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JQSR

http://publisher.uthm.edu.my/ojs/index.php/jqsr
e-ISSN : 2773-5532

Journal of Quranic Sciences and Research

# Physicochemical, Antioxidant and Sensory Attributes of Steamed Bun (*Mantao)* With Dried Figs Puree

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DOI: https://doi.org/10.30880/jqsr.2020.01.01.006
Received 30 September 2020; Accepted 15 November 2020; Available Online 30 December 2020

**Abstract:** Bakery products have increased in demand and are frequently consumed. Most of these products do not necessarily have high antioxidant properties or provide the desired nutritional benefits. Dried figs are found to be a good source of nutrients especially in phenolic compounds. The aim of this experiment is to study the effect of steamed bun incorporated with dried figs puree in terms of physicochemical properties, antioxidant activity and sensory acceptability. Dried fig was used as puree to be incorporated with wheat flour in steamed bun formulations at levels of 2%, 5% and 10% for T1, T2 and T3 respectively, compared to a control steamed bun (0%). The effect of dried figs puree incorporation on quality attributes were analyzed, which include proximate composition, antioxidant, physical property such as color. Total phenolic compound and antioxidant activity of steamed buns were measured with a spectrophotometer using wavelengths of 760 nm and 517 nm. The incorporation of dried figs puree in steamed buns gave no significant differences ($P>0.05$) of ash, moisture, protein and crude fiber content, respectively when compared to control. Steamed bun with 10% of dried figs (T3) had significantly darker color ($P<0.05$) compared to control and other treatments at (T1) 2% and (T2) 5%. The highest values for total phenolic compound and the radical scavenging activity were obtained in T3 (10%) which are 0.98 mg GAE/g and 76.73% respectively. Overall results show no significant different ($P>0.05$) of steamed bun from all formulations in sensory evaluation indicate that the consumers acceptability are agreeable towards all the steamed bun incorporated with dried figs puree. By popularizing the usage of figs and adapting a holistic approach of following the Sunnah of the Prophet of Rasullullah SAW, thus make it possible to create a palatable bakery product with wide acceptability and nutritionally advantageous.

**Keywords:** Antioxidant activity, physical property, proximate composition, Total Phenolic Compound

## 1. Introduction

Figs or its scientific name, *Ficus carica*, belong to the Asian species of flowering plants, from the mulberry family (*Moraceae*), possesses a unique sweet taste, with soft and chewy texture that contain numerous small edible seeds. Figs are commercially popularized as ingredients in cookies, snack bars, bakery products or added to savoury and sweet recipes like jam, pudding, candy and caramel. Fresh figs are highly perishable and consuming them have been associated with longevity and health (Reyes *et al.*, 2016). As a versatile fruit, it is suitable as a healthy diet snack and are consumed worldwide in either fresh or dried forms. Figs are among one of the many fruits mentioned in Quran, available in Paradise, besides dates, olives, pomegranates, grapes and bananas. Throughout history, figs have been known as one of the classical fruits sought out by ancient civilizations. Often described as a fruit of prosperity, and mentioned in the Bible, the fig from the Ficus tree was cultivated very early throughout the Middle East countries like Egypt and Europe before later reaching China and England.

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The first Quranic verse of surah At-Tin provided many beneficial attributes of figs; the importance were strongly described: "I swear by the Fig and Olive" (Quran, 95:1). The dense nutritional values content, of fresh or dried fruits, with substantial amounts of vitamin C, vitamin K, potassium, phosphorus, magnesium, calcium, and fiber with considerable amounts of vitamins, amino acids, antioxidants and dietary fiber (Solomon *et al.* 2006; Elleuch *et al.* 2011; Martinez-Carcia *et al.* 2013) indicate that figs is a highly nutritious fruit. Figs had higher level of minerals such as potassium, calcium and also are sodium-free, fat-free and cholesterol-free (Chessa 1997; Crisosto *et al.* 2010; Michailides 2003). Therefore, choosing wholesome food; avoiding harmful and excess junk food is Islam's holistic approach of advocating health. Allah SWT had decreed in the Quran to the whole of mankind (Quran, 2: 168) "O People! Eat of what is lawful and good on the Earth and do not follow the footsteps of Shaitaan, for he is your open enemy"; to the Muslims believers; "Eat the good things which We have provided for you and render thanks to Allah if it is indeed He Whom ye worship" (Quran, 2:172).

