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UTILIZATION OF ULTRAFILTERED MILK PERMEATE AS WATER SUBSTITUTE IN MANGO DRINK FORTIFIED WITH PUMPKIN CUBES *EN* ROUTE TO INNOVATE A FUNCTIONAL DRINK

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ABSTRACT

This study aimed to annexation such impressive health benefits possessed of pumpkin to mango drink in addition to a rich source of the essential electrolytes, namely UF- milk permeate *en* route to innovate a functional drink.

To achieve this purpose, mango drink based on 14% fresh mango pulp, *per se,* and 12% sucrose was made (the control). Mango pulp was replaced with cooked (at 90° C for 5 min) pumpkin cubes (CPC) at the level of 5, 10 or 15% (W/W). Then 0.2% CMC, 0.015% $CaCl_2$ and 73.785% tap water were added for each one and well mixed. On the other hand, the mango pulp replaced with 10% CPC was chosen as a control in next study, where the water was replaced with UF- milk permeate (UFMP) at the level of 25, 50 or 75% and well mixed. All drinks were heat treated at 90° C for 5 min, filled into Pyrex glass bottles, air tightly closed, and cooled to *ca* 4° C.

The obtained results indicated that, separately, CPC composed of higher moisture and total nitrogen contents and lower carbohydrates content than mango pulp. Therefore, the mango pulp replacement with CPC in the drink was associated with significant increments in the total solids content as well as pH value and decrements in the moisture, acidity and total as well as reducing sugars contents. Organoleptically, the mango drink of 10% CPC possessed scores as high as the control towards the color as well as overall acceptance and came in the second order *versus* the control towards the consistency and taste criteria. Therefore, this formula was chosen to expose to the experiment of utilization of UFMP instead of water in the drink making. The concerned results confirmed that, significant increments in drink total solids, ash, total as well as reducing sugars contents and pH value, while both moisture and acidity contents of drink reduced by water replacement with UFMP. Sensory, the drink of 75% UFMP gained the highest scores in all criteria assessed being better than the control in both consistency and taste attributes. Finally, the forgoing results led satisfactory to conclude that, it could successfully made a drink that meets the intended health purposes based on the substitution of 10% of mango pulp with cooked cubes of pumpkin of many impressive health benefits as well as the utilization of UF milk permeate as a source of the essential electrolytes instead of 75% of required water *en* route to innovate a functional drink.

Keywords: Total solids and sugars; Acidity; Ash; Sensory attributes; Functional drink

INTRODUCTION

Although not widely known to consumers in general, the difference between juice, nectar and still drink is related to the content of fruit juice present in the packaged beverage. Worldwide, products labeled as “juice” must contain 100% fresh fruit, therefore these are pure products with no preservatives or sweeteners and no artificial colors, and may or may not contain pulp of the fruit itself. In this category, there is a division between “Reconstituted Juices,” which are basically concentrated from three to six times at the juice concentrate factories where they are produced, and subsequently diluted with potable drinking water at a bottling plant, returning the juice to its original condition (in terms of concentration of soluble solids in

water) at the time of bottling, before being distributed to consumers. Another division of the juice category is “Not-From-Concentrate,” commonly known as NFC, which only undergoes a slight pasteurization process.

In the still drink category, the fruit juice content in the packaged beverage is less than 25%, and in many countries only 3 to 5% (for example, China). These beverages contain a larger quantity of additives, making them a product of lesser value, representing a gateway for the consumption of industrialized still drinks for lower income populations (**Neves et al 2011**).

There's a big difference between a 'fruit juice' and a 'fruit drink'. If it says 'fruit juice', it must contain undiluted fruit juice. This can have up to 4% added sugar. If it says 'fruit drink', it must contain at least 5% fruit juice. But in Egypt, it must contain at least 10% fruit juice (**EOSQ, 2017**).

The beverage market represents a large and growing industry within which there are several categories. Electrolytes or sports beverages are designed to deliver rehydration, and they fall into the functional beverage category. Functional beverages offer some types of health benefit, and this category is a rapidly growing sector of the beverage market. The still drink market, which includes functional beverages, grows at an annual rate of 7%, doubles that of carbonated counterparts and encompasses a wide array of beverages (**Williams, 2001**). Thirst- quenching is a consumer term that may potentially be applied to any beverage (**McEwan and Colwill, 1996**).

