cups and then stored at 4±1ºC in refrigerator for 14 days and sampled for analysis at fresh and after 14 days. This experiment was triplicate.

Table (1): The percentages of materials in prepared yoghurt drink.

| **Treatments** | **Yoghurt drink %** | **Sugar %** | **Fruit (%)** |
|---|---|---|---|
| Control | 94 | 6 | -- |
| Semi dried dates | | | |
| $T_1$ | 92 | 6 | 2 |
| $T_2$ | 89 | 6 | 5 |
| $T_3$ | 87 | 6 | 7 |
| $T_4$ | 84 | 6 | 10 |
| Dried apricot | | | |
| $T_1$ | 92 | 6 | 2 |
| $T_2$ | 89 | 6 | 5 |
| $T_3$ | 87 | 6 | 7 |
| $T_4$ | 84 | 6 | 10 |
| Fresh kiwifruit | | | |
| $T_1$ | 92 | 6 | 2 |

| | | | |
|---|---|---|---|
| $T_2$ | 89 | 6 | 5 |
| $T_3$ | 87 | 6 | 7 |
| $T_4$ | 84 | 6 | 10 |

**Chemical analysis:**

Fresh yoghurt samples were analyzed for titratable acidity (T.A.) and total solids (T.S.) as described by **Ling (1963)**. The pH value was measured by using pH meter type HANNA pH meter (Italy) (8417). The moisture, fat, protein, ash and fiber contents were determined as described in **AOAC *(*2005*).*** The carbohydrates as Nitrogen free extract (NFE) calculated by difference (100 – (fat + protein + ash + fiber)). Results expressed as g/100 g on fresh weight basis. Total calories were calculated according to **FAO/WHO/UNU, (1985)**. Results expressed as kcal/100 g on fresh weight basis.

The minerals Fe, Zn and Ca were digested using a microwave digestion system (Multiwave Go Plus) and determined using microwave plasma atomic emission spectroscopy (MP-AES) (model 4210, Agilent), Malaysia, according to **A.O.A.C. (2019).**

The total phenols and flavonoids were determined using the method described by **Batista et al. (2011).** The total antioxidant activity was regulated by the 1,1-diphenyl-2-picryl-hydrazyl (DPPH) method of **Maksimovi et al. (2005).**

**Sensory evaluation:**

YD treatments were assessed for their sensory qualities by ten professional panelists from the staff of the Food Technology Research Institute, Agriculture Research Center (ARC), Egypt. The panelists were asked to judge the samples for appearance (out of 10 points), flavor (out of 50 points), body and

texture (out of 30 points) and color (out of 10 points) as described by **El-Etriby *et al.* (1997).**

Statistical analysis:

Statistical analyses were carried out by the SPSS 19 program. Data were expressed as means. The Statistical analysis was performed using a one-way analysis of variance followed by Duncan test was taken to compare the data as outlined by **Snedecor and Cochran (1980).** Values of $P \leq 0.05$ were considered as significantly different.

## Results and Discussion

### *Chemical composition of fruits:*

Chemical composition of fresh kiwifruit, semi dried date and dried apricot is shown in table (2). The obtained results revealed that fresh kiwi consists of % moisture 82.9 %, ash 0.6 % , fat 1.88 %, protein 23.97 %, crude fiber 13.74 % and carbohydrate 59.81% (g 1100 g DW). While, semi dried date contained 11.8 % , 1.06 % , 0.49 % , 24.92 % , 9.04 % and 64.49 % for ash, fat, protein, fiber and carbohydrates, respectively. Chemical composition of semi dried date are in agreement with those found by **(Khan *et al*., 2008; Ahmed *et al* ., 2014 and Ayad et al ., 2020).**

It could be concluded that dried apricot, semi dried date and fresh kiwi are considered as a good source of carbohydrate, total calories, ash, crude fibers and protein. Moreover, dried apricot was the best results of these chemical constituents.

Table (2) showed that minerals of calcium (Ca), iron (Fe) and zinc (Zn) of some fruits (fresh kiwi, semi dried date and dried apricot). It is evident from the obtained results that Ca, Fe and Zn of kiwi fresh fruit were 213.5, 2.88, and 0.67, respectively mg / 100 g on dry weight basis. Meanwhile, semi dried date was 75.71, 3.95 and 0.49, respectively. In addition, dried apricot contained 86.2 of Ca, 20.83 of Fe and 0.96 of Zn.

These results are in agreement with those found by **(Hussain et al., 2010) and Ayad et al., 2020).** Date fruit is a rich source of minerals. Also, apricot is a good source of minerals especially potassium and iron **(Ghorpade et al., 1995).**

It is worth mentioning that fresh kiwi fruit was recorded the highest value of calcium, iron and zinc, followed by dried apricot and semi dried date are considered as a good source of calcium, iron and zinc. Moreover, dried apricot is the highest values of Fe and Zn.

Total phenols, flavonoids and radical scavenging activity (DPPH) of fruits (fresh kiwi, semi dried date and dried apricot) were illustrated in table (2). The results showed that total phenols of fresh kiwi, semi dried date and dried apricot were 172.24, 136.27 and 143.72, respectively mg GAE / 100 g on dry weight basis. The results are in agreement with those noticed by **(Biglari *et al* ., 2008 and Habib *et al* 2013**) . They showed that kiwifruit is rich source of polyphenols and vitamins. Meanwhile, total flavonoids of fresh kiwi, semi dried date and dried apricot were 382.12, 364.91 and 355.08, respectively mg quercetin / 100 g on dry weight basis. These results are in agreement with those found by **(Lim *et al*., 2016 and Ragab *et al*., 2019)**.

It is obvious from the results that DPPH % of fresh kiwi, semi dried date and dried apricot were 66.08 % , 87.5 and 92.5 % respectively. Moreover, dried apricot was recorded the highest value of antioxidant activity by DPPH % , followed by semi dried date and the lowest values were found in fresh kiwi fruit. While, the highest contents of total phenol and total flavonoid was found on kiwifruit.

