Physicochemical and sensorial properties of recombined butter produced from milk fat and fish oil blend

Edy Subroto*, Tensiska, Rossi Indiarto, Herlina Marta and Ayu Septhi Wulan

Department of Food Industrial Technology, Faculty of Agro-Industrial Technology, Universitas Padjadjaran, Jl.Raya Bandung-Sumedang Km. 21, Jatinangor, Sumedang 40600, Indonesia

*Correspondence: edy.subroto@unpad.ac.id  Accepted: 05 Dec 2018  Published online: 26 Dec 2018

Butter has a fatty acid composition which is high in saturated fatty acids but low in polyunsaturated fatty acids (PUFA). Butter which is substituted with fish oil containing PUFA has good nutritional value. The objective of this research was to determine the ratio of fish oil to milk fat for the production of recombined butter which has good physicochemical and sensorial characteristics that preferred by the panelists. Fish oil and milk fat at various ratios (0:100; 5:95; 10:80; 15:85; and 20:80 w/w) were blended with the ingredients for recombined butter formulation. The increasing proportion of fish oil increased the adhesiveness but decreased the melting point, hardness, and sensorial characteristics of recombined butter. The optimum ratio of fish oil to milk fat was 5:95 (w/w). The recombined butter had a melting point, hardness, adhesiveness, and cohesiveness were 34.2 °C; 49.2 N; 282.3 N; and 0.9, respectively. Sensorial characteristics consisting of flavor, spread ability, taste, texture, color, and overall acceptability were preferred by panelists. The recombined butter was contained of PUFA (EPA) about 2.05%, which was beneficial for health.

Keywords: recombined butter, fish oil, milk fat, poly unsaturated fatty acid

INTRODUCTION
Butter is one of the processed products from fat. Butter is a soft-solid product made from milk fat or cream or a mixture of water-in-oil (w/o) emulsions, generally containing a minimum fat content of 80% and a maximum of 16% moisture content (Lee et al., 2018). This product has been known that butter is rich in fat-soluble vitamins, namely vitamins of A, D, E, and K (Gómez-Cortés et al., 2018).

Butter is made from milk fat because its consistency is half solid either with or without the addition of salt (NaCl). Milk fat is a relatively high saturated fat about 65% and about 35% unsaturated fatty acids (El-Hadad and Tikhomirova, 2018; Lopez et al., 2006). Milk fat contains the main fatty acids in the form of palmitate (27.9%), oleate (17.2%), stearate (12.2%), and myristate (11.1%) (Gómez-Cortés et al., 2018). The weakness of milk fat is nonexistent or poor in polyunsaturated fatty acids (PUFA) which is a good nutritional value (Gómez-Cortés et al., 2018; Lubary et al., 2011). Fish oil has a high PUFA, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Subroto et al., 2013). Therefore fish oil has the potential to be used as a functional food ingredient to increase the nutritional value in the production of butter known as recombined butter. Recombined butter is manufactured from anhydrous milk fat and non-fat-milk-solids, are combined and processed into the desired product (Tunick et al., 1997). The addition of fish oil as a food ingredient in butter production has not been widely studied.

The difference in fatty acid composition of milk fat and fish oil determines the physicochemical
properties of the butter produced (Lock and Bauman, 2004). The consistency of butter can be modified by adding a fat/oil fraction that has a lower melting point than milk fat so that the spreadability of butter is better (Schäffer et al., 2001). In addition, the problem with the use of fish oil is a fishy flavor that can affect the sensorial characteristic of butter. This often causes fish oil is difficult to be liked by consumers as a component of food ingredients that are of concern to researchers (Lanier and Corl, 2015). Therefore, the right proportion of fish oil is needed in the production of recombined butter.

In this study, recombined butter was produced at various ratios of fish oil to milk fat to obtain recombined butter which has high nutritional value. Physicochemical and sensorial characteristics of recombined butter were studied. The analysis included melting points, texture profiles, sensory evaluation, and fatty acid composition.

