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Production of Carbonated Drink Using Reziz Date Dibs and Hulu-Mur Flavour

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ABSTRACT

Valorisation of raw foods can substantially improve the resilience of the food chain, thereby mitigating the escalating food crisis. As date fruits contain most of the essential ingredients, it could serve as an unprecedented source of functional food production. This study aimed at valorising the commercially less valued date fruit, reziz, to prepare a carbonated drink. The collected reziz date fruit was subjected to date syrup (dibs) extraction using a specifically designed apparatus, Dibsi 10101, at 4 different pressures, 1000, -1.4, -2.8 and -5.5 millibar (mbar). However, the dibs extracted at -5.5 mbar yielded better clear dibs and thus was used in downstream production. Hulu-Mur (sweet and sour), a nutrient-rich flavouring agent derived from sorghum and Sudanese spices extract, was used as a favour enhancer. To produce the carbonated drink "Abridate," a different proportion of Hulu-Mur extract (1:5 w/v) and carbon dioxide were blended and subjected to a 10-point hedonic organoleptic evaluation. The results demonstrated that the superior Abridate was obtained by blending 6.89% of Hulu-Mur flavour extract with 11.8 TSS dibs at 4-bar carbon dioxide pressure. Abridate was comparable to commercially available carbonated beverages and held a substantial advantage over hazardous carbonated drinks due to its organic nature.

KEYWORDS

Abridate, carbonated drink, date palm, dibs, Hulu-Mur, reziz, soft drink

CITATION

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1. Introduction

Date palm (Phoenix dactylifera L., family Arecaceae) is a monocotyledon, dioecious, perennial woody fruit tree with a genome size of ~650 Mbp (Al-Mssallem *et al.*, 2013; Mathew *et al.*, 2014). This majestic and holistic plant also referred to as the "tree of life," has the oldest cultivation history, which can be traced up to 7000 BC (Ahmed *et al.*, 1995). Date palm is native to Arabian Peninsula, possibly originated from Iraq and being cultivated in Mauritania, Pakistan, Iran (Pintaud *et al.*, 2011), sub-Saharan African countries, Australia, the United States (California), Peru, and a few other warmer parts of the world. With a total production of circa 8.5 million tons, the worldwide area under date palm cultivation is 1.5 million hectares (ha) (FAOSTAT, 2020). Kingdom of Saudi Arabia (KSA) ranked fourth in date palm production with 1.54 thousand tons of date fruit production from circa 152 thousand hectares of cultivated area (FAOSTAT, 2020). Worldwide diversity of date palm comprises circa 300 varieties, which are grown in Saudi Arabia (El-Habba and Al-Mulhim, 2013); nonetheless, only 50–60 cultivars are consumed at commercial scale, while other cultivars have very limited utilities with almost zero commercial values.

Date palm is strongly associated with the socio-economic values of the people in the Arabian Peninsula and serves as a livelihood for the natives, providing the raw material for housing, timber, handicrafts, and shelter. In addition, it had been a source of wine production and consumption among the Ancient Egyptians. Date palm tree starts fruiting at circa 5 years with an average production of about 70–140 kg/tree/year and continues to produce for up to 60 years (Al-Alawi *et al.*, 2017). The five stages of pre-maturation, maturation, and ripening of date are Hababauk, Kimri, Khalal, Rutab, and Tamer (Al-Mssallem *et al.*, 2013). Date palm fruits have highly nutritious ingredients and are strongly fortified with carbohydrates (44-88%), lipids (1.5-4%), fat (0.2-0.5%), protein (2-5%), moisture (11%), fibre (4-6%), nutrients including calcium (55.60 mg/100g), magnesium (53.24 mg/100g), Iron (0.1-0.5%), Potassium (440.18 mg/100g), sodium (10.05 mg/100g), phosphorous (70.24 mg/100g), manganese (0.26 mg/100g), copper (0.21 mg.100g), zinc (0.29 mg/100g), and vitamins including A (10-150 IU), B6 (10%), C (0.3-0.8%) and K (2.7 µg) (Booij *et al.*, 1992; Al-Shahib and Marshall, 2002; Habib *et al.*, 2011; El-Sharnouby *et al.*, 2014; and Assirey, 2015). Date palm fruits are berries containing a single seed and usually vary in their physical, organoleptic and chemical characteristics (Al-Qarawi *et al.*, 2004).

