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Patil SH
Department of Food Science and Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, (MS) India

Shere PD
Department of Food Science and Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, (MS) India

Sawate AR
Department of Food Science and Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, (MS) India

Mete BS
Department of Food Science and Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, (MS) India

Correspondence
Patil S.H
Department of Food Science and Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, (MS) India

Effect of hydrocolloids on textural and sensory quality of date-mango leather

Patil SH, Shere PD, Sawate AR and Mete BS

Abstract
The date fruit is rich in phytochemicals like phenolics, carotenoids, anthocyanins and flavonoids. In addition also providing fiber, carbohydrate, vitamins and minerals. Date is not commonly used in the form of products. Hence, efforts were made to prepared leather from 100% date and date: mango combination at 60:40 ratio. To improve the textural quality of leather the hydrocolloids such as pectin and carboxy methyl cellulose were used at 0.5, 1 and 1.5 %w/w level.the resultant leather was evaluated for its sensory quality on a 9 point hedonic scale to decide best quality leather. The sensory level ranked the best product at 1% level of pectin and carboxy methyl cellulose with respect to color, flavour, texture and overall acceptability. The best selected product was also studies for textural parameter. The results revealed that hardness and gumminess increased with addition of hydrocolloids.

Keywords: Date leather, textural charercterstics, Sensory evaluation

1. Introduction
The date palm (*Phoenix dactylifera* L., *family Arecaceae*) is famous for its delicious fruits. Due to nutritional, economic and distinct medicinal properties of date fruit, it is a common diet source for millions of people in Middle East and around the world Barreveld, (1993) [9]. The date fruit for its nutritional value and health benefits are well known across the globe due to rich in high profile nutrients and health promoting properties. Date palm (*Phoenix dactylifera* L.) is a multipurpose tree providing, fiber, carbohydrates, minerals and vitamins besides having certain medicinal properties (Vayalil 2002; Al-Farsi *et al.* 2005) [23, 6]. Because of its high nutritional value and its long life the date palm has been mentioned as the 'tree of life' (Augstburger *et al* 2002) [8]. Dates and dried fruit have high concentration of polyphenols with excellent nutritional value that enrich lipoprotein in plasma and protect it from oxidation. These have also been identified as having antioxidant and antimutagenic properties and help in controlling cardiovascular diseases Vayalil (2002) [23]. The date fruit pulp is rich in phytochemicals like phenolics, sterols, carotenoids, anthocyanins, procyanidins, and flavonoids. The ratio and concentrations of these constituents depend on the type of the fruit, stage of fruit picking, location and soil conditions. These phytochemicals also contribute to the nutritional and organoleptic properties of the fruits (Abdelhak *et al*., 2005; Abdul and Allaith, 2008; Al Farsi *et al*., 2005; Ahmed *et al*., 1995; Fayadh and Al-Showiman, 1990; Hulme, 1970) [1, 2, 6, 4, 11, 13].

Dates (*Phoenix dactylifera*) are important produce in many Arabian Gulf countries. Date palm is becoming an important commercial crop in the producing countries with significant increase in yield by adopting advanced biotechnological approach. However, date processing industries have not expanded at the same rate. Recently the demand for table dates has decreased; while, there has been renewed interest in the date as a component of new food formulations /preparations. Processing industries produce various date products like date-paste, date-syrup, date-dip, date-honey, date-jam, date-vinegar, etc. Date is generally steamed, destoned, macerated, and converted to a semi-solid form known as paste with approximately 20–23% moisture content and a water activity below 0.6 (Ahmed, Ramaswamy and Khan, 2005) [5].

Mango (*Mangifera indica* L.) is greatly relished for its succulence, exotic flavour and delicious taste in most countries of the world. (Bhatnagar and Subramanyam, 1973) [10]. Apart from its delicacy, it is a nutritionally important fruit being a good source of vitamin A, B and C and minerals. Mango is considered to be a fruit with tremendous potential for future.

Fruit leather refers to fruit rolls or fruit roll-ups which is a confectionery product made by dehydrating fruit pulp into leathery sheets with chewy texture with different degrees of hardness (Hardeep and Satinderpal, 2003; Andress *et al.* 1999) [12, 7]. Fruit leathers are examples of health food snacks due to their natural ingredients and nutritional contents

(Raab and Oehler, 1976) [17]. Fruit leathers are products with intermediate moisture and have a flexible sheet form. They are consumed as snacks in many parts of the world (Torley *et al*. 2006) [22]. These products are light, pleasant to chew and tasty, becoming an attractive way to incorporate fruit to diet, especially for children and adolescents (Quintero Ruiz *et al.* 2012) [16]. Hence present investigation aimed to produce leather with different proportion of date and mango.