Ultrafiltration (UF) of milk or whey produces a large quantity of permeate as by-product. Permeate is a source of high quality vitamins and minerals that are important to the human health. Where, it is a good source of the essential electrolytes such as calcium, potassium, sodium, magnesium and phosphorus those may be taken as sports drinks after normal or vigorous exercise to replace these ions lost due to effort **(Abd El-Khair, 2009 and Hattem et al 2011)**. Permeate is rich in minerals not found in substitute ingredients and enhances the overall nutritional content of a food product (**Fitzpatrick et al 2001**).

From this point, some trials were carried out for utilizing permeate (P) ultrafiltered whether from milk (M) or whey (W). Where, MP was mixed with fruit homogenate (strawberry or mango) at ratio of 3:1 (v/w). It was reported that, both drinks were sensory accepted (**Hattem et al 2011).** Likewise, 500 ml MP beverages fortified with 240 g lemon as well as 300 g guava could be recommended as new acceptable functional products **(Rizk, 2016).** Early, **Beucler et al (2005)** found that, drinks made using not more than 25 or 50% of either enzymatically hydrolyzed lactase or unhydrolyzed WP were similar to the commercial beverages in visual and flavor properties. They confirmed also that, drinks made with WP were higher in electrolytes (Na, K, Zn, Mg, P) content compared with a commercial sports beverage. Beverage incorporation represents a value-added utilization for low levels of WP.

On the other hand, pumpkin refers to *Cucurbita pepo*, an orange type of winter squash. While commonly viewed as a vegetable, pumpkin is scientifically a fruit, as it contains seeds. Beyond its delicious taste, pumpkin is nutritious and linked to many impressive health benefits **(Gong et al 2012)**. Where, pumpkin is high in vitamins and minerals, while being low in calories. It’s also a great source of antioxidants, alpha-carotene and beta-carotene, (provitamin A) carotenoid components those convert in the body into vitamin A, with which lutein and zeaxanthin presented also in high levels may protect eyes against sight loss, which becomes more common with age (**Wang et al 2011; 2014 and Eisenhauer et al 2017**) and can help keep the skin strong and healthy; i.e. acts as a natural sunblock (**Roberts et al 2009; Stahl and Sies, 2012 and Pullar et al 2017).** Pumpkin contains the beta-cryptoxanthin and many others, which may protect cells against damage by free radicals (**Johnson, 2002 and Khansari et al 2009).** Carotenoids, those function as antioxidants. These compounds are linked to lower risks of stomach, throat, pancreas and breast cancers (**Dreher and Junod, 1996; Hu et al 2012; Zhou et al 2016)** .Besides its high level of vitamin A, it is high also in vitamin C, that can help boost the immune system. Its supply of vitamin E, iron and folate may strengthen the immunity as well (**Maggini et al 2007; Huijskens et al 2014 and Veldhoen and Ferreira, 2015).** It is also good supply of fiber and potassium, which have been linked to heart health benefits (**Milde et al 2007 and Vinceti et al 2016**).

For that in view, it was aimed in this study to annexation such impressive health benefits possessed of pumpkin to mango drink in addition to a rich source of the essential electrolytes, namely ultrafiltered (UF) milk permeate *en* route to innovate a functional drink.

MATERIALS AND METHODS

1. Materials

Mango fruits *(Mangifira indica*) were purchased from El-Obour market, El-Obour City, Qalyoubia Governorate, Egypt. Fresh pumpkin fruit (*Cucurbita pepo*) was obtained from "Hyper one" market, El–Sheikh Zayed City, Giza Governorate, Egypt. Ultra-filtered milk permeate (UFMP) was obtained from Animal Production Research Institute, Agricultural Research Center, Giza, Egypt. Commercial grade granulated cane sugar produced by Sugar and Integrated Industries Co. at Hawamdia, Giza Governorate, Egypt. Other used ingredients; i.e., calcium chloride and sodium carboxy methyl cellulose (CMC) were obtained from El-Gomhouria Co. for Drugs and Medical Supplies, Cairo, Egypt.

2. Experimental procedures

2.1. Preparation of mango pulp

Mango fruits were washed and then peeled. Seeds were removed to get the mango pulp, which was blended to obtain a homogenous pulp. Thus, the pulp is ready for using as fresh as in the preparation of the drink.