MATERIALS AND METHODS

Milk fat was obtained from PT Fonterra Brand Indonesia; Fish oil “Prince Gold® Alaska Deep Sea Fish Oil” was from Prince of Peace® Enterprises, Inc, USA. KOH, HCl, KI, ethanol, Na$_2$SO$_3$, NaOH, acetic acid, chloroform, and phenolphthalein were obtained from Merck KGaA (Darmstadt, Germany).

Production of recombined butter

Production of recombined butter was according to Illingworth and Bissell (1994) and Tunick et al. (1997) with modification. 37.35 g milk fat/50 g blend, 4.15 g stearin/50 g blend, and fish oil at the various ratios of fish oil to milk fat (0:100; 5:95; 10:90; 15:85; and 20:80 w/w) were mixed with fat-soluble ingredients, such as 0.25 g of lecithin and 5 mg of β-carotene were then stirred until homogeneous at a temperature of 65-70 °C for 15 minutes. The water-based materials consist of 7 g water, 1.24 g NaCl, and 5 mg butter flavor were mixed until dissolved. Fat base materials and waterbased materials were mixed and pasteurized at 80 °C for 15 seconds. The mixture was then emulsified using a homogenizer at 5-10 °C for 25 minutes. Recombined butter was then packed and tempered at 5-10 °C for 48 hours.

Determination of melting point

The AOCS official method Cc 1-25 (AOCS, 1997) was used to determine the melting point (MP). The sample was inserted in a capillary tube with a diameter of 1 mm, then closed using a flame without burning sample, then incubated in a cooler (4-10 °C) for 16 hours. The capillary tube was dipped in a beaker glass containing 600 ml water, equipped with a thermometer. Starting from 8-10 °C below the melting point of the sample, the temperature was raised (0.5 °C/min). The melting point was shown when the product in the capillary tube turned clear/transparent.

Determination of texture profile

The texture of recombined butter was analyzed by the texture profile analysis (TPA) method using the TXT 32 texture analyzer according to Bourne (2002). Samples in a cylindrical cup with a diameter of 3 cm and the height of 2 cm. Butter samples at a temperature of 15 °C were pressed with a P/6 probe with a diameter of 50 mm twice. The speed of the probe was set at pre-test speed of 1 mm/s, the test speed of 5 mm/s, the post-test speed of 5 mm/s, a distance of 10 mm, and trigger force of 5 g. Parameters observed included hardness, adhesiveness, and cohesiveness obtained from a macro program from the TXT 32 texture analyzer software.

Determination of fatty acid composition

The fatty acid composition was analyzed using gas chromatography (GC) after transesterification to fatty acid methyl esters (FAMEs) according to Subroto et al. (2018). About 200 μL of sample was methylated by the addition of 400 μL BF3-methanol complex and was heated at 90 °C for 2 h. The FAMEs residues were extracted with 500 μL hexane, then the FAMEs were analyzed by a “Varian 450-GC” equipped with a Wcot fused silica of CP-Sil 5 CB. FAMEs (2 μL) was injected into GC, and further identified by comparing their retention times with the authentic standard. The quantitative composition was obtained according to the AOCS Official Method Ce 1-62 (AOCS, 2004).

Sensory evaluation

Sensory evaluation was performed using a 5-point hedonic scale (1 dislike extremely, 5 like extremely) where panelists evaluated the sensory attributes i.e. texture, color, flavor, taste, spread ability, and overall acceptability of butter. Fifteen panelists were selected. Five formulations of butter (each weighing ~5 g) were served at 20 ± 1 °C in a cup. Samples were coded using three digit random numbers. Panelists were asked to take a small bite of bread and then drink water to rinse their palate after tasting each butter.
Analysis of iodine value, saponification value, acid value, and free fatty acid

The AOCS official method Cd 1d-92 was used to determine the iodine value. The saponification value was determined according to the AOCS official method Cd 3-25, while the acid value and free fatty acid were determined by AOCS official method Cd 3d-63 (AOCS, 1997).