Hydrocolloids are widely used in many food formulations to improve quality attributes and shelf-life. Hydrocolloids are a heterogeneous group of long chain polymers (polysaccharides and proteins) characterised by their property of forming viscous dispersions and/or gels when dispersed in water. Considering these two properties, they are aptly termed as 'hydrophilic colloids' or 'hydrocolloids. The two main uses are as thickening and gelling agents. As thickening agents, they find uses in soups, gravies, salad dressings, sauces and toppings while as gelling agents, they are extensively used in products like jam, jelly, marmalade, restructured foods and low sugar/calorie gels. The modification of texture and/or viscosity of food system helps to modify its sensory properties, and hence, hydrocolloids are used as important food additives to perform specific purposes (Saha and Bhattacharya, 2010) [20]. Hydrocolloids are important in maintaining desired texture of fruit leathers. They have been used as gelling or thickening agents capable of binding water molecules, thereby enhancing the desired textural properties of foodstuffs (Rascón-Díaz *et al.* 2012)

Materials and methods

Materials

The raw materials utilized during present investigation like date fruits, mango pulp and packaging material were procured from local market of Parbhani, Maharashtra.

Method

Preparation of Date Leather

The fruit leather was prepared as per the method given by Parn *et al.* (2014) with slight modification. The selected fresh dates fruits (at tamer stage) without any physical damage were cut into halves with hands to remove seeds. Date fruits were boiled until become soft. Fruits were them passed through heavy duty grinder to get soft paste. Further, this paste was boiled with continuous stirring (for 10min.) without addition of sugar. The mixture was then poured into aluminum trays smeared with glycerin. Dried the sample in cabinet tray dryer at 65±5^{0}C for 12-14 hrs. Samples were removed from dryer, cut into pieces and packed.

Organoleptic evaluation of leather

Leather was evaluated for sensory characteristics like colour, flavour, texture, consistency and overall acceptability by 10 semi-trained panel members comprised of academic staff members of the Department of Food Science and Technology, CFT, Parbhani, Judgment was made through rating of product on a 9 point Hedonic Scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'.

TPA analysis of date leather

There are certain parameters of food which play crucial role in judging the consumer acceptability. Texture is considered as most crucial properties of leather which can be judged on the basis of hardness, stickiness, chewiness, cohesiveness etc these properties helps in determining the amount of force required to chew/bite the piece of fruit leather during mastication.

Texture analysis was performed using texture analyzer (single arm texture analyzer TA-XT Plus, Stable Micro Systems, Surrey, UK) with a load cell of 2 kg weight. A force versus time curve for a two-cycle compression was measured, with a disk probe (of 35mm diameter) and at a displacement speed of 10 mm/min. In built software of the texture analyzer was used for analyzing the data generated.

Table 1: Set parameters of TAX-T2i texture analyser

Test mode	Compression
Pre-test speed	1 mm/sec
Test speed	5 mm/sec
Post-test speed	5 mm/sec
Target mode	Distance
Distance	10 mm
Time	5 sec

Statistical analysis

The obtained data in the present investigation was statistically analyzed. The analysis of variance of the data obtained was done by using completely Randomized Design (CRD). The analysis of variance revealed at significant of P<0.05 level, S.E. and C.D. at 5% level were mentioned whenever required.

Results and Discussion

Effect of hydrocolloids on sensory quality of date mango leather

The hydrocolloids at various levels Viz., 0.5, 1 and 1.5 were used in preparation of leather and results obtained are presented in Table 2.

Table 2: Effect of Pectin and CMC on sensory quality of date mango leather

Hydrocolloids	Treatment	Color and appearance	Flavor	Taste	Texture	Overall acceptability
Pectin	Lp0	8.0	8.0	7.5	7.1	7.6
	Lp1	8.1	8.0	7.7	8.0	7.9
	Lp2	8.1	8.0	8.0	8.2	8.1
	Lp3	7.9	7.8	7.2	7.9	7.8
	SE±	0.12	0.13	0.12	0.12	0.17
	CD at 5%	0.39	0.42	0.40	0.42	0.56
CMC	Lc0	8.0	8.0	7.5	7.2	7.6
	Lc1	8.0	8.0	7.8	7.5	7.8
	Lc2	8.0	8.0	7.9	8.1	8.0
	Lc3	7.8	7.7	7.0	7.2	7.4
	SE±	0.17	0.14	0.12	0.12	0.07
	CD at 5%	0.56	0.45	0.39	0.40	0.24

*Each value is average of three determinations

Lp0=control without addition of pectin, Lp1= 0.5 % pectin, Lp2= 1 % pectin, Lp3= 1.5 % pectin and Lc0=control without addition of CMC, Lc1= 0.5 % CMC, Lc2= 1 % CMC, Lc3= 1.5 % CMC

Color

Color serves as a preliminary parameter for the acceptance and indicates the fitness of product for consumption. Results revealed that the color of leather was comparably same among the entire samples i.e. 8.1 up to the 1 percent level of pectin. The treatment LP2 (8.1) having 1 percent pectin was found to be significantly superior over the rest of the treatments.

It is worthwhile to note that higher level of pectin addition in leather is not desirable for color, flavor and textural quality point of view. It could be revealed that pectin level beyond 1% slightly decreased the color score. While in case of CMC, The treatment Lc2 (8.0) having 1 percent CMC was found to be significantly superior over the rest of the treatments. It seems that color and appearance was decreased after 1% level of hydrocollids incorporation

Flavour

The average flavour score for Leather added with pectin and CMC at various levels Viz. 0.5, 1 and 1.5 percent were observed to be comparatively similar up to 1% pectin (i.e. 8.0) and 1% CMC (8.0) i.e. nearly equal. The lowest score for flavour was observed in case of sample 1.5% pectin (7.8) and 1.5% CMC (7.7).