Table (2): Chemical compositions of fresh kiwifruit, semi dried date (SDD) and dried apricot (DA).

| Items | Fresh kiwifruit | Semi dried date | Dried apricot |
|---|---|---|---|
| Moisture (g/100g) | 82. 90±0.31 | 11.8±1.01 | 22.9±0.49 |
| Chemical composition (g/100g DW) | | | |
| Protein | 23.97±0.01 | 24.92±0.58 | 17.00±0.01 |
| Fat | 1.88±0.39 | 0.49±0.01 | 0.62±0.01 |
| Ash | 0.6±0.43 | 1.06±0.44 | 2.39±0.59 |
| Fiber | 13.74±0.01 | 9.04±2.58 | 20.66±0.67 |
| Carbohydrate | 59.81±0.83 | 64.49±2.44 | 59.33±0.55 |
| Energy (Kcal) | 352±0.01 | 362±2.69 | 311±2.31 |
| Some minerals (mg/100g DW) | | | |
| Fe | 2.88±0.003 | 3.95±0.03 | 20.25±0.003 |
| Ca | 213.5±0.39 | 75.67±0.89 | 86.2±5.91 |
| Zn | 0.67±0.01 | 0.48±0.003 | 0.96±0.01 |
| Some antioxidant contents | | | |
| Total phenols (mg/100g)* | 172.24±1.34 | 136.27±3.55 | 143.72±5.27 |
| Total flavonoids (mg/100g)* | 382.12±5.89 | 364.91±2.30 | 355.08±8.00 |
| Antioxidant activity by DPPH (%) | 66.08±0.32 | 87.5±0.21 | 92.5±0.28 |

* Total phenols as Gallic acid and total flavonoids as Quercetin.
** Samples were analysis as triple.

## *Chemical composition of prepared yoghurt fortified with kiwifruit:*

Table (3) shows chemical composition of prepared yoghurt fortified with different levels of fresh kiwi fruit in both at

zero time and during cold storage at 4± 1 °C. Results revealed that moisture content was ranged from 82.20 ±0.06 to 82.11±0.02 (g/100g on DW Ash (1.12±0.01 to 1.14±0.02), fat (0.82±0.001) to (0.84±0.01), protein (3.60±0.02 to 3.76±0.01), carbohydrates (12.09±0.50 to 12.30±0.04), respectively at zero time. Meanwhile, energy was a same value (71.00) kcal/100 g on DW at zero time.

Addition of fresh kiwi to yogurt caused an increase in ash, fibers, carbohydrates and calories in both after processing and during cold storage at 4±1 °C for 14 days. These results could be due to that fresh kiwifruits is a good source of carbohydrate, ash, fibers, minerals and calories. These results are in agreement with those obtained by **(Hussain *et al* 2010; Farahat and El-Batawy, 2013 and Ragab *et al*.2019)**.

Statistical analysis of the obtained data showed that there are significant increase as the addition kiwi an increased at $p \leq 0.05$ among all prepared yogurt samples in both at zero time or 14 days of storage period .

Concerning of minerals contents, Ca, Fe and Zn for prepared yoghurt fortified by fresh kiwifruit with different percentages (0,2,5,7 and 10%) during storage at 4±1c$^{o}$ for 14 days are illustrated in table (3). The obtained results indicated that the average of Ca was ranged from (150 to 159.80), Fe (0,19 to 0.20) and Zn (0.19 to 0.21) mg/100g on DW, respectively. These minerals were increased as the levels of kiwifruit increased. This increase of minerals content could be attributed to the kiwi fruit is a good source of these studied minerals as shown in the previously results as shown in table (3). These results are in agreement with those found by **(Farahat and El-Batawy , 2013)**. Kiwifruit was improvements not only in nutri-

tional value, but also benefits to immune and metabolic health **(Boeing *et al*., 2012)**.

Statistical analysis of the obtained data showed that these were significant increase of Ca, Fe and Zn at $P \leq 0.05$ of all prepared yoghurt formulae as the levels of Kiwi fruit addition in either at zero time or during cold storage period.

It is mentioned from the results that, formula (5) which contained 10% fresh kiwifruit is the highest value of Ca, Fe and Zn in both at zero time or at 14 days of cold storage at 4±1 $c^o$.

Table (3): chemical composition of yogurt fortified with different percentages of fresh kiwifruit during storage.

| Formulae | Chemical composition (g/100g FW) | | | | | | | Some minerals (mg/100g DW)* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moisture | Protein | Fat | Ash | Fiber | Carbo. | Energy | Fe | Zn | Ca |
| Zero time | | | | | | | | | | |
| Control | 82.20±0.06$^{a}$ | 3.76±0.01$^{a}$ | 0.83±.0.01$^{ab}$ | 1.12±0.01$^{a}$ | -- | 12.09±0.50$^{c}$ | 71.00±0.28$^{a}$ | 159.80 | 0.19 | 0.21 |
| 2% kiwi | 82.17±0.04$^{a}$ | 3.72±0.01$^{a}$ | 0.84±0.01$^{a}$ | 1.13±0.01$^{a}$ | 0.04±0.01$^{d}$ | 12.09±0.02 $^{c}$ | 71.00±0.13$^{a}$ | 157.00 | 0.19 | 0.20 |
| 5% kiwi | 82.14±0.01$^{a}$ | 3.67±0.06$^{b}$ | 0.83±0.01$^{ab}$ | 1.14±0.02$^{a}$ | 0.07±0.01$^{c}$ | 12.15±0.02$^{bc}$ | 71.00±0.05 $^{a}$ | 152.80 | 0.20 | 0.21 |
| 7% kiwi | 82.11±0.01$^{a}$ | 3.62±0.06$^{c}$ | 0.83±0.01$^{ab}$ | 1.12±0.02$^{a}$ | 0.10±0.01$^{b}$ | 12.22±0.02$^{ab}$ | 71.00±0.01$^{a}$ | 150.00 | 0.19 | 0.20 |
| 10% kiwi | 82.11±0.02$^{a}$ | 3.60±0.02$^{c}$ | 0.82±0.001$^{b}$ | 1.12±0.02$^{a}$ | 0.14±0.01$^{a}$ | 12.30±0.04 $^{a}$ | 71.00±0.02$^{a}$ | 154.80 | 0.20 | 0.19 |
| Storage 14 days at 4°C | | | | | | | | | | |
| Control | 78.85±0.01$^{a}$ | 4.36±0.01$^{a}$ | 0.98±0.01$^{a}$ | 1.35±0.01$^{a}$ | -- | 14.46±0.02$^{d}$ | 84.00±0.03$^{a}$ | 152.22 | 0.17 | 0.19 |
| 2% kiwi | 78.84±0.29$^{a}$ | 4.28±.0.01$^{b}$ | 0.97±0.01$^{a}$ | 1.32±0.01$^{ab}$ | 0.30±.001$^{c}$ | 14.58±0.01$^{c}$ | 84.00±0.05$^{a}$ | 150.40 | 0.17 | 0.17 |
| 5% kiwi | 78.48±0.02$^{ab}$ | 4.25±0.01$^{c}$ | 0.95±0.01$^{b}$ | 1.33±0.01$^{ab}$ | 0.32±0.001$^{c}$ | 14.67±0.01$^{b}$ | 84.00±0.12$^{a}$ | 145.20 | 0.18 | 0.18 |
| 7% kiwi | 78.42±0.03$^{ab}$ | 4.22±0.01$^{d}$ | 0.93±0.03$^{c}$ | 1.30±0.01$^{bc}$ | 0.43±0.01$^{b}$ | 14.70±0.02$^{b}$ | 84.00±0.17$^{a}$ | 142.60 | 0.17 | 0.17 |
| 10% kiwi | 78.36±0.05$^{b}$ | 4.19±0.01$^{e}$ | 0.91±0.01$^{d}$ | 1.27±0.01$^{c}$ | 0.47±-0.01$^{a}$ | 14.80±0.03$^{a}$ | 84.00±0.21$^{a}$ | 146.20 | 0.18 | 0.16 |