2.2. Preparation of cooked pumpkin cubes

Pumpkin fruit (*ca* 4 kg) was washed and cut into 2 halves to remove the seeds and peeled. The peeled pumpkin fruit was cut into small cubes of equal size (*ca* one cm^3) and cook in hot water at 90° C for 5 min. Thereafter, cooked pumpkin cubes (CPC) were cooled to *ca* 4° C.

2.3. Preparation of mango pulp drink partially replaced with cooked pumpkin cubes

Mango drink based on 14% pulp and 12% sucrose was made (the control). Mango pulp was replaced with cooked pumpkin cubes (CPC) at the level of 5, 10 or 15% (W/W). Then 0.2% CMC, 0.015% $CaCl_2$ and 73.785% tap water were added for each one and well mixed. All drinks were heat treated at 90° C for 5 min, filled into Pyrex glass bottles, air tightly closed and cooled to *ca* 4° C, **(Table, 1)**.

2.4. Preparation of mango pulp drink replaced with 10% cooked pumpkin cubes made using milk permeate instead of water with different levels

Drink based on 12.6% mango pulp, 1.4% CPC, 12% sucrose 0.2% CMC, 0.015% $CaCl_2$ and 73.785% tap water was prepared (control). Then, the water was replaced with ultrafiltered milk permeate (MP) at the level of 25, 50 or 75% and well mixed. All drinks were heat treated at 90° C for 5 min, filled into Pyrex glass bottles, air tightly closed and cooled to *ca* 4° C, **(Table, 2)**.

3. Analytical methods

Physiochemical analyses including moisture, total nitrogen, fat, fiber, Reducing sugars and ash contents were determined according to **AOAC (2012).** Carbohydrate content was calculated by difference. The total sugars content was determined according to phenol-sulphoric acid method as described by **Charles (2010).** Titratable acidity content was determined as citric acid according to the method of **AOAC (2012).** The pH value in milk was measured electrometrically using Lab. pH meter with a glass electrode, Hanna model 8417 digital pH meter at 20 °C after calibrating with fresh pH 4.0 and 7.0 standard buffers according to the methods of **BSI (1989).**

Sensory evaluation was carried out by ten panelists using 10 – hedonic scale for color, consistency, taste and overall acceptability **(Meilgaard et al 2016).**

Statistical analysis was performed according to **SAS (1990)** using General Linear Model (GLM) with main effect of treatments. Duncan's multiple range was used to separate among of three replicates at $P \leq 0.05$.

Table 1. Recipe of mango pulp drink partially replaced with cooked pumpkin cubes

Ingredient (g)	Mango pulp replacement level with cooked pumpkin cubes (W/W)			
	Nil (Control)	**5%**	**10%**	**15%**
Mango pulp	140	133	126	119
Pumpkin cubes	-	7	14	21
Sucrose	120	120	120	120
CMC	2	2	2	2
Calcium chloride	0.15	0.15	0.15	0.15
Water	737.85	737.85	737.85	737.85
Total	**1000**	**1000**	**1000**	**1000**

Table 2. Recipe of mango pulp drink replaced with 10% cooked pumpkin cubes made using ultrafiltered (UF) milk permeate instead of water with different levels

Ingredient (g)	Water replacement level with UF-milk permeate			
	Nil (Control)	**25%**	**50%**	**75%**
Milk permeate	0.00	184.46	368.93	553.39
Water	737.85	553.39	368.93	184.46
Sucrose	120	120	120	120
Mango pulp	126	126	126	126
Pumpkin cubes	14	14	14	14
CMC	2	2	2	2
Calcium chloride	0.15	0.15	0.15	0.15
Total	**1000**	**1000**	**1000**	**1000**

RESULTS AND DISCUSSION

1- Proximate composition of main ingredients

The proximate chemical composition of main ingredients that used to fortify fruit dairy drink was given in **Table (3)**. Cooked pumpkin cubes (CPC) had moisture, total nitrogen, fat, ash and fiber with 91.39, 0.318, 0.78, 0.31 and 1.35%, respectively. These results of CPC are in coincidence with those found by **Rizk (2016) and Abd El-Gaber (2018).** The corresponding values that determined in mango pulp were 83.42, 0.128, 0.36, 0.33, and 1.5 % respectively. While, those in milk permeate (MP) were, in order 94.32, 0.021, 0.00, 0.15 and 0.00%. The UFMP composition agrees with those found by **Fayed (1986) and El-Awamry (1990).** By calculating the total carbohydrates data showed mango fruit contains 3.19 times higher than that of pumpkin one.