Although a total of 1.4 million tons of date fruit are produced worldwide, quite unfortunately, only 1.1 million tons are marketed and circa 305 thousand tons of fruit get wasted. The major utilities of marketed date fruits in KSA include direct consumption, paste production, dibs, vinegar, feed and production of medical-grade alcohol (Aleid *et al.*, 2015). However, a huge amount of date palm fruit gets wasted in KSA, primarily because of poor taste, shape and hard texture and such dates are referred to as second-grade dates. In fact, with an average of 427 kg/capita amount of food wastage, KSA ranked top in the world. Ironically, the country that is relying on the import of food (~ 80-90%) has limited arable land and scarcity of water (Baig *et al.*, 2019). Such aggravating issues demand a wise use of available food to meet the sustainability of food production.

The surplus and less valued dates are excellent stuff for yielding refined sugar, confectionery pastes, concentrated juice, fermented products and most importantly, soft drinks (Samarawira, 1983). Soft drinks fall among the most demanded globally, especially in teenagers; in addition, the availability of soft drinks in various tastes and flavours has tremendously increased their global consumption. The population of KSA is about 34.2 million, and about 45% of them are in their youth (General Authority for Statistics, Saudi Arabia [https://www.stats.gov.sa/en/43]). Furthermore, natives of the Arabian peninsula have a strong religious and social affiliation towards the date palm, so this scenario favours a great potential for marketing date palm-based soft drinks. Reziz dates are highly enriched with

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carbohydrates and other nutrients; therefore, in KSA, these dates are consumed to prepare dibs (date juice). Nonetheless, preparing dibs from reziz dates is of less advantageous than making the soft drink, as liquid sugar obtained from Reziz dates has more sucrose content, it would, therefore, be ideal to substitute refined sugar in various food combinations such as carbonated soft drinks, confectionery and sweets (Mikki 1998). This will ultimately lead to value-addition and help in meeting the increasing demands of soft drinks, contribute to food sustainability, reduce the environmental hazards associated with spoilage of dates and minimise the health hazards associated with the soft drinks consumption.

Recently, innovative date by-products have been produced to manufacture value-added items with higher nutritional content. Production of high-quality natural sweeteners from date by-products for sucrose replacement in food formulations was a prime goal. Nonetheless, the production of an economical, nutritious, and functional beverage (soft drink) was a prime target of the present study. In 1991, the concept of functional food was coined by Japanese researchers who deemed the relationship between nutrition, sensory acceptance, fortification and physiological system variation and obtained a legal status from Food for Specified Health Use (FOSHU) (Burdock *et al*., 2006).

The present study aimed at valorising the less commercial value date, reziz, to produce a soft drink. To meet the objectives of this investigation, a modified and efficient method of dibs production was opted to yield good quality and clear dibs from reziz dates and mixed with Sudanese local flavouring agents (Hulu-Mur) to prepare a carbonated drink, referred to as Abridate. Abri is a Sudanese drink that is consumed widely especially during the holy month of Ramadan (Dirar, 1993) and has three different types, white Abri, colored Abri and Hulu-Mur. Hulu-Mur is prepared in flakes from fermented sorghum, spices, and herbs such as lesser galangal (Alpinia officinarum), cardamom, cinnamon, coriander, ginger, mugwort (Artemisia), date paste and tamarind.

2. Materials and Methods

2.1. Materials:

2.1.1. Sample Collection

During 2017, fully ripened reziz dates, at the tamr stage, were collected from the local market of Al Ahsa, KSA. After washing, the collected date fruits were air-dried at room temperature, packed into plastic containers and stored at 4°C until used in dibs production. All the work was carried out in the fermentation technology lab, Central laboratories, college of Agricultural and Food Sciences, King Faisal University, KSA.