Statistical analysis

The data were analyzed by one-way analysis of variance. Duncan test was applied to detect the differences. Significance was considered at P values <0.05.

RESULTS AND DISCUSSION

Chemical characteristic of milk fat and fish oil

Chemical characteristics include iodine value, saponification value, acid value, and free fatty acid of milk fat and fish oil can be seen in Table 1. Iodine value, saponification value, acid value, and free fatty acid between milk fat and fish oil were different significantly (p <0.05). The iodine value of milk fat and fish oil were 28.67 g I₂/100 g of fat and 124.84 g I₂/100 g of oil, respectively. Milk fat has an iodine value ranging from 25-42 g I₂/100 g of fat (Kusnandar, 2010), whereas the iodine value of fish oil ranges from 95-200 g I₂/100 g of oil (Young, 1986). The iodine value of milk fat was smaller than fish oil. This indicates that milk fat was dominated by saturated fatty acids while fish oil was dominated by unsaturated fatty acids.

The saponification value for milk fat was 107.97 mg KOH/g of fat while the saponification value of fish oil was 92.22 mg KOH/g of oil. Milk fat has saponification value ranging from 210-250 mg KOH/g of fat (Kusnandar, 2010). Whereas fish oil has a saponification value of about 188-199 mg KOH/g of oil (Young, 1986). The saponification value of milk fat was higher than fish oil. Thus milk fat had a small molecular weight and a short carbon chain compared to fish oil.

The acid value of milk fat and fish oil were 1.23 mg KOH/g of fat and 1.89 mg KOH/g of oil, respectively. Whereas free fatty acids of milk fat and fish oil were 0.63% and 1.02%, respectively. Generally, the free fatty acid in fish oil is about 1-7% (Young, 1986). Thus, the milk fat and fish oil used were still in pure and good quality.

The effect of fish oil to milk fat ratio on the melting point of recombined butter

The melting point of recombined butter was affected by the proportion of fish oil to milk fat. The higher the ratio of fish oil to milk fat, resulted in a higher decreasing in the melting point of recombined butter (Figure 1). The highest melting point was at fish oil to milk fat ratio of 0:100 which was 34.90 °C, while the lowest melting point was at fish oil to milk fat ratio of 20:80 which was 32.63 °C. Melting points of recombined butter were closely related to the composition of unsaturated fatty acids and saturated fatty acids from each fat/oil blend. However, in all proportions, fish oil produced recombined butter in a good temperature range of around 32-35 °C.

Generally, milk fat consists of 70% saturated fatty acids, 25% monounsaturated fatty acids, and 5% polyunsaturated fatty acids (Boe et al., 2007). According to Gómez-Cortés et al., (2018), most fatty acids were palmitic acid, stearic acid, myristic acid, and oleic acid. The dominance of saturated fatty acids caused milk fat to have a fairly high melting point. While fatty acids in fish oil were dominated by PUFA, including EPA and DHA. Fish oil has a low melting point so that it was liquid at room temperature.

Blending of fish oil which had a low melting point of about 10-15 °C with milk fat which had a higher melting point (32-37 °C) produced the recombined butter with the melting point between the melting point of the mixed fat/oil. Blending was a simple and beneficial mixing because it can be conducted by physical blending of fat/oil which produced the desired melting point of fat/oil (Moussata and Akoh, 1998).