It has been described that the Prophet Muhammad (SAW) and Ali ibn Abu Talib (a.s.) would refrain from eating bread from refined flour, and would rather eat that which contained barley and bran which had higher fiber content ("How the Quran and Hadith tell us to keep physically healthy - The Muslim Vibe," 2000). This corresponds to the British Heart Foundation (BHF) of encouraging the consumption of plenty of fruits, vegetables and starchy foods including bread, rice and pasta with wholegrain varieties. Dried figs are the healthier alternative of fruit that can be incorporated directly into cookies, confectionary products, bakery products and other processed food. The Hadith literature narrated by Abu Darda mentioned of someone who presented figs to the Prophet Muhammad (SAW); and began distributing them among his followers. He said: "Eat it as it cures various diseases".

Many consumers are unfamiliar with figs' benefits and its contribution of essential nutritional content. It had yet to be popularized in daily consumption. The U.S. Food and Drug Administration has agreed upon the following nutrient content claim that figs are fat-free, saturated fat-free, cholesterol-free, sodium-free, a good source of potassium, and a good source of fiber. Sadly, figs is an example of a high nutrient fruit that is typically neglected and an underutilized crop even though it possess high strategic potential in many marginalized rural areas (Kour *et al.*, 2018).

The World Health Organization (WHO, 2016) stated that over 340 million children and adolescents aged between 5-19 years were overweight or obese. In Malaysia, the number of overweight and obesity among adolescents has increased gradually from 5.4% in 2006 to 15.4% in 2014 for children aged between 7 to 13 years old (Mat *et al.*, 2018). Many Malaysian elderly were obese, and factors associated with obesity among them were being female, having secondary education with a household income of RM 3000 and above and being hypertensive or diabetic (Ariaratnam *et al.* 2020).

The dietary fiber intake among Malaysian is low compared to the Malaysian dietary recommendation; dietary fiber is believed to decrease the prevalence of obesity. Added fiber in food products like bread can extend the shelf life of the food product and enhance both the qualitative and sensory properties of bread (Kurek & Wyrwisz, 2015).

The steamed bun has recently become one of the Asian's top list of favorite foods as this traditional Chinese dim sum (steamed bun) is available either in fresh or frozen (processed) forms and vary with fillings and flour types**.** Lately, the growth of frozen steamed bun or *Mantao* segment have increased, due to the rising demand for packaged and processed food. The steamed bun's key players are mainly located in Asian countries such as China, Taiwan, Singapore, Republic of Korea and Malaysia. Based on the type of flour incorporated into recipes, many version of steamed buns can be formulated, using whole wheat flour, wheat bran and malt, multi grain and nuts, wheat bran, corn flour and other flours with high fiber content.

The dried fruit market is expanding (Woods, 2018) and the market trend from 2018 to 2023 have projected to an increase in the population of health-conscious consumers. It is expected that dried fruits will play a bigger role in the bakery market segment of dried fruit, with the advantage of longer shelf life stability, to be incorporated into breakfast cereal, bakery, confectionery, snacks, desserts, and others.

By popularizing the usage of figs and adapting a holistic approach of following the Sunnah of the Prophet of Rasullullah SAW, it is possible to create a versatile bakery product with wide acceptability in the market, among local Malaysian multiracial population with improved nutrition and antioxidants. Fig as a fruit plant have potential to provide nutritional and health advantages. Therefore, this study is done to determine the physicochemical qualities of dried figs puree in *Mantao*.

## 2. Materials and Methods

### 2.1. Dried Figs Puree Preparation

Dried figs of medium size were bought from Jaya Grocer supermarket, Nilai and were dried using a dehydrator (Excalibur 3926T, USA) for 24 hours. The dried figs are pureed using a Waring Laboratory Blender (Waring W-MX1100XTX, USA. Dried figs fruits were cut into small pieces to be further dried in the dehydrator (Excalibur 3926T, USA) at 65 $^{O}$C for 24 hours. The dehydrated dried figs were ground using a Waring Laboratory Blender (Waring W-MX1100XTX, USA) and were further treated with warm water. The ratio used for mixing the dried figs and water was 2:¾.

### 2.2. Samples Preparation

Wheat-flour (Anchor Brand), dried figs (Jaya Grocer), yeast (11g), baking powder (Kings), sugar, shortening (Nona), emplex (Meriah) and dough conditioner (Meriah) were purchased from a local supermarket in Nilai (July 2019). The proportions for raw materials used for steamed buns were weighed according to the formulations in Table 1.

