REVIEW OF LITERATURE

Lal pera is a Khoa based sweet. Literature related to method of preparation, physico-chemical characteristics and quality of Lal pera and Khoa, base product of lal Pera has been reviewed which is divided in two sections. In first section literature concerning Khoa is reviewed while second section is devoted to literature on lal pera.

1. Khoa
2. Pera

(1) KHOA :

(A) METHOD OF KHOA PREPARATION :

De (1980) reported existing trade practices for Khoa making normally 2 to 3 kgs or more milk was taken per batch and boiled in karahi over a brisk, non-smoky fire. The milk was stirred vigorously and constantaly with a circular motion by a khunti. During this operation all parts of the pan with which the milk came in contact were lightly scrapped to prevent the milk from scorching. Constant evaporation of moisture occurred and the milk thickened progressively, So far the process was similar to kheer making. However, no sugar was added and milk dehydration continued. At a certain concentration (Cow milk
2.8 times and buffalo milk 2.5 times & toned milk 3.0 times) heat coagulation of milk proteins began and the concentrate became progressively ‘Insoluble’ in water. This stage was marked by an abrupt change in colour. The heating was continued with greater control thereafter, and speed of stirring cum scraping was increased. Soon the viscous mass reached a semi-soild/pasty consistency and began to dry-up. Very close attention was paid to the last stage. The final product was ready when it showed signs of leaving the bottom and sides of the karahi and sticking together. The Khoa pat was invariably made after removing the pan from the fire and working the contents up and down in to a single compact mass. It was generally marketed in different sizes and shapes.

B. IMPROVED METHOD FOR KHOA MAKING :

De (1980) suggested improved method for Khoa making. This involved consideration of equipments, condition of dehyderation and quality of milk.

(I) EQUIPMENTS :

The karahi and open fire combination was conveniently substituted by a stainless steel jacketed pan/kettle. In the jacket of which either steam or water was circulated as required. This not only provided greater control of the dehyderation process, but also an on-smoky, heating medium. The standard iron rod, flattened at one end for stirring cum scraping was normally used.

(II) DEHYDERATION CONDITION :

The physico-chemical quality of Khoa was influenced by the con-
dition of dehydration which included temperature of dehydration and amount of milk taken per batch for dehydration.

In order to obtain a desirable body and texture in Khoa, the milk was kept boiling till it assumed a pasty consistency and then the temprature was lowered to 85 + 3°C till the pat formation stage. During the entire dehydration process, the milk was stirred at 96-100 r.p.m. The dehydration was stopped when the pan content started leaving the pan surface and showed a tendency to stick together. The amount of milk handled per batch varied between 1/4 to 1/5th of the total capacity of the pan used.

(III) CHANGES DURING KHOA PREPARATION:

The methods of Khoa preparation and changes during its preparation have been discussed by several workers.

Davis (1940) pointed out the physico-chemical reactions which take place in various constituentes of milk during the indigenous method of Khoa making. He reported that Khoa is whole milk product from which moisture has been evaporated up to 25-30% and total solids increased up to 70-75%. He also mentioned a rapid deterioration of albumin, globulin and destruction of other colloids in early heating which was accelerated by frothing and incorporation of air by means of stirring. For the process there was no evidence either of churning or the ‘oiling off’ of the butter fat because vigorous stirring of hot milk had homogenous effect.

Rangappa (1948) observed that boiling of milk for 10 minutes in an open vessel with continuous stirring, as is a common practice in
India, caused a variable reduction in Volume, loss of 0.28 per cent total solids, 0.1 percent fat and 0.14 percent of lactose, and a reduction of bacterial count.

De and Ray (1952) have pointed out the influence of dehydration condition and types of milk on production of Khoa. They have reported that the ratio of S.N.F./Fat in milk influenced both the yield and total solids in the final product of Khoa. They also reported that boiling the milk for Khoa making and then lowering the temperature (180-190°F) at the time of pat formation with continuous stirring at a speed of 150-160 r.p.m. resulted in to good Khoa character.

Warner (1953) while discussing the method of Khoa preparation, reported that sometimes skimmed milk could also be used for the purpose, but the product had firmer structure. Heating duration depended upon the quantity of milk and the rate of heat exchange.

De and Srinivas (1967) studied the utilization of aged roller dried skimmed milk powder with butter or ghee for Khoa making and reported that by using 100 gms butter, 200 grams SMP and 1000 grams water, Khoa could be prepared without fat leakage provided vigorous stirring and scrapping is done during heating khoa, thus product had normal flavour but slightly caramalized colour. The average composition of Khoa prepared under standardization laboratory condition had moisture 25.6 percent, fat 24.01 percent and S.N.F. 50.3 percent.

Singh (1970) observed for most economical and efficient production of Khoa with drum heater: (a) the optimum feed rate should be 1.0 kg milk per min. in the drum heater: (b) a steam pressure of 1.4 kg/
cm² in the first pan and 0.7 kg/cm² in the second pan is desirable and (c) production run of 6-8 hours duration should be carried out. The khoa obtained by this equipment invariably had a moisture content ranging from 33.3 to 37.3 percent.

Patel (1976) standardized method for the manufacture of Khoa powder, consisting of (a) standardizing buffalo milk to 5% fat (9.8% S.N.F.) straining through a muslin cloth; (b) preheating to 65-70°C and homogenizing at 2500 ± 200psi², (c) making Khoa up to concentrate stage, (d) mixing water to make slurry with 16.18 % solids (e) adding sodium citrate @ 0.5 % of Khoa solids, (f) heating to 600°C passing through micropulverizer (g) roller drying with steam pressure of 4.17 ± 0.35 kg cm² (60 ± 5psi) and jar packing of the dried products.