*Samples were analysis as triple from Atomic. **a,b,c…. etc: means within the same column with different superscripts are significantly different (P<0.05).

***Chemical composition of prepared yoghurt fortified with semi dried date (SDD):***

Table (4) illustrates chemical composition of prepared yoghurt supplemented with different percentage of semi dried date (2,5,7 and 10%) in either after processing or during cold storage period at 4 ± I c for 14 days. The obtained results showed that moisture content was ranged from (76.32±0.52 to 82.20±0.06) (g/100g on fresh weight basis). The higher value was found in formula (1) and the lowest was in formula (5) without addition. Ash content was ranged from (1.12±0.01 to 1.19±0.01), the highest value was found in formula (5) and the lowest was found in control sample. Fat was ranged from (0.82±0.01 to 0.84±0.01). Meanwhile, crude protein was ranged from (3.64±0.03 to 3.76±0.01). However carbohydrate was ranged from (12.09±0.05 to 17.83±0.57). The highest value was found in formula (5) which contained 10% semi dried date. On the other hand, energy was ranged from (71.00±0.28 to 93.26±2.14) (kcal / 100g dry weight basis). This result may be due to date is richness of different cultivars with carbohydrates and fiber (**Al-Tamim, 2014**). Moreover, dates is considered as a good source of bioactive components **(Habib and Ibrahim , 2008 and Habib *et al* ., 2014)** .

Statistical analysis of the obtained results indicated that there are significant increases as the level of date increase at $p \leq 0.05$ among all prepared yoghurt samples in either processing or at the end of cold storage period. It is clear from the abovementioned results that formula ( 5 ) which contained 10% semi dried date was recorded the highest value of ash, fibers , carbohydrates and calories , followed by formula (4) , (3) and (2) , respectively . In

contrast, formula (1) or control sample was the lowest value of these chemical components.

Minerals content of prepared yoghurt fortified by semi dried date with different percentages (2,5,7 and 10%) during cold storage at 4±1 $c^{o}$ for 14 days are illustrated in table (4). Results showed that Ca was ranged from (149.00 to 159.80) my/100g on dry weight basis. The lowest value was noticed in formula (5) which contained 10% semi dried date. On the other hand, Fe was ranged from (0.19 to 0.49), while Zn value was ranged from (0.20 to 0.22), respectively. These studied minerals increased as the levels of semi dried date increased. This increase of studied minerals may be due to that semi dried date is a rich source of these minerals as shown in the previously results in table (4). Also, Date is a rich source of minerals such as calcium, iron, zinc and other minerals **(Al-Shabib and marshall, 2003 and Khan *et al*, 2008)**.

Table (4): chemical composition of yogurt fortified with different percentages of semi dried date (SDD) during storage.

| Formulae | Chemical composition (g/100g FW) | | | | | | | Some minerals (mg/100g DW)* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moisture | Protein | Fat | Ash | Fiber | Carbo. | Energy | Fe | Zn | Ca |
| Zero time | | | | | | | | | | |
| Control | 82.20±0.06$^{a}$ | 3.76±0.01$^{a}$ | 0.83±0.01$^{a}$ | 1.12±0.01$^{c}$ | -- | 12.09±0.05$^{e}$ | 71.00±0.28$^{d}$ | 159.80 | 0.19 | 0.21 |
| 2% SDD | 80.86±0.01$^{b}$ | 3.72±0.01$^{a}$ | 0.83±0.01$^{a}$ | 1.13±0.01$^{c}$ | 0.06±0.01$^{c}$ | 13.40±0.01$^{d}$ | 75.92±0.04$^{c}$ | 157.64 | 0.24 | 0.21 |
| 5% SDD | 78.75±0.02$^{c}$ | 3.72±0.02$^{a}$ | 0.84±0.01$^{a}$ | 1.16±0.01$^{b}$ | 0.13±0.01$^{b}$ | 15.40±0.02$^{c}$ | 84.04±0.05$^{b}$ | 154.40 | 0.34 | 0.22 |
| 7% SDD | 77.66±0.51$^{d}$ | 3.63±0.01$^{b}$ | 0.82±0.01$^{a}$ | 1.16±0.01$^{b}$ | 0.15±0.01$^{b}$ | 16.58±0.50$^{b}$ | 88.21±2.57$^{b}$ | 152.24 | 0.39 | 0.22 |
| 10% SDD | 76.32±0.52$^{e}$ | 3.64±0.03$^{b}$ | 0.82±0.01$^{a}$ | 1.19±0.01$^{a}$ | 0.20±0.01$^{a}$ | 17.83±0.57$^{a}$ | 93.26±2.14$^{a}$ | 149.00 | 0.49 | 0.22 |
| Storage 14 days at 4°C | | | | | | | | | | |
| Control | 78.85±0.01$^{a}$ | 4.36±0.01$^{a}$ | 0.98±0.01$^{a}$ | 1.35±0.01$^{c}$ | -- | 14.46±0.02$^{e}$ | 84.00±0.03$^{e}$ | 152.22 | 0.17 | 0.19 |
| 2% SDD | 77.17±0.02$^{b}$ | 4.24±0.01$^{b}$ | 0.98±0.01$^{a}$ | 1.36±0.01$^{bc}$ | 0.35±0.01$^{d}$ | 15.90±0.02$^{d}$ | 89.00±0.05$^{d}$ | 150.46 | 0.21 | 0.18 |
| 5% SDD | 75.11±0.02$^{c}$ | 4.22±0.01$^{b}$ | 0.95±0.01$^{b}$ | 1.38±0.01$^{bc}$ | 0.42±0.01$^{c}$ | 17.92±0.01$^{c}$ | 97.00±0.11$^{c}$ | 147.60 | 0.32 | 0.19 |
| 7% SDD | 72.35±0.17$^{d}$ | 4.15±0.08$^{b}$ | 0.94±0.02$^{b}$ | 1.48±0.01$^{b}$ | 0.47±0.01$^{b}$ | 20.61±0.17$^{b}$ | 108.00±0.37$^{b}$ | 145.60 | 0.36 | 0.18 |
| 10% SDD | 71.64±0.03$^{e}$ | 3.96±0.01$^{c}$ | 0.92±0.01$^{c}$ | 1.60±0.01$^{a}$ | 0.54±0.01$^{a}$ | 21.34±0.02$^{a}$ | 110.00±0.17$^{a}$ | 142.70 | 0.45 | 0.19 |