**Table 1 - The formula proportions for steamed bun making.**

| Ingredients (g/ml) | White Steamed Bun Control C) | Fortified steamed bun with dried figs puree | | |
|---|---|---|---|---|
| | | T1 (2%) | T2 (5%) | T3 (10%) |
| Wheat flour | 100.0 | 100.0 | 100.0 | 100.0 |
| Dried figs' puree | 0.0 | 2.0 | 5.0 | 10.0 |
| Yeast | 2.0 | 2.0 | 2.0 | 2.0 |
| Baking powder | 1.6 | 1.6 | 1.6 | 1.6 |
| Emulsifier | 3.0 | 3.0 | 3.0 | 3.0 |
| Sugar | 8.0 | 8.0 | 8.0 | 8.0 |
| Shortening | 2.0 | 2.0 | 2.0 | 2.0 |
| Dough conditioner | 0.5 | 0.5 | 0.5 | 0.5 |
| Water | 60.0 | 60.0 | 60.0 | 60.0 |
| Total | 177.1 | 179.1 | 182.1 | 187.1 |

Source: (Yen *et al.*, 2015) with minor modifications

## 2.3. Steamed Bun Making

Yeast was added in 60ml of water with a little amount of sugar to support the growth of yeast at a temperature range of (26-29$^{O}$C). Other dry ingredients were mixed in separate bowls at room temperature. The shortening was melted and then were added to the mixture of dry ingredients followed by the addition of dried figs puree, with cultured yeast and brought to mix using a bowl mixer (Panasonic MX-AC400TSK, Malaysia) at low speed for the first 2 minutes, then with incremental speed for the next 6 minutes with constant observation to avoid over-kneading. To identify whether the dough was well-kneaded, a window test was conducted by observing the gluten formation in the dough and its elasticity, to ensure that the dough will not tear up when being stretched slightly. After complete kneading of the dough, it was rolled into smooth pastry using a roller, cut and shaped into several pillow-shaped buns of approximately 20-25g each.

The buns were then placed in the proofer (Fresh FX11Bss, Malaysia) at 35$^{O}$C for proofing and initial fermentation of 12 to 15 minutes (Tseng, Yang, Lee and Mau, 2011). After being shaped, the conventional method for steaming was conducted for about 7 to 8 minutes in a steaming pot with a boiling wok under it. Next, the steamed buns were taken out of the pot and were cooled to the room temperature for 30 minutes and their weight were taken. Selected samples of steamed buns from each formulation were taken and appropriately packed and stored to be prepared for further analysis.

## 2.4. Proximate Analysis

The proximate compositions of wheat flours and steamed buns including moisture content, crude fiber, crude ash, crude fat and crude proteins were determined according to the methods of AOAC (2005). The carbohydrate content was determined by subtracting the contents of moisture, crude ash, fat, fiber and protein from 100% dry matter. Moisture content was analyzed using a moisture analyzer (MX-50, China), whereas crude ash was determined using a muffle furnace (Carbolite, UK), crude fat by Soxtherm (Gerhardt, Germany), crude fiber by Fibertherm (Gerhardt, Germany), while crude proteins was determined by the Kjedahltherm system (Gerhardt, Germany).

## 2.5. Antioxidant Analysis

### 2.5.1. Steamed Bun Extraction

The steamed buns from all formulations were dried in the dehydrator at 40 $^{O}$C for 24 hours (Ibrahim, *et al.*, 2018). Following that, the steamed buns were then ground into fine powder using Waring Laboratory Blender (Waring W-MX1100XTX, USA). The powdered preparation are then set aside for the subsequent antioxidant analysis. Methanol was used for extraction process according to the method of Yu, *et al.* (2013) with some modification. Two g of steamed bun samples from each formulation were mixed with 10 ml of methanol solvent in a conical flask; a magnetic stirrer was used to stir the mixture for 45 minutes. The resulting mixture was then filtered using filter pump with filter paper until all the residue had been filtered out. The clear solution was considered as the extracted sample. The supernatant produced from each formulation were poured into amber reagent bottle as stock and they were stored until they were ready for the analysis of total phenolic compound and DPPPH radical scavenging activity.