2.1.2. Commercial Reziz Dibs

To compare extracted reziz dibs, commercial-scale reziz fruit dibs was purchased from Golden Dibs Factory, KSA. The compared parameters include total soluble solids (TSS), pH, colour, minerals, clearness and recovery of soluble solids (RSS).

2.1.3. Preparation of Hulu-Mur and its Proximate Analysis

In the present study, 10 grams (g) of Hulu-Mur flakes were soaked for 6 hours in 50ml of water at room temperature, then the extract filtered through filter paper, Wattman No. 1, then stored in a clean air tight glass container in the refrigerator at 4oC until use.

Proximate analysis of Hulu-Mur was performed using Kjeldhal's method to assess the total proteins (Kirk, 1950) using KjelFlex K-360 (Switzerland). Moisture estimation was performed in the moisture analyser (HG63 halogen, Mettler Toledo, Switzerland). Ash and oil contents (percentages) were determined according to AOAC (2005). The Nutrients in Hulu-Mur flavour were quantified by an atomic absorption spectrophotometer (AA-7000 Shimadzu, Kyoto, Japan) after following the procedure (Meligy, 2018).

2.1.4. Reziz Date Syrups (Dibs) Production

To extract the reziz dibs, collected reziz dates with stones (ca 1 kg) were washed with distilled water, air-dried and then the clean dates were socked in four-litres of water at 75°C for 30 minutes. Soaked dates were then transferred to the Dibsi 10101 and blended for 20 minutes at 1000 rpm. The Dibsi 10101 is a specially designed machine to yield the maximum amount of clear dibs with less fibre and polymer contents (M. Yousif unpublished data). The resultant raw date syrup was then vacuum extracted at four different pressure (1000, -1.4, -2.8 and -5.5 mbar) followed by an array of four filtrations using different filter sizes (1, 0.25, 0.112 and 0.011mm) to yield the clear dibs. The finally yielded reziz dibs were mixed with water in a 1:4 ratio to yield the required brix. This Dibsi 10101 based method offers wonderful utilities over its competitor techniques to avoid date crushing using a pitched blade. So, the resultant dibs were very clear and contained fewer date fibre and stone endocarp layers.

2.1.5. Carbon Dioxide (CO_2)

The CO_2 used in the study was of food-grade quality and was obtained from the Second Industrial City of Dammam, KSA.

2.2. Soft Drink Formulation:

The extracted reziz dibs were diluted to 11.8 Brix using an abbe refractometer (Milton Roy, USA), followed by pasteurisation at 85oC for 30 minutes (Triowin, PT-20P, China). The pasteurised dibs were then flavoured with the Hulu-Mur (Hulu-Mur flavour extracted out 10g Abri flakes/50 ml water). Finally, the dibs were carbonated (Triowin, TW-FC 01, China) at three different pressures (3, 4 and 5 bar) to yield the carbonated drink, Abridate.

2.3. Physiochemical Analysis of the Hulu-Mur Flakes, Hulu-mur Extract and Reziz Dibs:

Hulu-Mur flakes were subjected to physicochemical analysis to assess moisture contents, oil, ash, protein contents and minerals (AOAC, 2005). In addition, Hulu-Mur extract was tested for pH, colour, TSS, acidity, total sugars, phenolic content, and minerals. The Reziz dibs were also tested for TSS, pH, total sugars and minerals. Furthermore, TSS (Brix) (RFM-960, Bellingham Stanley UK), reducing sugar (Blakeney and Mutton, 1980), total phenolic contents (Biglari *et al*., 2008), and the colour through a Chroma meter (Konica Minolta-CR-410-Japan) was also assessed.

