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Composition and Quality of Concentrated Yoghurt (Labneh) Supplemented with Date Fruits

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IN this study, Date fruits of two different cultivars were prepared in dried form and added separately to labneh in two levels of 5 % and 10 % (w/w) from varieties of Malkabi (M) and Gondaila (G) to give treatments of M5, M10, G5 and G10 respectively, whereas the control (C) was prepared without adding date powder (DP). Analysis of the fresh labneh revealed an increase (P≤0.05) in its contents of total solids, ash and carbohydrate and decrease in fat, FDM and protein contents due to the use of DP. The recorded changes were proportional with the amount of DP added. The control had the highest acidity (1.47%) and the lowest pH values (4.35), while the applied treatments had a significant impact on decreasing acidity, but the differences in pH were insignificant. The used dates significantly increased Ca, P and Mg contents, whereas the highest corresponding values were 102.56, 137.20 and 21.88 mg/100g labneh treated with Gondaila variety at level of 10% DP. The calculated caloric values expressed as KJ/100g were 738.08, 764.75, 794.55, 758.97 and 778.03 for the control and labneh from M5, M10, G5 and G10 respectively. Organoleptically, the control had the highest scores for appearance, whereas the DP- treated samples ranked the highest scores for flavour. No significant differences were recorded for scores given for consistency of all treated and untreated samples.

Keywords: Labneh, Date fruits, Supplementation.

Introduction

Labneh, Labaneh, Lebna, Labne and labanah are synonyms to labneh (strained or concentrated yoghurt). Different synonyms and names in different countries were given by (Tamime et al., 2014). However, this product is well known from long time ago as a fermented milk product with longer keeping quality than yoghurt, since it is made traditionally from yoghurt by straining away part of its water- soluble compounds using cloth bags, animal skin or earthenware vessels in the traditional method (TM) as previously mentioned by Özer (2006).

Many disadvantages of the TM were given in the literature (Tamime et al., 1989; Özer, 2006) and different alternative methods were given and discussed in details by Nsabimana et al., (2005 ; Özer, 2006 ; Tamime et al., 2014). However, the TM is still use in many cases for its simplicity.

On the other hand, it may be of interest to note that the acid- coagulated dairy products such as labneh, Karish cheese and Cottage cheese are suffering from loss of some minerals especially calcium and phosphorus in the whey due to conversion of them from the colloidal form to the soluble one as affected by decreasing pH during fermentation (Lucey & Fox, 1993; Lucey et al., 1996 ; Gaucheron, 2011; Zamberlin et al., 2012). This conversion is generally affected by the acidification process, pH of the whey drainage and cooking temperature of the curd (Lucey and Fox, 1993). In this respect, Guinee et

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al. (1993) mentioned that acidification promotes solubilization of the micellar calcium phosphate and reduction of the negative change on casein.

Owing to richness of Egyptian date fruits (DF) with minerals and many nutrients (El-Ghazali & Hussin, 1999; El-Ghazali et al., 2010; El-Sohaimy & Hafez, 2010), the present work was conducted to study impact of supplementation of labneh with DF on its composition and quality with special reference to its minerals content aiming to improve its nutritive value and health benefits.

Materials and Methods

Materials

Fresh cow's milk obtained from private farm at Aswan was standardized to 4% fat. Skim milk powder, SMP (low-heat) produced by Valio Seinajoki, Finland was purchased from Green Fields Company, Kafr El-Sheikh. Yoghurt starter (YC-XII-DVS) consisting of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* was obtained from Chr. Hansen's Lab., Denmark. Date fruits (Malkabi and Gondaila) at tamr stage were purchased from Aswan markets.

Methods

Preparation of date powder (DP)

This was done as described by Mehanna et al. (2017). Date flesh was prepared by removing seeds, minced and mixed well to be ready for drying in oven at 45 ˚C for 24 hr. The samples were milled and dried more under the same conditions for 20 hr and then subjected to milling. The obtained homogenous powder was packed in PE pouches and stored at -18 ˚C until use.