### 2.5.2. Total Phenolic Compound (TPC)

The Folin-Ciocalteu reagent (F-C reagent) method with minor modifications was used to determine the TPC of the floured fruiting body base polysaccharide (FFBBP) extract (Sulaiman and Ooi, 2012). F-C reagent was prepared by diluting 10 ml of the reagent with 90 ml of distilled water at room temperature (10 v/v%). Meanwhile, sodium carbonate ($Na_2CO_{3)}$ solution was prepared by dissolving 7 g $Na_2CO_3$ solid into 100 ml of distilled water. Following that, the steamed bun extract (2 ml) was added to 0.5ml of F-C reagent in the universal bottle. The mixture was then allowed to rest for 5 minutes and then was added to 1 ml of $Na_2CO_3$ solution (7%) and 10 mL of distilled water. Next, the reaction was incubated at room temperature in the dark for 30 minutes.

The absorbance was read at 760 nm using a spectrophotometer. The TPC of FFBBP extract was calculated by comparison with the absorbance of the standard curve gallic acid calibration curve). TPC was read as mg GAE/g (mg of gallic acid equivalent per gram of dry weight of the sample) (Abd Al Qadr *et al.*, 2018). Calculation of total phenolic compound is based on gallic acid equivalent as Equation 1,

$$\text{Total phenolic compound (mg GAE/g)} = c \times V/m \quad (1)$$

where c is concentration of gallic acid obtained from calibration curve (mg/ml), V is a volume of extract (mL) and m is mass of sample extract (g).

### 2.5.3. Radical Scavenging Activity DPPPH (2,2-diphenyl-1-picrylhydrazyl) Assay

2,2-diphenyl-1-picrylhydrazyl (DPPH) assay was based on the method with slight modification (Yi Yang *et al.*, 2016). Before the measurement, a stock solution (0.1 mM) of DPPH were prepared daily by dissolving 3.9 mg of DPPH in 100 mL of methanol and be stirred at room temperature. Meanwhile, 1 mL of 0.1 mM stock solution was added into 4 mL of methanol to prepare a control solution (blank). Following that, a volume of 1 ml of diluted steamed bun extract was mixed with 4 ml of methanol followed by 1 ml of the DPPH working solution. For steamed bun extract sample, dilution was done twice as it is significant to obtain the absorbance within the linear standard range. The entire sample, blank and standard wells was incubated in the dark for 30 minutes at room temperature after gently swirl. The absorbance was read at 517 nm. The radical scavenging activity is calculated as the radical scavenging percentage using Equation 2,

$$\%\ \text{radical scavenging} = [(Ac-As)/Ac] \times 100 \quad (2)$$

where Ac is absorbance of the control and As is absorbance of the sample.

## 2.6. Color Analysis

The appearance and surface color of the fortified steamed bun were measured using a color analysis colorimeter (Labscan XE Hunterlab, UK). Each steamed bun sample was individually measured in triplicate. The HunterLab *L**, *a**, *b** and the modified CIE system known as CIELAB color parameter was used as opponent-type systems in the food industry (Pathare, Opara, & Al-Said, 2013). Therefore, *a** resembles positive values for reddish color and negative values for the greenish color, meanwhile positive yellowish color are reflected by *b** and bluish color for negative values. For measurement of luminosity, it was approximately pictured by *L**, in which the property according to which each color can be resembled as equivalent of between black and white (member of grayscale) (Granato and Masson, 2010).

## 2.7. Sensory Evaluations

The sensory evaluations were conducted to ascertain the acceptability on the samples within 24 hours after the steamed buns were cooked. The samples were cut into small slices (2 cm thick) serving sizes to be evaluated by 70 untrained panelists (n=70) of students and staff from the Faculty of Science and Technology of Universiti Sains Islam Malaysia. Most of the panelist students were from Food Biotechnology students who are familiar with the sensory test procedures with ages ranging from 19 to 23 years. All the panelists completed the questionnaires. The sensory attributes of the steamed buns that were evaluated consisted of color, aroma, sweetness, texture and overall acceptability using a 9-point hedonic scale with 1, 5 and 9 representing extremely dislike, neither like nor dislike and extremely like respectively (Tseng *et al.*, 2011).

## 2.8. Statistical Analysis

The formula in making steamed bun were replicated twice and each quality measurement was conducted in three replicates except for the sensory evaluation. The experimental data was subjected to an analysis of variance for Tukey test using a ONE-WAY ANOVA (Minitab, 2017) to determine which formulation has significant differences between means at the level of 0.05. Control (C1) had no fig puree whilst the three treatments (T1, T2 and T3) had increased amount of figs flour as mentioned earlier in Table 1, respectively. There were three samples for each treatment and control (N=3) and the experiment was replicated two times (R=2). Hence, the total samples for statistical analyses were 264 samples (n=264).