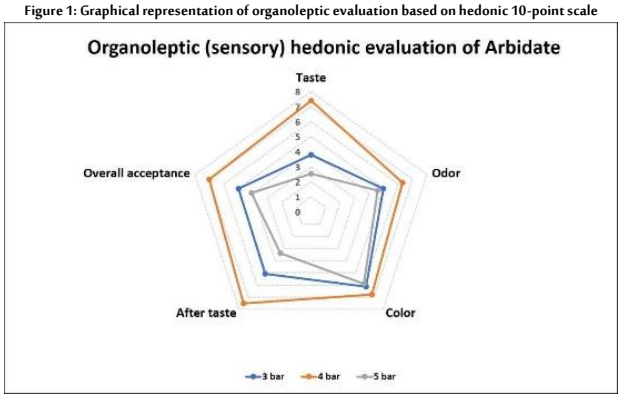
2.4. Organoleptic Evaluation:

Abridate, the reziz dibs based soft drink, was carbonated under three different carbon dioxide pressures (3, 4 and 5 bar) (Figure 1), and then subjected to organoleptic (sensory) evaluation using a standard 10 points hedonic scale (Table 1) after paired comparison evaluation (Ramadan, 1995). In the organoleptic evaluations, 15 staff members of the College of Agricultural & Food Sciences, King Faisal University, Saudi Arabia, were included to evaluate aroma, taste, odour, and colour (Figure 1; Table 1). The obtained scoring data were statistically analysed using analysis of variance (ANOVA) and the least significant difference (LSD) at 0.5% probability according (Lawless and Heymann, 2010).

Table 1: Organoleptic (sensory) evaluation and panelist evaluation layout

Treatment Code:									
Sample Code:									
Panelist name:									
9= Like extremely: Desirable:									
1= Dislike extremely: Undesirable									
Evaluation degree	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Taste									
Odour									
Colour									
After taste									
Overall acceptance									

Figure 1: Graphical representation of organoleptic evaluation based on hedonic 10-point scale



2.5. Microbiological Analysis of Abridate:

To assess the presence of viable microbial count, the standard plate count method was opted and a serial dilution of Abridate was used. Coliforms were determined on violet red bile agar plates (VRBA, CM107, Oxoid) after incubation at 37oC/24 hours. While yeast and mould were counted on potato dextrose agar plates, the plates were incubated at 30oC for 3 days spread on to count agar (CM0325, Oxoid) and then at 37oC/16 hours (Tournas *et al.*, 2001).

3. Results

3.1. Physiochemical Analysis:

3.1.1. Reziz Dibs

The extracted reziz dibs (using Dibsi 10101) were analysed and the results revealed that all the tested parameters (pH, colour, clearness and TSS) differ significantly ($p \geq 0.05$) except TSS, which were comparable in both dibs (Table 2).

Table 2: Analysis of Reziz syrup extracted under different pressures.

Pressure (mbar)	TSS (Brix)	pH	Sugar (%)	ΔE
1000	14.93^{a}	5.41^{b}	48.80^{a}	42.80^{a}
-1.4	14.63^{a}	5.38^{b}	47.23^{a}	43.25^{c}
-2.8	14.70^{a}	5.39^{b}	48.85^{a}	46.38^{b}
-5.5	14.87^{a}	6.03^{a}	48.14^{a}	47.54^{a}

The letters mentioned in the superscript are statistically significantly different ($p \leq 0.05$) if have different letters and vice versa (Fisher's least significant difference test). The higher the color measurement, the highest the fruits clear.

In addition, the comparative minerals analysis pinpointed that the level of K, Na, Zn, Fe, Cu, Ca, and Cr was higher ($p \leq 0.05$) in all extracted reziz dibs than the commercial dibs (Table 3). While the levels of Mn and Mg were comparable in both types of dibs. Nonetheless, a significantly higher amount of all the minerals was achieved at -0.014 and -0.028 mbar pressure (Table 3).

Table 3: Micro/macronutrients in the Reziz dibs extracted at different pressures in comparison to commercial dibs

Tested dibs at different pressure (mbar)	Cr	Fe	Cu	Zn	Mg	Ca	Na	K	Mn
Commercial dibs	26.65^{a}	32.55^{c}	15.79^{b}	6.44^{c}	268.33^{b}	159.44^{b}	45.47^{b}	1045.96^{c}	17.53^{a}
Extracted dibs at 1000	32.96^{a}	32.55^{c}	20.92^{a}	19.78^{a}	266.96^{ab}	197.27^{c}	56.06^{a}	1169.55^{a}	17.77^{a}
Extracted dibs at -1.4	30.36^{a}	45.57^{a}	17.57^{ab}	19.84^{a}	271.87^{a}	261.56^{a}	55.47^{a}	1168.67^{a}	17.18^{a}
Extracted dibs at -2.8	31.02^{a}	46.15^{a}	19.13^{ab}	15.29^{b}	265.59^{ab}	236.33^{a}	58.33^{a}	1151.74^{a}	17.34^{a}
Extracted dibs at -5.5	28.21^{a}	42.54^{a}	19.23^{ab}	24.58^{a}	261.64^{c}	212.73^{c}	47.03^{b}	1108.74^{b}	16.91^{a}