*Samples were analysis as triple from Atomic. **a,b,c…. etc: means within the same column with different superscripts are significantly different ($P<0.05$).

Statistical analysis of the obtained results that there were significant increase of Ca, Fe and Zn ($P \leq 0.05$) of all processed yoghurt samples as the percentage of semi dried date increased in eighter at zero time or at the end of cold storage period.

***Chemical composition of prepared yoghurt fortified with dried apricot (DA):***

Table (5) shows the percentage of chemical composition of prepared yoghurt supplemented by 2,5,7 and 10% of different levels of dried apricot during cold storage at 4±1 $c^o$ for 14 days. Results showed that moisture content was ranged from (76.32±0.20 to 82.20±0.06), Ash (1.12±0.01 to 1.32±0.01), fat (0.83±0.01 to 0.84±0.01); Protein (3.76±0.01 to 3.820.01), crude fiber (0±0 to 0.29±0.02), Carbohydrate (12.09±0.05 to 17.42±0.23) (g/100g) on dry weight basis. On the other hand, calories were ranged from (71.00±0.28 to 93.00±0.80) on dry weight basis. It is evident from the results that the addition of dried apricot to prepared yoghurt caused an increase in ash, crude fibers, carbohydrate and energy in either after processing or during subsequent cold storage. This may be due to that dried apricot is considered as a good, source of carbohydrate, ash and fiber. These results are confirmed by **(Ghorpade et al., 1995)**.

Statistical analysis of the obtained data showed there are significant differences among all treatments at $p \leq 0.05$ of all prepared yoghurt formulae in both after processing or during cold storage. It is worthy to mention that, the addition of dried apricot to yoghurt was improved nutritional value for product; the higher of addition, the higher nutritional value was increased.

Minerals content of Ca, Fe and Zn of prepared yoghurt supplemented by dried apricot with different ratio (0,2,5,7 and 10%) during cold storage at 4±1c$^{o}$ for 2 weeks are shown in table (5). Results showed that the average of Ca was ranged from (151.40 to 159.80), Fe (0.19 to 0.67) and Zn (0.21 to 0.24) mg/100g on dry weight basis, respectively. These minerals content were increased as the addition of dried apricot increased. This increase of studied minerals may be due to that apricot is a good source of minerals as illustrated in the previously study in table (5). These results are confirmed by **(Drogoudi *et al*, 2008)** who found that the most abundant minerals of apricot are iron and potassium. Also, **(Hussain *et al.*, 2010)** found that apricot contain microelements (Fe, Zn and Ca).

Table (5): chemical composition of yogurt fortified with different percentages of dried apricot (DA) during storage.