# 3. Results and Discussion

## 3.1. Proximate analysis

Nutrient composition of steamed bun for four formulations including control, sample T1, T2 and T3 were analyzed in triplicate. The proximate compositions include moisture content, crude fiber, crude ash, crude fat and crude proteins were determined and the results are shown in Table 2.

**Table 2 - Chemical composition of steamed buns.**

| Nutrient Content (%) | Samples | | | |
|---|---|---|---|---|
| | Control (0%) | T1 (2%) | T2 (5%) | T3 (10%) |
| Ash | 1.12±0.17A | 1.06±0.08A | 0.99±0.00A | 0.98±0.06A |
| Moisture | 41.36±0.55A | 41.63±0.56A | 42.17±0.62A | 42.66±0.22A |
| Protein | 6.20±0.49A | 6.23±0.29A | 6.10±0.05A | 6.03±0.21A |
| Fat | 0.68±0.03B | 0.69±0.03AB | 2.44±0.52A | 1.75±0.70A |
| Fiber | 2.76±0.49A | 2.52±0.43A | 3.15±0.46A | 2.67±0.28A |

Different alphabetical letters within rows indicate significant different ($P<0.05$) among steamed bun samples.
All data were calculated in replicate analysis with the value of mean ± SD.
Notes: Control = 0% Dried figs puree, T1 = 2% Dried figs puree, T2 = 5% Dried figs puree, T3 = 10% Dried figs puree

Ash is a measure of the total amount of minerals present within a food. The slight decrease of ash content with increasing amount of dried figs puree added are not significantly different ($p > 0.05$) from all other treatments. According to Wahab and Khan (2011), the amount of ash in dried figs ranged from 1.39% to 2.31% giving an average of 1.95%, meanwhile the volatiles compound in dried figs range between 79.81% to 82.25% with an average of 80.77%. Dried figs have high volatile compounds that can lead to some losses during experiment or steamed bun making through volatilization. Weight loss may occur during steaming, providing variable levels of minerals retained and lost, and expressed in the ash content values.

Moisture composition are not significantly different, among all treatments ($p > 0.05$) with control being the lowest, at 41.36% while the highest mean value in sample T3 is 42.66%. Several researchers reported that breads supplemented with non-wheat flour could increase the moisture content value. Higher moisture content may allow the moisture sorption isotherm to interact with the hygroscopic properties of various components whose sorption properties can change during the heating-induced physical or chemical interactions (Sandulachi, 2016).

The decreased value in protein content of steamed bun might have been affected, due to the dilution of gluten, as wheat flour was substituted with dried figs puree in steamed bun making (Aziah *et al.*, 2012). As reported by Nasir *et al.* (2015), there are a few factors that can influence total ash, protein and fat contents, such as drying technique, cultivar and methods used in nutrient determination. The fat content obtained from this experiment shows significantly lower ($p < 0.05$) fat values in control, compared to T2 and T3. In general, the dried fig has fat content of 0.56% (Soni *et al.*, 2014) while the USDA reported that the fat content in dried figs is 1%. Thus, the fat content portrayed by the results is in the range that corresponds to the fat content reported by the researchers.

Since the percentage of dried figs added to the steamed bun formula are at incremental values of 2%, 5% or 10%, therefore the proximate composition, especially the fiber content would be affected expectedly. The low crude fiber produced might be due to the hydrolysis of yeast enzymes that contribute to the losses during steaming (Aziah *et al.*, 2012). Chitin and hemicelluloses can be broken down during steaming that contributes to the variation of fiber value of steamed bun. However, a healthy diet is balanced with a mixture of all the foods Allah has provided for His creations. The variety of nutritional composition in steamed bun with dried figs puree is an effort to satisfy the body's needs for protein, fats, fiber, carbohydrates and minerals. It is not an exhaustive list of dietary requirements but rather a general idea of the types of food that maintain a healthy body and prevent illness.

## 3.2. Antioxidant Analysis

### 3.2.1. Total Phenolic Compound (TPC)

The total Phenolic Compound (TPC) was determined by using the Folin-Ciocalteau reagent. Results was expressed as mg of gallic acid per 1 g of steamed bun as shown in Table 3.