Values having different letters (mentioned in superscript) are statistically significantly different at $p \leq 0.05$ (Fisher's least significant difference test).

3.1.2. Analysis of Hulu-Mur and its Extracted Flavour

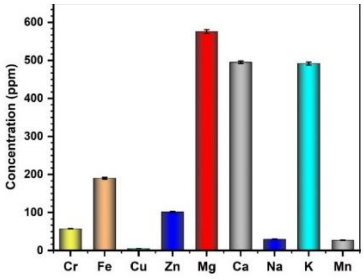
The proximate analysis of Hulu-Mur flakes revealed 8.3% moisture content, 1.07% fats content, 2.16% ash, and 13.87% of total protein (Table 4).

In the minerals' analysis, the most abundant minerals were Mg with ca 575 ppm concentration, followed by Ca (ca 495 ppm), K (ca 491 ppm), Fe (ca 190 ppm), Cr (ca 57 ppm), Na (ca 30 ppm), Mn (ca 27 ppm), and Cu (ca 5.1 ppm) on dry matter basis (Figure 2).

Table 4: Proximate analysis of Hulu-Mur Flakes

Proximate analysis	Mean±std
Moisture	8.30±0.01
Oil%	1.07±0.04
Ash	2.16±0.01
Protein	13.87±0.21

Figure 2: Estimation of micro- and macronutrients in Hulu-Mur flakes



Sugar content measured in Hulu-Mur flavour, after following Blakeley and Mutton (1980), was 211.1 g/kg sugar content (Table 5). The phenolic content as Gallic acid (as GAE) obtained was 519.17 per 100g after following the Folin-Ciocalteau essay. In the chemical analysis of Hulu-Mur flavour, pH was found to be acidic 3.73 with an acidity percentage of 0.21, whereas moisture level was quite high (above 92%). The colour and TSS values were found to be 75.61% and 7.43%, respectively (Table 5).

Table 5: Chemical and physical analysis of Hulu-Mur extract

Parameters	Value
pH	3.73±0.06
ΔE	75.61±2.13
Moisture (%)	92.57±0.08
TSS (%)	7.43±0.08
Acidity (%)	0.21±0.003
Sugar (g/kg)	211.07±0.03
Phenolic (conc. GAE/100g)	519.17±0.07

3.2. Organoleptic Evaluation of Abridate:

The preliminary sensory evaluation based on hedonic criterion revealed that Abridate obtained at carbonation under 4 bar and the addition of the 6.98% Hulu-Mur extract earned significantly ($p \leq 0.05$) high desirability with a cumulative acceptance score of 25.4 out of 40 points (Figure 1). All other combinations got less desirability scores in the order: 5 bar (score 22.47) > 3 bar (19.87), respectively (Figure 1). The chemical analysis of Abridate showed no significant differences ($p \leq 0.05$) in Abridate produced at three different carbocation pressures (Table 6). Almost all the tested parameters (including pH, colour, moisture, TSS and acidity) were comparable to each other except for minor changes that were statistically insignificant. The pH of all Abridates was mildly acidic with a range of 4.36-to-4.43, while the titratable acidity values were ca 0.19%, and no significant difference in the colours of the Abridates were observed (Table 6).

3.3. Microbiological Analysis:

The total viable microbial counts (yeast and mould, total count and faecal coliform) of all the formulated Abridates were performed prior to organoleptic evaluations (Table 6). The results demonstrated that the highest number of yeast and mould was (44 cfu/ml) in 3 bar carbonated Abridate followed by 5 bar (24 cfu/ml) and 4 bar (17 cfu/ml). However, the highest total count was (26 cfu/ml) at 5 bar and the least (13 cfu/ml) was 4 bar pressure (Table 6). Interestingly, no viable coliform could be detected in the carbonated Abridates.