| Formulae | Chemical composition (g/100g FW) | | | | | | | Some minerals (mg/100g DW)* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moisture | Protein | Fat | Ash | Fiber | Carbo. | Energy | Fe | Zn | Ca |
| Zero time | | | | | | | | | | |
| Control | 82.20±0.06$^{a}$ | 3.76±0.01$^{ab}$ | 0.83±0.01$^{a}$ | 1.12±0.01$^{e}$ | -- | 12.09±0.05$^{e}$ | 71.00±0.28$^{e}$ | 159.80 | 0.19 | 0.21 |
| 2% DA | 80.96±0.06$^{b}$ | 3.75±0.01$^{ab}$ | 0.83±0.01$^{a}$ | 1.19±0.01$^{d}$ | 0.10±0.02$^{d}$ | 13.17±0.01$^{d}$ | 75.00±0.01$^{d}$ | 158.12 | 0.28 | 0.21 |
| 5% DA | 78.58±0.30$^{c}$ | 3.78±0.01$^{ab}$ | 0.84±0.01$^{a}$ | 1.24±0.01$^{c}$ | 0.16±0.01$^{c}$ | 15.40±0.29$^{c}$ | 84.28±1.18$^{c}$ | 155.60 | 0.43 | 0.23 |
| 7% DA | 77.81±0.02$^{d}$ | 3.79±0.05$^{ab}$ | 0.84±0.01$^{a}$ | 1.28±0.01$^{b}$ | 0.22±0.01$^{b}$ | 16.06±0.02$^{b}$ | 87.00±0.14$^{b}$ | 153.92 | 0.52 | 0.23 |
| 10% DA | 76.32±0.20$^{e}$ | 3.820.01$^{a}$ | 0.84±0.01$^{a}$ | 1.32±0.01$^{a}$ | 0.29±0.02$^{a}$ | 17.42±0.23$^{a}$ | 93.00±0.80$^{a}$ | 151.40 | 0.67 | 0.24 |
| Storage 14 days at 4°C | | | | | | | | | | |
| Control | 78.85±0.01$^{a}$ | 4.36±0.01$^{e}$ | 0.98±0.01$^{a}$ | 1.35±0.01$^{e}$ | -- | 14.46±0.02$^{d}$ | 84.00±0.03$^{d}$ | 152.22 | 0.17 | 0.19 |
| 2% DA | 76.16±0.62$^{b}$ | 4.42±0.01$^{d}$ | 0.98±0.01$^{a}$ | 1.40±0.01$^{d}$ | 0.39±0.02$^{d}$ | 16.65±058$^{c}$ | 93.00±2.33$^{c}$ | 151.90 | 0.25 | 0.18 |
| 5% DA | 75.35±0.60$^{bc}$ | 4.45±0.01$^{c}$ | 0.95±0.01$^{b}$ | 1.46±0.01$^{c}$ | 0.48±0.01$^{c}$ | 17.30±0.58$^{bc}$ | 96.00±2.28$^{bc}$ | 148.40 | 0.40 | 0.18 |
| 7% DA | 73.97±059$^{c}$ | 4.49±0.01$^{b}$ | 0.93±0.01$^{c}$ | 1.59±0.01$^{b}$ | 0.55±0.02$^{b}$ | 18.56±0.58$^{b}$ | 101.00±2.30$^{b}$ | 146.18 | 0.49 | 0.19 |
| 10% DA | 71.95±0.07$^{d}$ | 4.52±0.01$^{a}$ | 0.91±0.01$^{d}$ | 1.57±0.02$^{a}$ | 0.63±0.01$^{a}$ | 20.42±0.06$^{a}$ | 108.00±0.16$^{a}$ | 143.60 | 0.60 | 0.19 |

*Samples were analysis as triple from Atomic. **a,b,c…. etc: means within the same column with different superscripts are significantly different ($P<0.05$).

Statistical analysis of the obtained results indicated that there were significant increase ($P \leq 0.05$) in minerals content (Ca, Fe and Zn) among all prepared yoghurt fortified by dried apricot in either at zero time or at the end of cold storage at 4±1c° for 2 weeks.

***pH- value, TA, TS and some phytochemical contents of yogurt fortified with different percentages of fresh kiwifruit during storage***:

PH value, acidity and total solids of yoghurt supplemented by fresh Kiwifruit with different ratio 2, 5, 7 and 10% during cold storage at 4±1c° for 2 weeks are shown in table (6). The obtained results indicated that pH value was ranged from 4.51±0.01 to 4.70±0.03, acidity (1.49±0.001 to 1.08±0.004) and total solids (10.7±0.088 to 16.6±0.26), respectively. It is noticed that pH, titratable acidity (TA) and total solids (TS) values were increased as the level of fresh Kiwifruit increased in after processed, but pH- value and TA were decreased during cold storage period.

Statistical analysis of the obtained results indicated that there are. Significant difference among all treatments at $p \leq 0.05$ of pH value, acidity and total solid due to the addition of fresh kiwi to prepared yoghurt and cold storage at 4 ± 1 c for 2 weeks. However, formula (5) which contained 10% fresh Kiwi was recorded the highest value of pH, acidity and total solids meanwhile, the lowest value was found in control sample (without any addition).

Table (6) illustrates total phenols, flavonoids and radical scavenging activity by DPPH % of prepared yoghurt supplemented by fresh Kiwi fruit with different ratio (0,2,5,7 and 10) during 14 days of cold storage at 4±1 $c^o$. Results indicated that the average of total phenols was (255.70±0.12 to 372.10±1.54) mg Gallic acid /100 g on fresh weight sample just immediately after processing. On the other hand, total flavonoids was ranged from (66.30±1.01 to 98.30±0.59) after processing. Both total phenols and flavonoids of prepared yoghurt were increased with the percentages of fresh Kiwi fruit increased. These results may be due to that Kiwifruit is a good source of polyphenols and flavonoids as shown in the previously results. These results are in agreement with those obtained by **(Almedia *et al,* 2018)** who found that Kiwi fruit is a good source of polyphenol compounds.

It is obvious from the results that DPPH scavenging activity % was ranged from (20.8±0.01 to 58.1±0.91) after processing DPPH% was increased as the level of addition of fresh Kiwifruit increased. These results are confirmed by **(Ragab *et al,* 2014)** Statistical analysis of the obtained $p \leq 0.05$ results showed that total phenols, flavonoids and antioxidant activity by DPPH scavenging activity. Significantly increase as the level of the addition of Kiwi fruit increased.

Table (6): pH-value, TA, TS and some phytochemical contents of yogurt fortified with different percentages of fresh kiwifruit during storage.