**Table 3 - Total phenolic compound (TPC) of steamed buns.**

| TPC | Samples | | | |
|---|---|---|---|---|
| | **Control (0%)** | **T1 (2%)** | **T2 (5%)** | **T3 (10%)** |
| **mg GAE/g** | 0.76±0.11A | 0.51±0.16A | 0.26±0.11A | 0.98±0.86A |

Different alphabetical letters within rows indicate significant different (*P<0.05*) among steamed bun samples. All data were calculated in replicate analysis with the value of mean ± SD.
Notes: Control = 0% Dried figs, T1 = 2% Dried figs, T2 = 5% Dried figs, T3 = 10% Dried figs

According to Genna *et al.* (2016), antioxidant potential in the formulation of bread could be enhanced by the use of phenolic-rich materials. Ibrahim *et al.*, (2018) reported that the slightly decrease values of the TPC content may be due to time exposure for heat treatment as this could promote Maillard reaction that bind polyphenols to protein backbones. Furthermore, heating temperature that exceed 205$^{O}$C, could give significant effect to the crust of the bread as heat may alter the phenolic antioxidants in the inner and outer part of the loaf (Baiano *et al.*, 2015).

This was supported by Wang and Zhou (2004), that stated the decrease of the individual phenolics depend on their stability due to the interactions between wheat proteins and phenolic antioxidants through hydrogen bonding during preparation of the dough. Other than that, there also was a study that claimed that the reduction of phenolic compound may due to varietal, seasonal, agronomical differences, genomics, moisture content, method of extraction and standards used (Imeh and Khokhar, 2002). Phenolic compounds are an integral part of the human diet; meanwhile phenolics in fruits consist of compounds such as flavonoids, flavan-3-ols, hydroxinnamic acids, gallic acid derivatives and anthocyanins (Miletić, Popović, Mitrović, & Kandić, 2014). According to the study performed by the University of Scranton, dried figs had a higher level of the phenol content, which is rich in antioxidants that helps to treat diseases such as cancer, liver problems and urinary problems.

Higher dried figs percentages, incorporated in food is a good source of polyphenols and flavonoids including gallic acid, syringicacid, (-)-epicatechin and rutin (Kadam *et al.*, 2011; Vinson, 1999). Therefore, this steamed bun product is an alternate way to encourage the new product development that incorporated wholesome food with dried fruits.

### 3.2.2. Radical Scavenging Activity DPPPH (2,2-diphenyl-1-picrylhydrazyl) Assay

The antioxidant activity (AA) of the phenolic extracts for steamed buns of all level of dried figs puree incorporation (0%, 2%, 5% and 10%) were evaluated using DPPH assay and the findings were tabulated in Table 4.

**Table 4 - Radical scavenging activity (DPPH) of steamed buns.**

| (AA) | Samples | | | |
|---|---|---|---|---|
| | **Control (0%)** | **T1 (2%)** | **T2 (5%)** | **T3 (10%)** |
| % | 38.21±11.70B | 50.56±3.96B | 53.29±1.14B | 76.73±4.00A |

Different alphabetical letters within rows indicate significant different (*P<0.05*) among steamed bun samples. All data were calculated in replicate analysis with the value of mean ± SD.
Notes: Control = 0% Dried figs, T1 = 2% Dried figs, T2 = 5% Dried figs, T3 = 10% Dried figs

Meral and Erim Köse (2019) stated that the scavenging effect of the dough ranged between 72 to 84%; the result of this study was also supported by Moore *et al.* (2007) who reported that the yeast fermentation could increase the DPPH radical scavenging effect of wheat. Dordevic *et al.* (2010) reported that fermentation of *S. cerevisiae* could enhance the antioxidant activity. Furthermore, Meral and Dogan (2013) stated that the antioxidant activity and TPC content of bread enriched with non-wheat flour improved the antioxidant activity of bread therefore the longer the fermentation time it took, this could lead to increase in functional properties of breads from the antioxidant compound incorporated into the formulation. Therefore, this explains the high values of antioxidant in sample T3 with 10% of dried figs puree incorporation because the value of antioxidant in dried figs itself could improve the antioxidant activity of bread.

Polyphenols are essential compounds to prevent lipid auto-oxidation by acting as radical scavengers and important to protect the body against the danger of reactive oxygen species. Following that, these polyphenolic compounds altogether aid in removing harmful oxygen derived from free radicals of body cells that may lead to cancer, cardiovascular diseases, diabetes, chronic degenerative joint diseases and infections (Chang *et al.*, 2016; Debib *et al.*, 2014; Jasmine *et al.*, 2015; Li *et al.*, 2013; Tomás-Barberán and Andres-Lacueva, 2012).