Labneh manufacture

This was done from the prepared yoghurt using standardized milk fortified with 4% SMP. The procedures described by Tamime & Robinson (1999) were mainly followed for making yoghurt and labneh. Method of making yoghurt included heating milk (90˚C/15min), cooling to 42 ˚C, inoculating with yoghurt starter and incubating at the same temperature. The complete coagulation was followed by cooling overnight in the refrigerator(5±1˚C). The traditional method of making labneh was applied using cloth bags. So, the prepared yoghurt was mixed well, transferred into sterilized cloth bags, hanged in refrigerator (5±1˚C) to allow whey drainage for many hours. The prepared labneh was salted (0.5%, w/w) without (the control) and with supplementation with DP at levels of 5 and 10 % to give treatments of M5, M10, G5 and G10. All the control and treated samples were filled into plastic containers, mixed well and kept in refrigerator to be ready for analysis as a fresh product.

Methods of analysis

The fresh labneh was analysed for total solids, fat, protein and ash as well as acidity and pH as mainly given by AOAC (2005). A laboratory pH meter with glass electrode (HANNA HI8519) was used for measuring the pH. Carbohydrate's content was calculated by difference as follows:

Carbohydrates = TS- (Fat+ protein+ ash)

Mineral content including Ca, P and Mg were measured using ICP-OES (ICAP 6200) as described by James (1995).

The caloric value expressed as KJ/Kg was calculated from the following equation given by Walstra & Jenness (1984):

E = 370 F+ 170 P+ 168 L+18.

Where, E = energy (kJ/kg), F= Fat content (%), P= protein content (%), L= lactose or carbohydrate content (%).

Evaluation of the organoleptic properties

The organoleptic properties of labneh were evaluated according to the method recommended by Amer et al. (1997).

Statistical analysis

The statistical analysis was done following (SPSS, 1999). The attained results were subjected to ANOVA and Duncan's Test to reveal the significant differences among the averages at the significance level of 0.05. The data were expressed as averages ±SE.

Results and Discussion

Table 1 shows the gross chemical composition of the control labneh (C) and the product supplemented with date powder (DP) prepared from different two date cultivars being Malkabi (M) or Gondaila (G) at two levels of 5% and 10 % to give treatments of M5, M10, G5 and G10. The applied treatments significantly ($P \leq 0.05$) increased the content of total solids (TS), ash and carbohydrate and such increase was proportional with the amount of DP used. The opposite was noticed with fat, FDM and protein contents since adding more DP significantly decreased their values in the prepared fresh labneh.

Impact of the used date fruits on TS content

of labneh could be attributed to the dates grown in Aswan contain some moisture only since the farmers standing the fruit above palm trees for drying naturally before sun-drying (El-Ghazali & Hussin, 1999). More than 85% TS was given in the literature for most date cultivars (El-Ghazali & Hussin, 1999 ; El-Ghazali et al., 2010; Al-Tamim, 2014). However, the DP prepared by Magouz (2012) contained 96.26% TS, whereas Abdel-Wahed (2019) gave range of 84.85-88.05 %.

Table 1 reveals also that the applied treatments significantly increased carbohydrate and ash contents of labneh. The higher was amount of DP added from (M) or (G) varieties, the higher were the contents of carbohydrate and ash. This finding was accompanied by significant decreases in the fat, FDM and protein, since their values were negatively correlated with the amount of DP added. However, G10 treated labneh had the maximum TS (35.33 %) and carbohydrate (13.45 %) and M10 treated labneh had the maximum ash content (1.75 %), whereas the control labneh had the maximum fat, FDM and protein contents with corresponding values of 13.11%, 44.40 % and 10.51 % respectively. The control had also the highest acidity (1.47 %), whereas the changes in pH due to the applied treatments were insignificant (Fig.1). The control labneh prepared by Abdel-Wahed (2019) showed also the maximum acidity value of 1.60 % and the minimum pH values of 4.28. The changes of both parameters due to the use of DP prepared from different cultivars were statistically significant (P≤0.05).

Analysis of the prepared labneh for minerals content (Table 2) showed significant increase (P≤0.05) in its contents with respect to Ca, P and Mg. This increase was found to be related to date variety and amount of DP added. The use of Gondaila variety caused always the highest increase in the minerals content as compared with impact of Malkabi variety. This was true at any level of supplementation. However, the highest values of Ca, P and Mg were 102.56, 137.20 and 21.88 mg/100g in order when G10 was the applied treatment. Such impact of DP agrees with the results given by Abdel-Wahed (2019) who prepared DP from different three cultivars and used it for supplementation of labneh. The minimum values of Ca, P and Mg were given for control product being 94.0, 141.0 and 19.0 mg/100g in order, whereas the values in treated labneh was in the range of 97.5-104.5 mg for Ca, 143.5-152.5 mg for P and 20.5-24.4 mg/100g for Mg depending on variety of the date used and the level of supplementation.