| Formulae | pH- value | TA | TS | Total phe-nols (mg/100g)** | Total flavo-noids (mg/100g)** | Antioxidant activity by DPPH % |
|---|---|---|---|---|---|---|
| Zero time | | | | | | |
| Control | 4.51±0.01$^{b}$ | 1.49±0.001$^{e}$ | 10.7±0.088$^{d}$ | 255.70±0.12$^{c}$ | 66.30±1.01$^{e}$ | 20.80±0.01$^{e}$ |
| 2% kiwi | 4.52±0.01$^{b}$ | 0.59±0.002$^{d}$ | 11.3±0.088$^{c}$ | 226.80±0.15$^{c}$ | 68.90±0.06$^{d}$ | 35.30±0.11$^{d}$ |
| 5% kiwi | 4.53±0.02$^{b}$ | 0.64±0.002$^{c}$ | 11.8±0.14$^{c}$ | 229.04±0.58$^{c}$ | 78.70±0.06$^{c}$ | 48.10±0.13$^{c}$ |
| 7% kiwi | 4.50±0.03$^{b}$ | 0.84 ±0.003$^{b}$ | 12.4±0.17$^{b}$ | 306.10±0.58$^{b}$ | 89.30±0.17$^{b}$ | 56.30±0.21$^{b}$ |
| 10% kiwi | 4.70±0.03$^{a}$ | 1.08±0.004$^{a}$ | 16.6±0.26$^{a}$ | 372.10±1.54$^{a}$ | 98.30±0.59$^{a}$ | 58.10±0.91$^{a}$ |
| Storage 14 days at 4°C | | | | | | |
| Control | 4.3±0.01$^{b}$ | 0.74±0.001$^{d}$ | 11.7±0.088$^{e}$ | 76.40±0.20$^{e}$ | 42.30±0.003$^{e}$ | 13.80±0.06$^{c}$ |
| 2% kiwi | 4.4±0.01$^{b}$ | 0.81±0.001$^{c}$ | 12.2±0.088$^{d}$ | 170.20±1.17$^{d}$ | 60.04±0.03$^{d}$ | 14.50±0.17$^{c}$ |
| 5% kiwi | 4.47±0.01$^{ab}$ | 0.89±0.001$^{b}$ | 12.6±0.088$^{c}$ | 198.30±1.17$^{c}$ | 72.20±0.12$^{c}$ | 16.02±0.29$^{b}$ |
| 7% kiwi | 4.49±0.03$^{ab}$ | 0.89±0.002$^{b}$ | 13.03±0.12$^{b}$ | 229.20±1.75$^{b}$ | 84.10±0.55$^{b}$ | 16.33±0.31$^{b}$ |
| 10% kiwi | 4.67±0.15$^{a}$ | 2.12±0.002$^{a}$ | 17.26±0.12$^{a}$ | 257.20±5.2$^{a}$ | 92.50±1.13$^{a}$ | 31.70±0.57$^{a}$ |

*a,b,c…. etc: means within the same column with different superscripts are significantly different ($P<0.05$).

** Total phenols as Gallic acid and total flavonoids as Quercetin.

## *pH- value, TA, TS and some antioxidants contents of yogurt fortified with different percentages of semi dried date (SDD) during storage:*

Total solids, pH value and acidity of processed yoghurt supplemented by semi dried date with different levels (2,5, 7 and 10%) during cold storage at 4±1 c$^{o}$ for 14 days are shown in table(7). It was noticed that the average of total solids was

ranged from (10.7±0.09 to 16.70±0.26), pH-value (4.51±0.01 to 4.74±0.02) and titratable acidity (1.49±0.001 to 1.04±0.03), respectively. It is worthy to mention that total acidity, pH value and acidity were increased as the level of semi dried date increased after processed. The same trends of results are in agreement with those found by **(Jambi, 2018)**

Statistical analysis of the obtained results showed that there were significant ($p \leq 0.05$) increases in both total solid and acidity as the addition percent of semi dried date increased. Meanwhile, PH value showed no significant difference. Moreover, addition of semi dried date to yoghurt with the percent 10% was recorded the highest value of total solids, while the lowest value was noticed in control sample (without any addition).

Table (7) shows total phenols, flavonoids and scavening activity DPPH of processed yoghurt fortified by simidry date with different levels of (0,2,5,7 and 10%) during cold storage at 4±1 $c^o$ 2 weeks The obtained data showed that the average of total polyphenols was ranged from (255.70±0.12 to 294.00±0.59) mg GAE/100g fresh weight. On the other hand, total flavonoids were ranged from (66.30±1.01 to 99.10±0.60) as quercetin /100g on fresh weight samples. Both total phenols and flavonoids were increased as the level of semi dried date increased. This increase attributed to that semi dried date is a good source of polyphenols and flavonoids as shown in the previously results in the table (8).

Anti-oxidant activity by radical activity was determined by DPPH % scavening of the prepared yoghurt formulae was ranged from (20.80±0.01 to 55.90±0.20 %). The highest per-

centage of DPPH % was found in formula (5) which contained 10% semi dried dates and the lowest percentage was noticed in control sample,(without any addition).

Statistical analysis of the obtained results showed that there were significantly increase ($P \leq 0.05$) in total phenols, flavonoids and DPPH% off all prepared yoghurt supplemented by semi dried date in both at zero time or at the end of cold storage.

Moreover, formula (5) which contained 10%, semi dried date showed the highest percentage of total phenols, flavonoids and DPPH % scavening activity of both prepared yoghurt in both after processing and at the end of cold storage period, followed by formulae (4), (3), (2) and (1) control samples (without any addition).

Table (7): pH-value, TA, TS and some antioxidants contents of yogurt fortified with different percentages of semi dried date (SDD) during storage.

| Formulae | pH- value | TA | TS | Total phenols (mg/100g)** | Total flavonoids (mg/100g)** | Antioxidant activity by DPPH % |
|---|---|---|---|---|---|---|
| Zero time | | | | | | |
| Control | 4.51±0.01$^{c}$ | 1.49±0.001$^{a}$ | 10.7±0.0$^{d}$ | 255.70±0.12$^{b}$ | 66.30±1.01$^{d}$ | 20.80±0.01$^{c}$ |
| 2% SDD | 4.52±0.01$^{d}$ | 0.49±0.002$^{d}$ | 14.10±0.08$^{c}$ | 218.50±0.10$^{e}$ | 72.90±0.06$^{c}$ | 55.30±0.02$^{b}$ |
| 5% SDD | 4.54±0.01$^{c}$ | 0.57±0.003$^{c}$ | 15.30±0.08$^{b}$ | 225.70±0.12$^{d}$ | 74.60±0.06$^{b}$ | 55.50±0.05$^{ab}$ |
| 7% SDD | 4.64±0.01$^{b}$ | 0.65±0.004$^{b}$ | 16.60±0.17$^{a}$ | 229.70±0.58$^{c}$ | 98.30±0.47$^{a}$ | 55.70±0.10$^{ab}$ |
| 10% SDD | 4.74±0.02$^{a}$ | 1.04±0.03$^{a}$ | 16.70±0.26$^{a}$ | 294.00±0.59$^{a}$ | 99.10±0.60$^{a}$ | 55.90±0.20$^{a}$ |
| Storage 14 days at 4°C | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Control | 4.30±0.01$^{b}$ | 0.74±0.001$^{d}$ | 11.7±0.088$^{e}$ | 76.40±0.20$^{e}$ | 42.30±0.003$^{c}$ | 13.80±0.06$^{e}$ |
| 2% SDD | 4.48±0.01$^{a}$ | 0.50±0.001$^{d}$ | 15.30±0.08$^{c}$ | 176.00±1.10$^{d}$ | 30.04±0.12$^{d}$ | 14.50±0.10$^{d}$ |
| 5% SDD | 4.51±0.02$^{a}$ | 0.72±0.001$^{c}$ | 17.20±0.12$^{b}$ | 202.80±1.70$^{c}$ | 33.10±0.55$^{d}$ | 19.60±0.26$^{c}$ |
| 7% SDD | 4.56±0.02$^{a}$ | 0.74±0.001$^{b}$ | 17.30±0.12$^{b}$ | 213.80±2.80$^{b}$ | 93.30±1.70$^{b}$ | 22.10±0.26$^{b}$ |
| 10% SDD | 4.67±0.15$^{a}$ | 0.89±0.003$^{a}$ | 19.30±0.14$^{a}$ | 240.00±3.40$^{a}$ | 96.50±1.70$^{a}$ | 46.80±0.57$^{a}$ |