Table 3. Proximate chemical composition of main ingredients used for making mango drink

Component (%)	Ingredient		
	Mango pulp	Cooked pumpkin cubes	Milk permeate
Moisture	83.42	91.39	94.32
Total nitrogen	0.128	0.318	0.021
Fat	0.36	0.78	0.00
Ash	0.33	0.31	0.15
Fiber	1.50	1.35	0.00
Carbohydrates*	13.59	4.26	5.40

* Calculated by difference

2- Selection of the most preferred mango pulp replacement level with cooked pumpkin cubes

2.1- Physicochemical properties of mango pulp drink as replaced with cooked pumpkin cubes

Physicochemical properties of prepared mango drink as replaced with CPC were shown in **Table (4)**. The mango drink contains 83– 84% moisture along different replacing levels with CPC compared with control sample (83.36%).

Total solids content took the opposite direction of moisture content. Moreover, once the CPC was added, at any level, both acidity and ash contents were significantly lowered. Meanwhile, reversible patterns were noticed regarding pH value, which exhibited proportional increase as the replacement level of mango pulp with CPC heightened. Total as well as reducing sugars contents of drink significantly diminished as the CPC level increased. It is may be due to the relatively lower carbohydrates content possessed CPC *versus* mango pulp **(Table, 3)**.

2.2- Sensory screening of mango drink as replaced with cooked pumpkin cubes

Concerning the judging scores, the Figures listed in **Table (5)** show that, the drink color did not significantly influence by adding CPC up to 10 %, then the color score reduced when the replacement level increased. This could be due to that, unlike CPC, mango pulp was indeed, the sole source of the dissolved color present in the drink solution. The consistency score lowered significantly as the portion of CPC heightened. The participation of mango pulp in the drink consistency reduced in the presence of 5% CPC. The heavy distribution of CPC when added at the level of 10% restored the body weakness occurred due to the partial absence of mango pulp. But, the drink consistency became heavier when the replacement level increased to 15%. Moreover, the drink suffered from some taste flatness in the case of 5% CPC, which improved again at the 10% CPC and then messy taste was observed at the level of 15 % CPC.

The overall acceptance of 10% CPC – Mango drink was as good as the control. While, this criterion was low scored for the 5% and rather 15% CPC – mango drinks.

So, the forgoing organoleptic results led satisfactory to choose the mango drink replaced with 10% CPC for the following study as a control towards the partially utilization of milk permeate instead water.

3- Selection of the most preferred water replacement level with milk permeate

3.1- Physicochemical properties mango drink replaced with 10% cooked pumpkin cubes made using UF-milk permeate

Regarding the data displaying in **Table (6)** it could observe that, the moisture content of drink decreased and hence the total solids increased proportionally as the portion of UFMP instead of water raised. That is axiomatically due to the solids

present in the milk permeate *versus* the water. Moreover, the water replacement with water up to 25% did not result in any significant effect on the acidity content nor the pH value of drink. There more, significant decrement in the acidity content and hence increment in the pH value of drink were occurred as the milk permeate portion rose than 25%. Once the milk permeate was added at any level, the ash content of drink was significantly heightened. Similarly, significant ascending pattern in total and reducing sugars contents of drink were seen by increasing the milk permeate level. That could be attributed to lactose-induced the permeate solids. These findings agree with those reported by **Rizk (2016).**

Table 4. Physicochemical properties of mango drink as affected by replacing with cooked pumpkin cubes

Parameter	Mango pulp replacement level with cooked pumpkin cubes			
	Nil (Control)	**5%**	**10%**	**15%**
Moisture (%)	83.36^{b}±1.30	83.40^{b}±1.52	83.95^{a}±1.41	83.34^{b}±1.95
Total solids (%)	16.64^{a}±0.12	16.60^{a}±0.11	16.05^{b}±0.06	16.66^{a}±0.10
Acidity (%)	0.52^{a}±0.10	0.41^{ab}±0.10	0.34^{ab}±0.10	0.25^{b}±0.10
pH value	4.58^{c}±0.35	4.69^{c}±0.37	4.90^{b}±0.41	5.18^{a}±0.43
Ash (%)	0.19^{a}±0.02	0.14^{b}±0.02	0.12^{b}±0.02	0.12^{b}±0.01
Total sugars (%)	**15.24^{a}±3.42**	**14.82^{b}±3.72**	**14.50^{b}±2.40**	**13.74^{c}±3.30**
Reducing sugars (%)	**2.13^{a}±1.02**	**1.90^{b}±1.14**	**0.94^{c}±1.54**	**0.75^{d}±1.33**

Means (±SD) with the same letter at any position did not significantly differ (p>0.05).