Impact of date fruits on the detailed chemical composition of the prepared labneh could be explained on the basis of richness of different date cultivars with carbohydrates (reducing and non-reducing sugars), dietary fibers and minerals (Ca, P, Mg, K, Na, Mn, Fe, Zn, Cu and Se) and poorness of them with fat and protein (El-Ghazali & Hussin, 1999; Al-Farsi & Lee, 2008; El-Ghazali et al., 2010; El-Sohaimy & Hafez, 2010; Hasnaoui et al., 2010; AL-Tamim, 2014; Trabzuni et al., 2014).

TABLE 1.Gross chemical composition (%) of fresh labneh as affected by supplementation with two different date cultivars of Malkabi (M) or Gondaila (G) at levels of 5 and 10 %, w/w (Averages ± SE of 3 replicates).

Treatments	TS*	Fat	FDM*	Protein	Carbohydrate	Ash
Control	29.51±0.22^{c}	13.11±0.35^{a}	44.40±0.99^{a}	10.51±0.15^{a}	4.32±0.32^{e}	1.57±0.01^{d}
M5	32.19±0.27^{b}	12.28±0.37^{ab}	38.12±1.01^{b}	10.45±0.05^{ab}	7.80±0.29^{d}	1.66±0.01^{bc}
M10	35.26±0.33^{a}	11.28±0.37^{c}	31.96±0.90^{d}	9.93±0.11^{cd}	12.31±0.26^{b}	1.75±0.01^{a}
G5	32.76±0.16^{b}	11.50±0.25^{bc}	35.12±0.79^{c}	10.19±0.08^{bc}	9.43±0.26^{c}	1.64±0.01^{c}
G10	35.33±0.26^{a}	10.33±0.08^{d}	29.26±0.30^{e}	9.88±0.06^{d}	13.45±0.21^{a}	1.67±0.01^{b}

*TS= Total solids, FDM= Fat on dry matter basis.

- Averages with different superscripts differed significantly (P≤0.05).

TABLE 2. Minerals content (mg/100g) of fresh labneh made without (control) and with supplementation with date fruits (Malkabi, M and Gondaila, G) at two levels of 5 and 10%, w/w (Averages ±SE of 3 replicates).*

Treatments	Calcium	Phosphorus	Magnesium
Control	78.19±0.42^{d}	123.72±1.48^{c}	15.53±0.09^{e}
M5	90.19±1.92^{c}	128.10±1.09^{b}	18.07±0.01^{d}
M10	96.37±0.83^{b}	134.05±0.00^{a}	21.42±0.05^{b}
G5	92.06±1.59^{c}	130.72±1.64^{b}	18.79±0.14^{c}
G10	102.56±0.58^{a}	137.20±0.46^{a}	21.88±0.22^{a}

*Averages with different superscripts differed significantly (P≤0.05).

The increase in the carbohydrate content (Table 1) due to the use of DP may be responsible for the recorded increase in the calculated caloric values (Fig.1) since the changes in fat and protein due to the applied treatments were slight. However, the caloric values were 738.08, 764.75, 794.55, 758.97 and 778.03 KJ/100g for the control and the prepared product from treatments M5, M10, G5 and G10 respectively.

Generally, impact of the two date cultivars used in the present study is in agreement with the trends given by Mehanna et al. (2017) who used the same varieties for making zabady and by Mehanna et al. (2019) who used their date paste and date syrup for making stirred yoghurt and yoghurt drink respectively.

Organoleptic evaluation (Table 3) revealed that the control had the highest significant scores for appearance that may be due to the brownish colour noticed in the DP treated samples (Mehanna et al., 2019), but the differences in the scores given for consistency were statistically insignificant. In this respect, Mehanna et al. (2017) and Abdel-Wahed (2019) found some adverse effect of using DP on the appearance and texture of zabady and labneh respectively. The scores given for the flavour were always higher in the treated samples with scores of 51.40, 53.87, 56.67, 52.13 and 54.87 out of 60 points for the control, M5, M10, G5 and G10 treatments respectively. This trend agrees with the finding of Mehanna et al. (2019) who attributed such impact to sweetness of the product.