Table 6: Chemical, physical and microbial analysis of Abridate

Pressure bar	ΔE	Acidity%	TSS%	Moisture%	pH	ΔE	Yeast & Molds cfu/ml	Coliform cfu/ml	Total counts cfu/ml
3	73.66^{a}	0.19^{a}	13.59^{a}	86.41^{a}	4.36^{a}	72.91^{a}	44	Not Detected	23
4	70.93^{b}	0.18^{a}	13.26^{b}	86.65^{a}	4.36^{a}	72.38^{a}	17	Not Detected	13
5	71.22^{ab}	0.19^{a}	13.56^{ab}	86.44^{a}	4.43^{a}	72.22^{a}	24	Not Detected	26

4. Discussion

The use of date syrup (dibs) or date powder as a sugar substituent in the preparation of different kinds of food had been an old practice and has been exploited in yogurt preparation (Hariri *et al.*, 2018 and Amerinasab *et al.*, 2015), soft drink (Hariri *et al.*, 2017), fibre (Hashim *et al.*, 2009), dairy cream (Ahmed *et al.*, 2016), milk (Ardali *et al.*, 2014 and Kazemalilou and Alizadeh, 2017), tomato ketchup (Mikki *et al.*, 1987) and powder. Although high sugar contents in date fruit are an excellent source, nonetheless, the major faced challenges in obtaining high-quality dibs are taste, texture, phenolics, flavonoids and polymers that can affect the reformulated products. To deal with such problems, a new modified machine, the Dibsi 10101, was used to extract reziz dibs under vacuum conditions. The obtained reziz dibs was of high quality with higher sugar content, good texture, low phenolics, and low polymers. Importantly, this method was devoid of heating or enzymes usage which ultimately led to cost-effectiveness. After achieving dibs through an array of filters, clear dibs were achieved which showed that clarification steps removed all unwanted substances except the sugars. The pH of the dibs was in a range of 5.38-to-6.03, that was slightly higher to 4.24 (Farahnaky *et al.*, 2016), 5.26 (Hariri *et al.*, 2019), and 4.91 (El-Sharnouby *et al.*, 2014) than earlier extracted dibs and concur with Abekhti *et al.*, 2013. This increase in pH demonstrated that extracted dibs might contain a higher percentage of sucrose as the pH of sucrose solutions are usually in the range of 7.3-7.9 or this may be attributed to the reduction in organic acids which usually are present in date fruit or produced during processing. While the pH of Abridate was reduced to ca 4.36, which was obviously due to the presence of carbonic acid. The reduction in pH corroborated by researchers, who reported that pH in all sorts of soft drinks is in the acidic range (Lin *et al.*, 2003; Hariri *et al.*, 2017).

The moisture content decides the shelf-life of the materials. As a rule of thumb, the lower the moisture level, the longer the shelf-life, so moisture content is a significant quality indicator. Abridate moisture content was slightly lower (circa 87%), owing to less chances of microbial growth. The low moisture content accompanied with the high soluble solid contents of Abridate explained its longer shelf life without spoilage (Mintah *et al.*, 2011). The microbial count revealed that the best Abridate, achieved at 4 bar pressure, contained small amounts of microbes. The total yeast and moulds count was 17 cfu/ml and the total coliform count was 13 cfu/ml, while faecal coliform could not be detected. Our data deciphered that the total viable microbial count was significantly lower than the earlier report by Hariri and his colleagues, who reported that the average total viable count in the produced soft drink was in the range of 8.8×104 for control to 12×104cfu/ ml (Hariri *et al.*, 2017). In organoleptic evaluation, Abridate carbonated at 4 bar pressure got the highest desirability, the fewer microbial counts could also be the reason. The significant reduction of the microbial count in Abridate may likely be due to the presence of phenolics or tannins. Phenolic compounds are plant secondary oxidation products and possess antioxidant activity that not only inhibits microbial growth but also plays a pivotal role in delaying chronic diseases such as cardiovascular diseases, cancer, bowel syndrome and Alzheimer's (Chun *et al.*, 2005). The presence of a higher amount of phenolics linked to the reduction of microbial activity has been reported in yoghurt (Şengül *et al.*, 2012) and date fruit (Chaira *et al.*, 2009). Although, the presence of phenolics is good, up to a certain threshold limit and beyond that limit, these compounds trigger taste and colour to rot. Our phenolics concentration (519.17 as GAE/100g; Table 6) was comparable to previously reported levels of phenolics of 453.04 (as GAE/100g sample) (Farahnaky *et al.*, 2016) and 368.35–529.29 (as GAE/100g) (Abbès *et al.*, 2013). The small discrepancy between studies is most likely due to differences in the date varieties used or the method of extraction. These results indicated that the extraction method could either reduce or eliminate the natural functional compounds present in the dibs.