## 3.3. Physical analysis

### 3.3.1. Colour Analysis

The results of color measurement of steamed bun supplemented with dried figs puree are presented in Table 5. The crumb color of steamed bun was slightly affected by the incorporation of dried figs puree in the dough. In general, as percentage of dried figs puree supplemented in steamed buns increased, the color intensity of steamed buns also increased gradually.

**Table 5 - Color properties (CP) of steamed buns from four formulations (0%, 2%, 5% and 10% of dried figs puree incorporation) respectively.**

| (CP) | Samples | | | |
|---|---|---|---|---|
| | Control (0%) | T1 (2%) | T2 (5%) | T3 (10%) |
| **L*** | 80.31±0.72$^{A}$ | 79.12±0.37$^{A}$ | 77.73±0.41$^{B}$ | 75.96±0.45$^{C}$ |
| **a*** | 0.25±0.09$^{D}$ | 0.97±0.07$^{C}$ | 1.72±0.07$^{B}$ | 2.87±0.01$^{A}$ |
| **b*** | 21.39±0.68$^{C}$ | 22.59±0.25$^{BC}$ | 23.47±1.18$^{AB}$ | 24.71±038$^{A}$ |

Different alphabetical letters within rows indicate significant different (*P<0.05*) among steamed bun samples. All data were calculated in replicate analysis with the value of mean ± SD.
Notes: L*: (-L*= 0 black and +L*= 100 white), a*: (-a*= greenness and +a*= redness), b*: (-b*= blueness and +b*= yellowness)

The steamed bread color was affected by the added fiber and the gluten content from the flour. The darkness of the samples was also the result from the Maillard reaction between reducing sugar and protein (Mohamed *et al.*, 2009). Earlier researchers have made similar observations (Sangnark and Noomhorm, 2004; Anil, 2007; Mohamed *et al.*, 2009) in which the replacement of high-fiber dietary flour in bread resulted in dark flour.

The color of the steamed bread produced were lightly affected by the fortification, but the changes were within the acceptable range as the formulation for the control steamed bun and the formulation T1 were not significantly different, ($p > 0.05$) but the formulation T2 and T3 have significant *L** value ($p < 0.05$). Overall, the formulation T3 with the highest dried figs incorporation resulted in the highest mean value for *a** and *b** values which are 2.87 and 24.71 respectively for the highest reddish tone and yellowish hue colors, while *L** value has the lowest mean value (75.96) indicates the darkest color of T3 compared to other formulations.

## 3.4. Sensory Evaluations

The mean score for appearance, color, texture, aroma, taste and overall acceptability for steamed buns with different incorporation of dried figs puree were presented and illustrated in Table 6 and Fig. 1 respectively.

**Table 6 - Sensory analysis of steamed buns.**

| Attributes | Samples | | | |
|---|---|---|---|---|
| | Control (0%) | T1 (2%) | T2 (5%) | T3 (10%) |
| **Appearance** | 7.07±1.24$^{A}$ | 7.03±1.36$^{A}$ | 7.11±1.08$^{A}$ | 6.44±1.44$^{B}$ |
| **Colour** | 7.09±1.20$^{A}$ | 7.14±1.28$^{A}$ | 6.84±1.29$^{AB}$ | 6.39±1.46$^{B}$ |
| **Texture** | 6.67±1.60$^{A}$ | 7.09±1.45$^{A}$ | 6.94±1.40$^{A}$ | 6.89±1.35$^{A}$ |
| **Aroma** | 6.59±1.60$^{A}$ | 6.94±1.43$^{A}$ | 6.70±1.44$^{A}$ | 7.09±1.27$^{A}$ |
| **Taste** | 6.59±1.60$^{A}$ | 7.01±1.53$^{A}$ | 6.81±1.47$^{A}$ | 7.04±1.20$^{A}$ |
| **Overall Acceptance** | 6.97±1.34$^{A}$ | 7.23±1.31$^{A}$ | 7.09±1.19$^{A}$ | 7.07±1.05$^{A}$ |

Different alphabetical letters within rows indicate significant different (*P<0.05*) among steamed bun samples. All data were calculated in replicate analysis with the value of mean ± SD.
Notes: Control = 0% Dried figs, T1 = 2% Dried figs, T2 = 5% Dried figs, T3 = 10% Dried figs