*a,b,c…. etc: means within the same column with different superscripts are significantly different (P<0.05).

** Total phenols as Gallic acid and total flavonoids as Quercetin.

***pH-value, TA, TS and some antioxidants contents of yogurt fortified with different percentages of dried apricot (DA) during storage:***

Table (8) illustrates PH value, acidity and total solids of prepared yoghurt fortified by different ratio of dried apricot during cold storage period at 4 ± 1c° for 14 days. The obtained data indicated that the average of PH-value was ranged from (4.51±0.01 to 4.67±0.01), titratable acidity (1.49±0.001 to 0.84±0.004) and total solids (10.7±0.09 to 17.5±0.20) respectively. The results that PH value, acidity and showed total solids were increased as the percent of dried apricot increased, the highest value was found in prepared yoghurt supplemented by 10% and the lowest value was found in control sample (without any addition ). The same trends of results are in agreement with those found by **(Drogoudi et al., 2008)**.

Statistical analysis of the results showed that there were significantly increase at $P \leq 0.05$ in both total solids and the acidity of all prepared samples after processed. In contrast, PH values of samples did not significant differences.

Table (8) illustrates total phenols, flavonoids and antioxidant activity by DPPH% radical scavenging activity of prepared yoghurt supplemented by dried apricot with different ratio of dried apricot (2,5,7, and 10%) during cold storage at 4 ± 1c$^{o}$ for 14 days. Results showed that after processing the average of total phenols was from (255.70±0.12 to 417.7±3.18) mg gallic acid /100g on fresh weight samples. The highest value was found in formula (5) which contained 10% dried apricot and the lowest value was found in control sample (without any addition). On the other hand, total flavonoids was ranged from (66.30±1.01 to 69.40±0.28) mg quercetin /100g dry weight sample, the higher value was found in formula (5) and the lowest value was noticed in control sample.

It is evident from the results that DPPH (%) radical scavenging activity of prepared yoghurt was ranged from 20.80±0.01 to 56.30±0.20 % just after processing or at zero time. Statistical analysis of the obtained results indicated that total phenols, flavonoids and DPPH% of processed yoghurt fortified by dry apricot were significantly increased ($P \leq 0.05$) in either at zero time or during cold storage . In addition apricot is a good source of polyphenols and carotenoids and has an antioxidant activity **(Rice-Evans *et al* 1997 and Gardner *et al.*, 2000)**.

Table (8): pH, TA, TS and some antioxidants contents of yogurt fortified with different percentages of dried apricot (DA) during storage.

| Formulae | pH- value | TA | TS | Total phe-nols (mg/100g)** | Total flavo-noids (mg/100g)** | Antioxidant activity by DPPH % |
|---|---|---|---|---|---|---|
| Zero time | | | | | | |
| Control | 4.51±0.01$^{a}$ | 1.49±0.001$^{a}$ | 10.7±0.09$^{d}$ | 255.70±0.12$^{d}$ | 66.30±1.01$^{ab}$ | 20.80±0.01$^{e}$ |
| 2% DA | 4.56±0.01$^{a}$ | 0.61±0.001$^{c}$ | 14.4±0.11$^{c}$ | 189.3±0.12$^{e}$ | 16.20±0.06$^{e}$ | 37.50±0.07$^{d}$ |
| 5% DA | 4.65±0.01$^{a}$ | 0.71±0.001$^{b}$ | 16.1±0.14$^{b}$ | 225.7±0.12$^{c}$ | 18.60±0.06$^{d}$ | 41.60±0.09$^{c}$ |
| 7% DA | 4.65±0.02$^{a}$ | 0.79±0.002$^{a}$ | 16.3±0.18$^{b}$ | 366.4±0.21$^{b}$ | 56.60±0.11$^{c}$ | 48.10±0.11$^{b}$ |
| 10% DA | 4.67±0.01$^{a}$ | 0.84±0.004$^{a}$ | 17.5±0.20$^{a}$ | 417.7±3.18$^{a}$ | 69.40±0.28$^{a}$ | 56.30±0.20$^{a}$ |
| Storage 14 days at 4°C | | | | | | |
| Control | 4.30±0.01$^{c}$ | 0.74±0.001$^{c}$ | 11.7±0.088$^{e}$ | 76.40±0.20$^{e}$ | 42.30±0.003$^{b}$ | 13.80±0.06$^{c}$ |
| 2% DA | 4.31±0.03$^{bc}$ | 0.71±0.001$^{d}$ | 14.6±0.04$^{c}$ | 102.80±0.20$^{d}$ | 15.60±0.02$^{e}$ | 17.10±0.06$^{c}$ |
| 5% DA | 4.33±0.03$^{bc}$ | 0.74±0.001$^{c}$ | 17.1±0.08$^{b}$ | 193±1.15$^{c}$ | 17.70±0.16$^{c}$ | 17.30±0.10$^{c}$ |
| 7% DA | 4.40±0.03$^{b}$ | 0.76±0.001$^{b}$ | 17.2±0.08$^{b}$ | 340.00±2.88$^{b}$ | 48.50±0.55$^{b}$ | 50.70±0.50$^{b}$ |
| 10% DA | 4.55±0.04$^{a}$ | 0.89±0.001$^{a}$ | 19.5±0.12$^{a}$ | 385.30±3.40$^{a}$ | 57.90±4.04$^{a}$ | 56.80±0.60$^{a}$ |

*a,b,c…. etc: means within the same column with different superscripts are significantly different ($P<0.05$).