The minerals contents in reziz dibs and Hulu-Mur was assessed and presented (Table 3 and 4), respectively. In reziz dibs, a comparative analysis was also made with the commercially available reziz dibs, which deciphered that almost all the tested minerals had more in reziz dibs. It could be attributed to the Dibsi 10101 machine, which thoroughly chopped all the date fruits and released the maximum amount of minerals, or we can speculate that our opted method is devoid of heating steps and heating could degrade the minerals. In reziz dibs, the highest amount of potassium was found, followed by magnesium, calcium, sodium, and iron. Similar findings had previously been discovered by (Farahnaky *et al.*, 2016) and (El-Sharnouby *et al.*, 2014) with the highest potassium level followed by magnesium, sodium, calcium and iron. Nonetheless, another study recorded the maximum concentration of sodium accompanied by potassium, calcium and magnesium (Al-Hooti *et al.*, 2002). Reziz dibs contained a relatively small amount of sodium, hence taking into consideration the additional regular consumption of sodium for diabetic and hypertension users, lower sodium concentrations of the date concentrate and in particular, the liquid sugar may be beneficial for the formulation of Abridate. In Hulu-Mur, the highest amount of magnesium (576 ppm), followed by calcium (495) and potassium (491ppm), was detected. Despite the exception of magnesium, the Hulu-Mur equivalent produces a slightly higher mineral content ($p \leq 0.05$) (Na, K, Ca, and Fe) than commercial non-alcoholic carbonated beverages (Baidab *et al.*, 2016). Among the analysed minerals, Abridate contained a higher amount of almost all the essential minerals than standard non-alcoholic beverages. Therefore, the established carbonated drink, Abridate, will provide children with some important minerals for proper growth and healthy life.

Analysis for Hulu-Mur in this study revealed that there are a high protein and ash content as compared to previous findings (Baidab *et al.*, 2016). In addition, Hulu Mur flakes contained high phenolic content and mineral contents than the findings of Mahgoub *et al.*, (1999) in the fermented Hulu-Mur, which may be due to surface soil contamination or the effect to the stone milling machine (Mahgoub *et al.*, 1999).

The tested shelf life of Abridate was found to be not much longer. After just one-week of storage, the taste of the Abridate changed slightly, so here we assume that the main causative agent would be some impurities such as pectins or tannins in dibs. Such impurities were observed in Abridate when stored in the refrigerator for more than a week. The other possible reasons for bitter taste could be some microbial growth or reactions that took place between Hulu-Mur flavour, reziz dibs and carbon dioxide.

5. Conclusions

Dibsi 10101 yielded clear reziz dibs with higher TSS and minerals, indicating that it can be used to extract dibs on a pilot or industrial scale and the extracted dibs can be used to substantially substitute sugar in various kinds of functional foods, including soft drinks. The produced Abridate was comparable to commercially available soft drinks, however, its organic nature makes it superior over synthetic and hazardous soft drinks. In addition, it contained reducing sugar (Glucose and Fructose) and valuable supplements; thereby, if commercialised properly with improved shelf-life, it holds a tremendous potential to substitute soft drinks.

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