TABLE 3. Organoleptic properties and the scoring points of fresh control (C) labneh and supplemented labneh with date cultivars of Malkabi (M) or Gondaila (G) at levels of 5 and 10 %, w/w (Averages ± SE of 10 judges).*

Treatments	Appearance (10)	Consistency (30)	Flavour (60)
Control	9.27±0.23^{a}	26.87±0.87^{a}	51.40±1.54^{b}
M5	8.40±0.24^{b}	26.93±0.56^{a}	53.87±1.09^{ab}
M10	8.27±0.36^{b}	27.00±0.81^{a}	56.67±0.89^{a}
G5	8.60±0.25^{ab}	26.47±0.50^{a}	52.13±1.21^{b}
G10	8.47±0.31^{ab}	26.87±0.68^{a}	54.87±1.06^{ab}

-The values in parentheses represent the maximum attainable score.
* Averages with different superscripts differed significantly (P≤0.05).

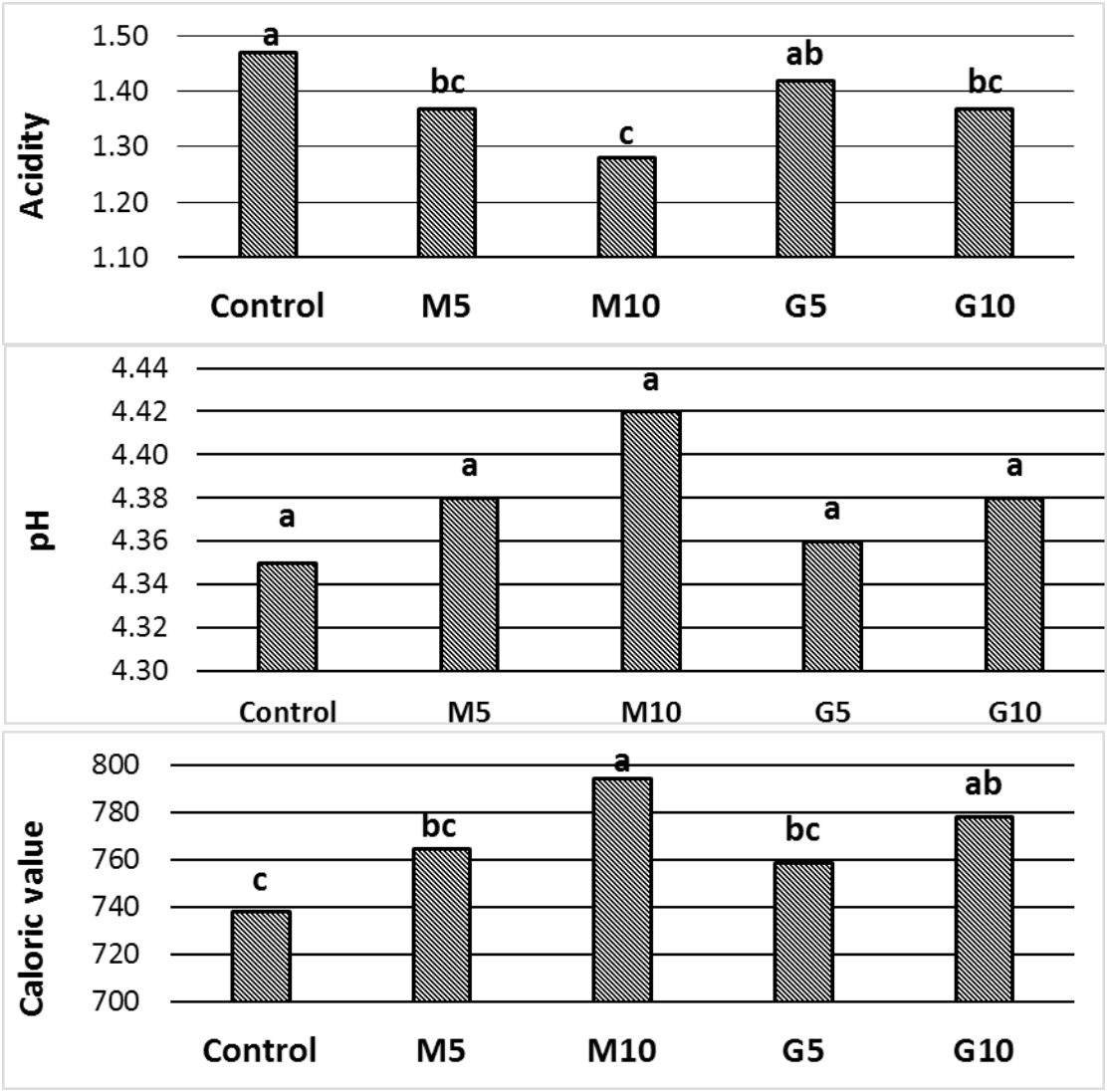

Fig. 1. Acidity (%), pH and caloric value (KJ/100g) of fresh labneh supplemented with date cultivars of Malkabi (M) and Gondaila (G) at levels of 5% and 10 % (w/w). C= control, M5, M10, G5 and G10= The applied treatments. (a, b,..etc letters represent significance at P≤0.05 when different).