** Total phenols as Gallic acid and total flavonoids as Quercetin.

## *Sensory evaluation of yoghurt fortified with fresh kiwifruit, semi dried date (SDD) and dried apricot (DA):*

Table (9) showed the sensory evaluation of flavor, body & texture, color and appearance of prepared yoghurt fortified by different ratio of fresh Kiwifruit or semi dried date or dried apricot as ( 0,2,5, 7 and 10%) after processing were carried out by 10 panelists of stuff members of Home Economics Department, Faculty of specific Education, Benha University.

The obtained results showed that, the addition of kiwifruit or SDD or DA to prepared yoghurt improved flavor, body & texture, color and appearance, was improved in all organoleptic evaluation. Moreover, Formula (5) which contained 10% Kiwifruit or SDD or DA was recorded the highest score of all sensory evaluation.

These results are in the line with (**Soliman and Shehata, 2019; Blassy *et al*., 2020; Zaher *et al*., 2023; Sobti *et al*., 2023and Yacoub *et al*., 2024**) who found that, fortification dairy products by fruit caused to improve of sensory properties.

Table (9): Sensory evaluation of yoghurt fortified with fresh kiwifruit, semi dried date (SDD) and dried apricot (DA).

| Properties | Flavor (50) | Body & texture (30) | Color (10) | Appearance (10) |
|---|---|---|---|---|
| Different percentages of kiwifruit | | | | |
| Control | 42.50±1.10$^{a}$ | 25.50±0.57$^{a}$ | 7.20±0.22$^{c}$ | 7.20±0.24$^{c}$ |
| 2 % kiwifruit | 44.00±1.17$^{a}$ | 27.50±0.76$^{a}$ | 7.40±0.4$^{c}$ | 7.80±0.29$^{c}$ |
| 5 % kiwifruit | 44.10±1.32$^{a}$ | 26.80±0.82$^{a}$ | 7.90±0.44$^{bc}$ | 8.00±0.29$^{bc}$ |
| 7 % kiwifruit | 44.30±1.47$^{a}$ | 28.10±0.89$^{a}$ | 8.90±0.45$^{ab}$ | 8.80±0.33$^{ab}$ |
| 10 % kiwifruit | 46.30±3.91$^{a}$ | 28.30±2.04$^{a}$ | 9.50±.048$^{a}$ | 9.20±0.35$^{a}$ |
| Different percentages semi dried date (SDD) | | | | |
| Control | 44.00±0.64$^{a}$ | 25.50±0.53$^{a}$ | 8.20±0.22$^{b}$ | 8.60±0.21$^{a}$ |

| | | | | |
|---|---|---|---|---|
| 2 % SDD | 45.60±0.77[a] | 27.90±0.54[a] | 8.40±0.3[ab] | 8.90±0.23[a] |
| 5 % SDD | 46.60±1.13[a] | 28.20±0.67[a] | 8.50±0.37[ab] | 9.00±0.24[a] |
| 7 % SDD | 47.00±1.21[a] | 28.30±0.87[a] | 8.50±0.45[ab] | 9.00±0.3[a] |
| 10 % SDD | 48.10±3.91[a] | 28.60±2.04[a] | 9.50±0.53[a] | 9.20±0.42[a] |
| Different percentages of dried apricot (DA) | | | | |
| Control | 36.05±3.9[a] | 20.90±2.04[a] | 9.10±0.22[a] | 8.70±0.15[a] |
| 2 % DA | 36.20±5.89[a] | 21.20±2.68[a] | 9.20±0.22[a] | 8.80±0.15[a] |
| 5 % DA | 37.00±5.9[a] | 21.40±2.73[a] | 9.25±0.25[a] | 9.10±0.17[a] |
| 7 % DA | 44.00±6.05[a] | 24.30±2.93[a] | 9.50±0.27[a] | 9.20±0.24[a] |
| 10 % DA | 45.20±7.64[a] | 25.50±4.01[a] | 9.50±0.29[a] | 9.30±0.24[a] |

*a,b,c…. etc: means within the same column with different superscripts are significantly different (P<0.05).

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الملخص : تعتبر منتجات الحليب المتخمرة (مثل مشروب الزبادى أو الزبادو) من أكثر الأطعمة المحببة للناس وخاصة الأطفال . ولكنها تفتقر لعنصر الحديد كما لا يوجد بها ألياف . وفى هذا البحث تم استخدام الحليب الجاموسى منزوع الدسم لتصنيع مشروب الزبادى وتدعيمه ببعض أنواع الفاكهة كمصادر طبيعية للحديد والألياف . ولهذا تم اختيار الكيوي الطازج والبلح النصف جاف والمشمش المجفف فى هذه الدراسة لتدعيم مشروب الزبادى . ثم بعد ذلك تم اضافة الفاكهة بنسب (٢ ، ٥ ، ٧ ، ١٠%) لكل منها على حدة وفى البحث الحالى قمنا بدراسة تأثير الفاكهة المضافة للزبادى على الخواص الفيزيائية الكيميائية وبعض المواد الكيميائية النباتية والتقييم الحسى للمنتجات بعد التصنيع مباشرة وفى نهاية فترة التخزين بعد ١٤ يوم . بشكل عام الفاكهة المضافة أدت إلى تحسين جودة الزبادى حيث زادت نسب الألياف والكربوهيدرات والطاقة والحديد والزنك والمواد الكيميائية النباتية (الفينولات ، الفلافونويدات ، المواد المضادة للأكسدة) على الجانب الآخر انخفضت قيمة البروتين والأس الهيدروجينى بعد التصنيع وفى نهاية فترة التخزين . علاوة على ذلك فإن مشروب الزبادى المدعم بالفواكه سجل درجات أعلى بالخواص الحسية مقارنة بعينة الكنترول وأخيراً فإن استخدام الفواكه مع الألبان المتخمرة يحسن من تركيبها الكيميائي ونشاطها المضاد للأكسدة وخواصها الحسية