Taste

The best taste score was observed in case of sample LP2 (8.0) followed by LC2 (7.9). The taste properties of leather prepared with incorporation of pectin & CMC at 1 percent were found to be better compared with other treatments. It was observed that treatment LP3 (7.2) and LC3 (7.0) showed lowest score due to higher concentration of pectin & CMC. It can be revealed that Pectin & CMC incorporation at 1 percent (LP2) in leather was found to be most acceptable; beyond this level it was unacceptable due to its negative affect on taste properties.

Texture

Texture of the products has direct impact on the texture and body of the Leather. As the pectin and CMC concentration increased the consistency was found to be increased and the highest score was recorded for the sample LP2 (8.2) LC2 (8.1) and lowest in control sample followed by LP2 (7.1) and LC2 (7.2).

Overall acceptability

Further, it could be revealed that the sample LP2 (8.2) and LC2 (8.0) ranked excellent as compared to the control and all the other samples. This indicates that the increase in pectin and CMC level the overall acceptability was found to be increased up to 1 percent level but beyond 1% level it affected negative the overall acceptability by declining the taste, taste, and consistency.

These results were comparable with findings reported by Ahmad *et al.* (2005) [3] in quality attributes of fruit bar made from papaya and tomato by incorporating hydrocolloids.

Texture profile analysis of date leather

Texture play an important role in determining whether consumer are prepared to accept the new product or not. The date leather sample and hydrocolloids sample were subjected for measuring textural parameter with respective to hardness, cohesiveness, springiness, gumminess and chewiness using cylindrical disk probe (of 35mm diameter).

Table 3: Texture profile analysis of date leather

Sample	Parameters				
	Hardness (kg)	Cohesiveness	Springiness (mm)	Gumminess	Chewiness (kg)
L0	63.153	1.215	0.875	79.004	69.128
L4	32.288	1.500	0.999	48.432	48.383
Lc	52.288	0.959	0.900	50.144	45.129
Lp	61.153	1.577	0.990	96.438	95.518

*Each value is average of three determinations

L0 –control sample (100 % date) L4 –selected sample (60 % date: 40% mango)

Lc –cmc sample (60 % date: 40% mango) Lp –pectin sample (60 % date: 40% mango).

The data (Table 3) showed that addition of mango pulp had significant negative effect on texture of leather. Maximum value of hardness was observed in control sample (63.153 kg) and minimum in selected leather i.e. L4 (32.288 kg). Moisture content was increased due to addition of mango pulp which caused reduction in hardness. These results are in line with the findings of Rehman *et al*.(2012) [19] in development of date –apricot bar where in they observed that hardness decreased from 420.52 to 315.58 g due to addition of dried apricot paste and Vijayanand *et al*.(2000) [24] observed that hardness of mango and guava leathers decreased with the increase of moisture content.

In case addition of hydrocolloids, maximum value of hardness was observed in pectin leather (Lp: 61.153 kg) and minimum in CMC leather i.e. Lc (52.288 kg). These results are in line with the findings of Karima *et al*. (2013) [14] in date-tamarind fruit leather with different types of hydrocolloids who observed highest hardness in date leather containing pectin followed by guar gum, starch and least in dextrin. Instrumental hardness and resilience of papaya-tomato fruit leather (75:25 ratio) showed that higher level of pectin and starch concentration (i.e., in combination) increased hardness, while resilience did not show any trend of papaya-tomato fruit leather (75:25 ratio) (Ahmed *et al.* 2005) [5].

With regard to gumminess, pectin sample (Lp) showed higher values compared to leather sample (Lc) (96.438 versus 50.144, respectively). Karima *et al* (2013) [14] studied that hardness and gumminess of date-tamarind leather increased with an increase in hydrocolloid concentration.

Both control (L0) and selected (L4) also had low cohesiveness, which ranged between 1.215 and 1.500. This suggests that the date fruit leather can easily be chewed, owing to their low cohesiveness.

From the data on springiness test in date leather samples of control (L0) and selected (L4) was recorded 0.875 and 0.999 respectively. The springiness value was very low(‹1) suggesting that the date Leather sample do not spring back to their original form once force is applied on them. The present finding are in close agreement with Parn *et al* (2015) [15] who observed that both variety of date bar had low springiness value ranged below (‹1).

With regard to gumminess, Control sample (L0) showed higher values compared to selected Leather sample (L4) (79.004 versus 48.432, respectively). Hence, control (L0) can be considered more dense than selected (L4) which means more energy is required to break down the bar into a state of

'ready to swallow.

Conclusion

It can be concluded that the mango pulp can be incorporated in date paste up to 40 percent, standardized different hydrocolloids such as pectin and CMC upto 1%. Resulted in production of better quality product with respect to color, flavor, taste, texture and overall acceptability.

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