Conclusion

A good quality labneh with improved nutritive value and more health benefits can be manufactured successfully with supplementation with date fruits.

References

Abdel-Wahed, G. A. A. (2019) A comprehensive study on yoghurt cheese (labneh). *Ph.D. Thesis, Faculty of Agriculture, Kafr El-Sheikh University, Egypt.*

Al-Farsi, M.A. and Lee, C. Y. (2008) Nutritional and functional properties of dates: A review. *Critical Reviews in Food Science and Nutrition*, **48**, 877-887. doi.org/10.1080/10408390701724264

Al-Tamim, E.A.A. (2014) Comparative study on the chemical composition of Saudi Sukkari and Egyptian Swei date palm fruits. *Journal of American Science*, **10**,149-153.

Amer, S. N., Girgis, E.S., Taha, S.H. and Abd El-

Moeety, S.H. (1997). Effect of milk total solids and type of starter on the quality of labneh. *Egyptian Journal of Dairy Science,* **25**, 179- 192.

AOAC (2005). Official Methods of Analysis of AOCA International, 17th Ed. Vol. 11 Gaitherburg, MD.

El-Ghazali, M. N., Awad-Allah, M. A. A., Gadalla, E.G. and El-banna, A.A. (2010) Comparison between traditional method (offshoots) and tissue cultures for the evaluation of some physical and chemical composition and nutritive value of some Egyptian dry- date cultivars grown at Aswan. *Bulletin of the National Nutrition Institute of the Arab Republic of Egypt.*1-16.

El-Ghazali, M.N. and Hussin, F. (1999) Effect of sun drying and mechanical drying on chemical composition and lipid, phospholipid fractions of Aswan dates. *Zagazig Journal of Agricultural Research*, **26**, 1303- 1323.

El-Sohaimy, S. A. and Hafez, E.E. (2010) Biochemical and nutritional charaterizations of date palm fruits (*Phoenix dactylifera L.*). *Journal of Applied Science Research,* **6**,1060-1067.

Gaucheron, F. (2011) Milk and dairy products. A unique micronutrient composition. *Journal of American Collage Nutrition*, **30**, 400S-409S. doi.org/10.108 0/07315724.2011.10719983.

Guinee, T.P, Pudia, P.D. and Farkye, N.Y. (1993) Fresh acid- curd cheese varieties. Ch. 13. In: Cheese: Chemistry, Physics and Microbiology. Vol. 2: Major Cheese Groups. 2nd Ed., Edited by Fox, P.F., Published by Chapman and Hall.

Hasnaoui,A., Elhoumaizi, M.A., Asehraou, A., Sindic, M., Deroanne,C. and Hakkou, A. (2010) Chemical composition and microbial quality of dates grown in Figuig Oasis of Morocco. *International Journal of Agriculture and Biology*, **12**, 311-314.

James, C. S. (1995) Analytical Chemistry of Foods. Blackie Academic and Professional, London, England.

Lucey, J.A. and Fox, P. F. (1993) Importance of calcium and phosphate in cheese manufacture: A review. *Journal of Dairy Science*, **76**, 1714-1724.

Lucey, J.A., Gorry, C., Okennedy, B., Kalab, M., Tan-Kinita, R. and Fox, P.F. (1996) Effect of acidification and neutralization of milk on some physicochemical properties of casein micelles. *International Dairy Journal*, **6**, 257-272.

Magouz, O. F. I. (2012) A study on fortification of zabady with iron using some natural sources. *M.Sc. Thesis, Faculty of Agriculture, Kafr El-Sheikh University, Egypt.*

Mehanna, N.M., Abd El-Aziz, A.M. and El-Wahsh, N.A. (2019) Utilization of date paste and date syrup in making stirred yoghurt and yoghurt drink. *Egyptian Journal of Dairy Science,* **47**, 19-25.