The effect of milk fat to fish oil ratio on the texture profile of recombined butter

Hardness

The hardness value of butter was a value for knowing the ease of pressing butter which was related to its spread ability which was determined from the maximum force (peak value) at the first pressure/compression. Hardness is the main parameter in determining the spread ability of fat (margarine and butter) and gives a large influence on consumer acceptance (Boure, 2002). Table 2. showed that the higher proportion of fish oil to milk fat decreased the hardness of recombined butter, especially at the fish oil to milk fat ratio of 20:80 caused decreasing in hardness value significantly (p <0.05). The hardness value of recombined butter was affected by the fatty acid composition. In the higher proportion of fish oil increased the unsaturated fatty acids that inhibit the formation of crystals in recombined butter, so the solid triglycerides were low.
Table 1. Chemical characteristics of milk fat and fish oil

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Milk fat</th>
<th>Fish oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodin value (g iod/100 g oil)</td>
<td>28.67 ± 1.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>124.84 ± 6.86&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Saponification value (mg KOH/g oil)</td>
<td>107.97 ± 0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>92.22 ± 1.26&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Acid value (mg KOH/g oil)</td>
<td>1.23 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.89 ± 0.15&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Free fatty acid (%)</td>
<td>0.63 ± 0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.01 ± 0.08&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Each value is presented as mean ± standard deviation (n=3). Different letters in the same row indicated significantly different values (p < 0.05).

Figure 1. The effect of fish oil to milk fat ratio on the melting point of recombined butter.

Table 2. The hardness, adhesiveness, and cohesiveness of recombined butter from fish oil and milk fat blend

<table>
<thead>
<tr>
<th>Ratio of fish oil : milk fat</th>
<th>Hardness (N)</th>
<th>Adhesiveness (N)</th>
<th>Cohesiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:100</td>
<td>52.35 ± 1.09&lt;sup&gt;a&lt;/sup&gt;</td>
<td>167.45 ± 96.69&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.23 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5:95</td>
<td>49.2 ± 0.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>282.27 ± 33.87&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.19 ± 0.09&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>10:90</td>
<td>48.6 ± 3.91&lt;sup&gt;a&lt;/sup&gt;</td>
<td>298.14 ± 58.18&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.18 ± 0.09&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>15:85</td>
<td>48.4 ± 2.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>305.92 ± 80.31&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.18 ± 0.10&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>20:80</td>
<td>31.6 ± 8.84&lt;sup&gt;b&lt;/sup&gt;</td>
<td>307.06 ± 61.75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.18 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Each value is presented as mean ± standard deviation (n=3). Different letters in the same column indicated significantly different values (p < 0.05).

The greater of solid triglycerides in the mixture, the stiffness/hardness of the fat increased due to an increase in the number of crystals and the strength of each other between the crystals. While the increasing amount of triglycerides with unsaturated fatty acids, the formation of crystals was not perfect during the recombined butter processing. This was due to the fat crystallization during manufacture of recombined butter, once fractions with a low melting point such as the fish oil crystallized predominantly in the polymorphic form α, which is the most unstable form (Lopez et al., 2006). The formation of unstable crystals, recombined butter could melt during storage, leading to an increase in liquid fat and resulting in a product with lower hardness. Queirós et al., (2016) also found that the addition of olein rich in unsaturated fatty acids caused a decreasing in the hardness value of butter. Blending of milk fat as saturated fat which has a high melting point with fish oil as unsaturated fatty acid which has a low melting point produced the melting point of recombined butter between the melting point of the mixed fat which affected the level of hardness of butter.

**Adhesiveness**

Adhesiveness was the work needed to
overcome the pulling force between the surface of foodstuffs and other objects (Bourne, 2002). The proportion of fish oil to milk fat affected the adhesiveness of recombinant butter significantly \((p<0.05)\) (Table 2). The higher proportion of fish oil increased the adhesiveness of the recombined butter. The highest adhesiveness of recombined butter from milk fat and fish oil was at the fish oil to milk fat ratio of 20:80 which was about 307.06 N.

Table 2. showed that the treatment of fish oil to milk fat ratio of 5:95 produced adhesiveness which was not different with the ratio of 0:100 \((p<0.05)\). This was due to the composition of the solids and fatty acids of the recombined butter, which had more saturated fatty acids with semi-solid texture, making it easier to pull the butter as a whole from its surface so that the adhesiveness value was still low. However, the proportion of fish oil above 10% resulted in a significant increase in adhesiveness \((p<0.05)\). But the more addition of fish oil to the mixture caused the texture of butter to be softer while the adhesiveness value increased. The butter containing high unsaturated fatty acids took longer to crystallize and presented lower solid fat content (Queirós et al., 2016). The more fat crystals that have not been formed, causing a stronger pulling force between recombined butter and other ingredients.