On a nine-point hedonic scale, all sensory attributes results were in the range of 6.4 to 7.2 indicating all the steamed buns from four formulations were acceptable. The results on sensory attributes by panelist showed that there was significance difference ($p < 0.05$) among samples with the values ranging between 6.44 to 7.11 and 6.39 to 7.14 for appearance and color respectively. Meanwhile, for attributes like texture, aroma, taste and overall acceptability, there were not significantly difference ($P > 0.05$) among all formulations indicating the positive acceptance of consumers towards steamed bun supplemented with dried figs puree thus giving potential use of dried figs puree in steamed bun for marketing.

All attributes of appearance, color, texture, aroma, taste and overall acceptability were not significantly different, ($p > 0.05$) between control, T1, T2 and T3 imply that a least cost formulation of T1, can be created, whilst the most expensive and highest content of figs as depicted from T3, can also be formulated, without deterring the consumers, in terms of hedonic parameters and overall acceptance. The significantly lower acceptance ($p < 0.05$) of appearance of T3, may be due to the darker color of steamed buns with decreasing values of L* as the percentage of dried figs incorporation increased. This is not a huge concern, as the aroma (7.09), and taste (7.04) of T3 were the highest, although the values are not significantly different ($p > 0.05$) from other treatments.

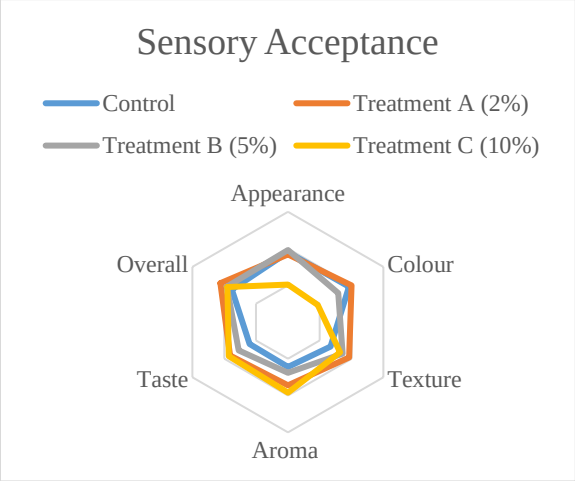


**Fig. 1 - Spider web of steamed buns supplemented with different dried figs incorporation.**

## 4. Conclusion

Dried figs puree incorporation did not significantly affect (P>0.05) nutrients composition of the steamed bun in terms of ash, moisture, protein and fiber content but gave slightly increase in terms of fat content. In addition, it is revealed that 10% of dried figs puree incorporation of steamed bun produced the highest antioxidant activity with radical scavenging effect which gives significantly different (P<0.05) mean value compared to steamed bun with no addition of dried figs. In terms of color, the incorporation of dried figs puree in steamed bun gave significantly different (P<0.05) in L* color variations that contribute to the darker color of steamed buns with decreasing values of L* as the percentage of dried figs incorporation increase. In term of acceptability, steamed bun with 2% of dried figs puree was found to be the most preferred steamed bun among consumers. The benefits imparted from incorporation of dried figs puree in the steamed bun indicate the importance of the fig as being a part of ingredient in food like steam bun, consumed by consumers frequently and can be designed and marketed as convenience food or easily prepared ready-to eat food or bite sized *Mantao*.

As future recommendations, eating healthy food and eating in moderation have been stated in Noble Quran: "And He enforced the balance. That you exceed not the bounds; but observe the balance strictly, and fall not short thereof "(Quran, 55:7-9). Dried figs purees can be used in other products to help diversify its uses in future, and also to explore comparable nutritional content among locally available tropical Malaysian fruits. Enhanced health promotion and education should be targeted at younger people in order to prevent obesity in the later years (Ariaratnam *et al.* 2020), at the same time educating the public to change bad eating habits by consuming more nutritious food, correct potion control, and making better informed choice by avoiding fast food, or empty calorie junk foods, and by eating in moderation. Consuming beneficial Malaysian fruits that equate valuable nutrient content with fruits mentioned in the heavenly Paradise from the Kitab Al-Quran, may provide the much desired healthful food eating habits that will lead towards healthier lifestyle and improvements in the quality of life.

## Acknowledgement

This research is funded by the Faculty Science and Technology from Universiti Sains Islam Malaysia (USIM).

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