Mehanna, N.M, Swelam, S. and Asar, A. M. (2017) Composition and quality of zabady supplemented with different date cultivars. *Journal of Food Industries and Nutrition Science, 7*, 1-9.

Nsabimana, C., Jiang, B. and Kossah, R. (2005) Manufacturing, properties and shelf-life of labneh: A review. *International Journal of Dairy Technology*, **58**, 129-137.

zer, B. (2006) Production of concentrated products. Ch.6, In: Fermented Milks. Edited by Tamime, A.1st Ed. A Blackwell Publishing Company.

SPSS (1999) SPSS for windows, release 10.0 (27 Oct. 1999). Standard Version Copyright SPSS Inc.,1989-1999.

Tamime, A.Y., Davies, G., Ghehade, A.S. and Mahdi, H.A. (1989) The production of labneh by ultrafiltration: A new technology. *Journal of the Society Dairy Technology*, **42**, 35-39. doi. org/10.1111/j.1471-0307.1989.tb02150.x

Tamime, A.Y., Hickey, M. and Muir, D.D. (2014) Strained fermented milks- A review of existing legislative provisions, survey of nutritional labelling of commercial products in selected markets and terminology of products in some selected countries. *International Journal of Dairy Technology*, **67**, 305-333.

Tamime, A. Y. and Robinson, R.K. (1999)Yoghurt : Science and Technology. 2 nd Ed, Woodhead Publishing Limited,Cambridge, England.

Trabzuni, D.M.; Ahmed, S.B. and Abu-Tarboush, H.M. (2014). Chemical composition, minerals and antioxidants of the heart of date palm from three Saudi cultivars. *Food and Nutrition Science*, **5**, 1379-1386. doi.org/10.4236/fns.2014.514150

Walstra, P. and Jenness, R. (1984) Dairy Chemistry and Physics. 1st Ed., John Wiley & Sons Pub., Inc., USA.

Zamberlin, S., Antunac, N., Havranek, J. and Samaržija, D. (2012) Mineral elements in milk and dairy products. *Mljekarstvo*, **62**, 111-125.

تركيب وجودة اليوجورت المركز (اللبنه) المدعم بثمار التمر

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هدفت الدراسة الحالية إلى تحضير مسحوق ثمار التمر من كل من صنفى ملكابى (م) و جنديلة (ج) وإستخدم المسحوق فى تدعيم اللبنه بنسب ٥٪ ، ١٠ ٪ (وزن/وزن) وكانت المعاملات م ٥ ، م١٠ ، ج٥ ، ج١٠ ومقارنة اللبنة المدعمة بأخرى غير مدعمة للمقارنة (عينة المقارنة). أظهرت نتائج تحليل اللبنه أن التدعيم أدى إلى زيادة المحتوى من الجوامد الكلية، الكربوهيدرات ، الرماد وإنخفاض المحتوى من الدهن ، الدهن/للمادة الجافة، البروتين. وكان التغير فى الحالتين متوافقا مع زيادة كمية المسحوق المضاف. كانت الحموضة المعايرة لعينة المقارنة أعلى ما يمكن(١,٧٤ ٪) وكانت أقل ما يمكن (١,٢٨ ٪) فى عينات المعاملة م١٠ فى حين لم تكن الفروق فى قيم الرقم الهيدروجينى معنوية إحصائياً. أدت المعاملات الأربع السابق ذكرها إلى زيادة محتوى اللبنه من الكالسيوم والفوسفور والماغنسيوم وكانت أعلى الأرقام على التوالى ١٠٢,٥٦ ، ١٣٧,٢٠ ،٢١,٨٨ مجم/١٠٠ جم لبنه مدعمة بالصنف جنديلة بنسبة ١٠ ٪ (المعاملة ج ١٠) وواكب ذلك إرتفاعا فى قيم الطاقة معبرا عنها بالكيلوجول/١٠٠ جرام حيث كانت القيم ٧٣٨,٠٨ ، ٧٦٤,٧٥، ٧٩٤,٥٥، ٧٥٨,٩٧، ٧٧٨,٠٣ لعينات المقارنة ومعاملات م٥ ، م١٠ ، ج٥ ، ج١٠ على التوالى. أظهرت نتائج التحكيم الحسى أن عينات المقارنة (الكنترول) لاقت أعلى قبولا من قبل المحكمين بالنسبة لمظهرها العام بينما كانت نكهة اللبنه المدعمة بثمار التمر أفضل فى حين لم يتأثر قوام وتركيب المنتج .