**Cohesiveness**

Cohesiveness was the strength of the internal bond that formed the cohesiveness of a food ingredient or the degree of change in the shape of a food material to be crushed, cracked, or broken (Bourne, 2002). All treatments for the proportion of fish oil to milk fat did not have a significant effect on the cohesiveness of recombined butter \((p<0.05)\) (Table 2). The cohesiveness of recombined butter was in the range of 0.18-0.23. The cohesiveness of recombined butter was strongly affected by the emulsion system in the fat/oil products. In the processing of recombined butter, the emulsifier (lecithin) formed a stable emulsion between the oil and water phases so as to create a compactness in the texture of recombined butter from milk fat and fish oil blend. Thus the difference in the type of fat/oil did not affect the cohesiveness of recombined butter.

**Sensorial characteristics of recombined butter**

Sensorial evaluation of recombined butter at various ratios of fish oil to milk fat consist of texture, color, taste, flavor, spread ability and overall acceptability (Figure 2). The textural and sensorial characteristic of recombined butter were affected by the fatty acid composition (Chen et al., 2004). The level of acceptance of panelists on the texture of recombined butter from milk fat and fish oil in the ratio of 5:95 showed the level of preference for texture with a score of 4.0. This was in accordance with butter which is generally semisolid soft but not oily and mildly soft at room temperature. The proportion of fish oil above 10% decreased the level of butter texture preference significantly \((p<0.05)\). This was due to the high proportion of fish oil in the mixture produced a very soft texture of the butter, which was less preferred by the panelists.

![Figure 2. Sensory evaluation of recombined butter from various fish oil to milk fat ratios.](image-url)
The color of food could improve and provide an attraction for consumers. Based on Figure 2, it was known that panelists liked the color of recombined butter with a score of 3.5-4.1 in all proportions of fish oil to milk fat and did not significantly different (p<0.05). Fish oil and milk fat both have a yellowish color, so panelists assessed that the use of fish oil did not affect the color preference of recombined butter, which in general butter had a yellowish white color.

The acceptance of spread ability of recombined butter from milk fat and fish oil in the proportion of fish oil up to 10% resulted in a high level of preference about 3.8. The samples contain high unsaturated fatty acids may become softer and probably most easily spreadable (Queirós et al., 2016). Nevertheless, the level of spread ability preference was significantly decreased at the proportion of fish oil more than 15% (p<0.05). This was due to the panelists assume that butter was oily and difficult to smear.

The treatment of fish oil substitution did not affect the level of preference for the flavor of recombined butter. Figure 2 showed that panelists had still good acceptability to the flavor of recombinant butter from milk fat and fish oil for all proportion. Recombined butter was favored by panelists with a level of preference about 3.3-3.6.

The treatment of fish oil substitution significantly affected the level of preference for flavor attributes. In the fish oil to milk fat ratio of 5:95 did not affect the preference for the taste of recombined butter, but the proportion of fish oil more than 10% decreased the taste preference of recombined butter significantly. This was due to fish oil has a bad taste so that the proportion above 10% affected the butter taste.

The ratio of fish oil to milk fat at 5:95 had no significant effect on overall acceptability, but the proportion of fish oil above 10% decreased the overall acceptability of recombined butter significantly (p<0.05). This was due to overall acceptability of recombined butter had differences in the attributes of texture, taste, and flavor, so that the panelists are less favored.

Based on the physicochemical and sensorial characteristics of recombined butter, the fish oil to milk fat ratio of 5:95 was chosen the best treatment. The recombined butter was then analyzed for its fatty acid composition compared to fish oil and milk fat as the raw material.