Table 5. Panelist scores of mango drink as affected by replacing with cooked pumpkin cubes

Sensory attribute (out of 10 point)	Mango pulp replacement level with cooked pumpkin cubes			
	Nil (Control)	**5%**	**10%**	**15%**
Color	9.40^{a} ± 0.70	9.30^{a}± 1.32	9.20^{a} ± 0.52	8.40^{b} ± 1.65
Consistency	9.20^{a} ± 0.79	9.00^{ab} ± 1.23	8.80^{b} ± 0.82	7.10^{c} ± 1.73
Taste	8.50^{a} ± 1.27	7.60^{c} ± 0.70	8.20^{b}± 1.23	6.10^{d}± 1.37
Overall acceptability	9.50^{a} ± 0.53	7.90^{b} ± 0.74	9.40^{a} ± 0.52	6.70^{c} ± 1.16

Means (±SD) with the same letter at any position did not significantly differ (p>0.05).

Table 6. Physicochemical properties of drink of mango pulp replaced with 10% cooked pumpkin cubes made using milk permeate instead of water with different levels

Parameter	Water replacement level with milk permeate			
	Nil Control	25%	50%	75%
Moisture (%)	83.95^{a}±1.41	82.97^{b}±1.43	81.35^{c}±1.33	80.77^{d}±1.11
Total solids (%)	16.05^{d}±0.06	17.03^{c}±0.20	18.65^{b}±0.31	19.23^{a}±0.42
Acidity (%)	0.34^{a}±0.10	0.29^{a}±0.14	0.18^{b}±0.04	0.13^{b}±0.05
pH value	4.90^{b}±0.41	5.18^{b}±0.43	5.63^{a}±0.48	5.74^{a}±0.50
Ash (%)	0.12^{b}±0.02	0.18^{a}±0.06	0.19^{a}±0.04	0.20^{a}±0.05
Total sugars (%)	14.50^{d}±1.40	15.83^{c}±1.45	16.70^{b}±1.14	18.73^{a}±1.32
Reducing sugars (%)	0.94^{d}±0.20	2.33^{c}±0.40	3.90^{b}±0.52	5.28^{a}±0.77

Means (±SD) with the same letter at any position did not significantly differ (p>0.05).

3.2- Sensory quality of drink of mango drink replaced with 10% cooked pumpkin cubes made using UF-milk permeate

The organoleptic evaluation of mango pulp drink substituted with 10% CPC as a function of replacement level of water with milk permeate revealed that, although water replacement levels of 25 and even 50% milk permeate did not produce satisfactory sensory acceptance, the highest replacement level (75%) resulting a drink as good as the control in the criterion of color as well as the overall acceptability and rather improve both criteria of consistency and taste **(Table, 7)**. Similar observations were reported by **El-Kholy and Abbas (2015) and Rizk (2016**).

Table 7. Panelist scores of mango pulp drink replaced with 10% cooked pumpkin cubes made using UF-milk permeate

Sensory attribute (out of 10 point)	Water replacement level with milk permeate			
	Nil (Control)	25%	50%	75%
Color	9.60^{a} ± 0.52	8.40^{c} ± 1.17	8.50^{b} ± 1.18	9.30^{a} ± 0.67
Consistency	9.00^{b} ± 0.82	8.50^{c} ± 0.85	8.40^{c} ± 0.84	9.40^{a} ± 0.70
Taste	8.20^{bc}± 1.23	8.30^{bc} ± 0.95	8.30^{bc} ± 0.95	9.40^{a} ± 0.70
Overall acceptability	9.40^{a} ± 0.52	8.00^{c} ± 0.67	8.60^{b} ± 0.97	9.20^{a} ± 0.42

Means (±SD) with the same letter at any position did not significantly differ (p>0.05).

CONCLUSION

Finally, the forgoing results led satisfactory to conclude that, it could successfully made a drink that meets the intended health purposes based on the substitution of 10% of mango pulp with cooked cubes of pumpkin of many impressive health benefits as well as utilization of UF milk permeate as a source of the essential electrolytes instead of 75% of required water *en* route to innovate a functional drink.

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الإستفادة من راشح اللبن الناتج من الترشيح الفائق كبديل للماء المستخدم لإبتكار مشروب مانجو مدعم بمكعبات قرع العسل كمشروب وظيفى

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تهدف هذه الدراسة للإستفادة من الفوائد الصحية لقرع العسل وذلك بإضافتها إلى مشروب المانجو إلى جانب إستخدام راشح اللبن الناتج من الترشيح الفائق كمصدر رئيسى لإليكتروليتات الأساسية لأنتاج مشروب وظيفى مبتكر. ولتحقيق هذا الغرض تم تصنيع مشروب مانجو 14% لب مانجو طازج بالإضافة إلى 12% سكروز (كمعاملة مقارنة). وتم إستبدال لب المانجو بمكعبات قرع العسل المطبوخة (على 90 °م/5 ق) بنسب 5 ، 10 أو 15% (وزن/ وزن). ثم تم إضافة 0.2 % كربوكسى ميثيل سليلوز و0.015% كلوريد كالسيوم و73.785% ماء لكل معاملة ثم تم مزج الخليط جيداً. ومن ناحية أخرى إحتوت معاملة المقارنة على 12.6% لب مانجو و1.4% مكعبات قرع العسل المطبوخة و12% سكروز و0.2 % كربوكسى ميثيل سليلوز و0.015% كلوريد كالسيوم و 73.785 % ماء. ثم إستبدل عن الماء براشح اللبن الناتج بالترشيح الفائق بنسب 25، 50 أو 75% ثم المزج جيداً. وقد عوملت جميع المشروبات حراريا على 0°م/5 ق ثم التعبئة فى زجاجات من البيركس وأحكم غلقها ثم التبريد على حوالى 4°م. أوضحت النتائج المتحصل عليها أن مكعبات قرع العسل المطبوخة ذات محتوى أعلى من كل من الرطوبة والنيتروجين الكلى ومحتوى أقل من الكربوهيدرات بالمقارنة بلب المانجو. لذلك فإن إستبدال لب المانجو بمكعبات قرع العسل المطبوخة نتج عنه مشروب مرتفع معنوياً فى محتواه من الجوامد الكلية ورقم الأس الهيدروجينى وعلى العكس من ذلك كان المحتوى أقل من الرطوبة والحموضة والسكريات الكلية والمختزلة. وحاز مشروب المانجو المدعم ب 10% مكعبات قرع العسل المطبوخ على قبول حسى أفضل من عينة المقارنة من ناحية اللون والقبول العام بينما جاء فى المرتبة الثانية حسياً بعد عينة المقارنة من حيث القوام والطعم. لذلك تم إختيار هذه التركيبة لتجربة الإستفادة من راشح اللبن الناتج من الترشيح الفائق بدلاً من الماء فى إنتاج المشروب. ولقد أكدت النتائج المتحصل عليها أنه يوجد زيادة معنوية فى كل من محتوى الجوامد الكلية والرماد والسكريات الكلية والمختزلة ورقم الأس الهيدروجينى للمشروب فى حين إنخفض محتوى المشروب من الرطوبة والحموضة بزيادة نسبة إستبدال الماء براشح اللبن. ولقد حصل المشروب المحتوى على 75% راشح لبن على أعلى درجات التقييم الحسى بل وكان أفضل من عينة المقارنة فى كل من صفتى القوام والطعم. ومن النتائج المتحصل عليها يمكن الإستنتاج إلى إنه يمكن بنجاح إنتاج مشروب وظيفى يلبى الأحتياجات الصحية عن طريق إستبدال 10% من لب المانجو بمكعبات قرع العسل المطبوخة بالأضافة إلى إستخدام راشح اللبن كمصدر للإليكتروليتات الأساسية بدلآ من 75% من الماء المستخدم.

الكلمات الدالة: السكريات والجوامد الكلية، الحموضة، الرماد، الخواص الحسية، المشروبات الوظيفية

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