### Fatty acid composition

The fatty acid composition of recombined butter compared to milk fat and fish oil was shown in Table 3. Milk fat was dominated by saturated fatty acids such as palmitic acid (28.15%), oleic acid (37.29%), and stearic acid (12.89%). While fish oil was dominated by PUFA such as EPA (23.10%) and DHA (12.21%). The mixing of milk fat with fish oil obtained recombined butter containing PUFA. Table 3 showed that the fatty acid composition of recombined butter was dominated by oleic, myristic, palmitic, and stearic acids were 31.72; 20.69; 19.29; and 13.96, respectively and containing PUFA (EPA) of 2.05%, so that it could be one of the processed fats/oils that are beneficial for health.

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Milk fat</th>
<th>Fish oil</th>
<th>Recombined butter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capric, C10:0</td>
<td>2.72 ± 0.01</td>
<td>ND</td>
<td>3.77 ± 0.02</td>
</tr>
<tr>
<td>Lauric, C12:0</td>
<td>5.42 ± 0.37</td>
<td>0.23 ± 0.23</td>
<td>8.24 ± 0.45</td>
</tr>
<tr>
<td>Miristic, C14:0</td>
<td>13.29 ± 0.77</td>
<td>8.64 ± 0.34</td>
<td>20.69 ± 2.31</td>
</tr>
<tr>
<td>Palmitoleic, C16:1</td>
<td>0.24 ± 0.01</td>
<td>13.42 ± 1.11</td>
<td>± 0.01</td>
</tr>
<tr>
<td>Palmitic, C16:0</td>
<td>28.15 ± 2.01</td>
<td>20.89 ± 0.98</td>
<td>19.29 ± 1.98</td>
</tr>
<tr>
<td>Linoleic, C18:2</td>
<td>ND</td>
<td>4.83 ± 0.40</td>
<td>ND</td>
</tr>
<tr>
<td>Oleic, C18:1</td>
<td>37.29 ± 1.80</td>
<td>11.78 ± 1.22</td>
<td>31.72 ± 1.91</td>
</tr>
<tr>
<td>Stearic, C18:0</td>
<td>12.89 ± 1.43</td>
<td>3.01 ± 0.02</td>
<td>13.96 ± 1.23</td>
</tr>
<tr>
<td>EPA, C20:5</td>
<td>ND</td>
<td>23.10 ± 2.91</td>
<td>2.05 ± 0.01</td>
</tr>
<tr>
<td>Eicosatetraenoic, C20:4</td>
<td>ND</td>
<td>0.79 ± 0.01</td>
<td>ND</td>
</tr>
<tr>
<td>Eicosenoic, C20:1</td>
<td>ND</td>
<td>1.12 ± 0.02</td>
<td>ND</td>
</tr>
<tr>
<td>DHA, C22:6</td>
<td>ND</td>
<td>12.21 ± 1.28</td>
<td>ND</td>
</tr>
</tbody>
</table>

Each value is presented as mean ± standard deviation (n=2)
ND = not detected; EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid
CONCLUSION
The higher of fish oil to milk fat ratio increased the adhesiveness but decreased the melting point, hardness and sensorial characteristic of recombined butter. Fish oil to milk fat ratio of 5:95 produced recombined butter with the best characteristics. The recombined butter had a melting point of 34.2 °C, the hardness of 49.2 N, adhesiveness of 282.3 N, cohesiveness of 0.19, and sensorial characteristic which was favored by the panelists. The Recombined butter contained PUFA (EPA) of 2.05% which was beneficial for health.

CONFLICT OF INTEREST
The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEDGEMENT
The authors would like to thank the support from the Ministry of Research, Technology and Higher Education of the Republic of Indonesia.

AUTHOR CONTRIBUTIONS
ES and AS designed and performed the experiments and also wrote the manuscript. TE, RI, and HM reviewed the manuscript.

REFERENCES
Addition of olein from milk fat positively affects the firmness of butter. Food Res. Int. 84: 69–75.