Garg et al. (1989) investigated post manufacture of Khoa with respect to the textural changes in the product. Instron hardness, guminess, chewiness and adhesiveness of Khoa particularly of low moisture type, registered a definite rise during holding 30°C for 72 hrs. Cohesiveness and springiness, however, remained largely unaffected.

Dynamic viscosity of the product followed a similar trend as hardness. The moisture content remaining unaltered during holding, the observed changes in texture of Khoa were considered attributable to probable changes in the physical status of the product constituents.

Adhikari et al. (1994) Studied the interrelationships between texture composition and microstructure of Khoa from buffalo milk. Instron hardness, guminess and chewiness were negatively correlated with
moisture and fat contents, but positively correlated with protein, lactose, added carbohydrates, ash and calcium contents of Khoa.

(C) QUALITY OF KHOA :

(1) PHYSICAL QUALITY :

*Chetak and Bandopadhyaya (1989)* analysed 57 samples of khoa and reported physical quality of Khoa as:

<table>
<thead>
<tr>
<th>Colour</th>
<th></th>
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<tbody>
<tr>
<td>Pale yellow</td>
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</tr>
<tr>
<td>White</td>
<td>22</td>
</tr>
<tr>
<td>Grey</td>
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<table>
<thead>
<tr>
<th>Appearance</th>
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</tr>
<tr>
<td>Hard granular</td>
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</tr>
<tr>
<td>Hard and smooth</td>
<td>26</td>
</tr>
<tr>
<td>Soft and Smooth</td>
<td>13</td>
</tr>
<tr>
<td>Soft granular</td>
<td>11</td>
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</table>

<table>
<thead>
<tr>
<th>Flavour</th>
<th></th>
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<tr>
<td>Normal</td>
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</tr>
<tr>
<td>Flat</td>
<td>3</td>
</tr>
<tr>
<td>Rancid</td>
<td>2</td>
</tr>
</tbody>
</table>

(2) CHEMICAL QUALITY :

Composition of Khoa has been reported by various scientists under various conditions:

*Iyer et al. (1940)* reported the chemical composition of Khoa. They found that fat percent of Khoa and fat percent of milk used for making showed a direct relationship. They also found moisture 25%, protein 32.92%, lactose 36.80%, fat 25.60% and ash 4.30% in Khoa.
prepared from mixed milk. The Khoa prepared from pure cow milk was found to contain moisture 26.0 to 40.7 %, protein 24.8-29.0 %, lactose 24.3-40.8% and ash 4.1 to 5.2 %, while buffalo milk Khoa was found to contain moisture 26.1 %, protein 22.4 %, lactose 30.9% fat 37.3 % and ash 3.7 %. These workers also suggested the standards for the composition of Khoa as protein 24.5%, Lactose 20.0 % fat 27.0 % and ash 4.0 percent.

**Bhat et al. (1948)** carried out on “chemical and microbiological studies of Khoa”, and reported on an average the chemical composition of Khoa as moisture 19.69 %, total solids 80.31 % protein 26.68 %, fat 29.72 %, lactose 20.24 % and ash 3.67 percent.

**De and Ray (1952)** reported an average composition of Khoa as total solids 73.0 %, moisture 27.0%, fat 33.0 %, protein 20.0 %, lactose 24.0 % and ash 4.0 percent.

**Balasubramaniam and Basu (1955)** gave detailed composition of Khoa as moisture 25.2 %, protein 20.1 %, total solids 74.8 %, lactose 24.9%, fat 25.9 %, ash 4 %, calcium 965 mgs/100 grams of Khoa, phosphorus 6.13 mgs/100 gms of khoa, vitamin A 497 micrograms, riboflavin 406 micrograms, folic acid 360 micrograms and vitamin C 45.6 micrograms per 100 gms of Khoa.

**Ananta Krishan and Srinivasan (1964)** reported the average composition of Khoa prepared from cow milk as moisture 25.6 %, ash 3.7 % and that from buffalo milk, moisture 19.3 %, fat 3.1 %, protein 17.8 %, lactose 22.1 % and ash 3.7 percent.

**De and Srinivas (1967)** studied the average composition of
Khoa prepared under standardized laboratory conditions and reported moisture 25.6%, fat 24.7% and S.N.F. 50.3 percent.

**Dasture and Lakhani (1971)** found that Khoa contained moisture 25.8%, fat 27.2%, protein 19.5% and ash 3.36 percent.

**Ramjan and Rahman (1973)** reported fresh Khoa containing 23.4%, fat 36.2%, S.N.F. and 40.40% moisture.

**Ghodekar et al. (1974)** analysed the market samples of Khoa and reported the composition of Khoa as fat 27.04%, protein 18.99%, Lactose 28.80%, total solids 75.91% and ash 3.70 percent.

**Zariwala et al.** reported the composition as follows.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of samples</th>
<th>Av. moisture (%)</th>
<th>Av. fat (%)</th>
<th>Av. lactose (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>38</td>
<td>25.56</td>
<td>25.80</td>
<td>16.32</td>
</tr>
<tr>
<td>1969</td>
<td>136</td>
<td>28.40</td>
<td>22.40</td>
<td>19.25</td>
</tr>
<tr>
<td>1970</td>
<td>201</td>
<td>29.11</td>
<td>28.44</td>
<td>17.38</td>
</tr>
<tr>
<td>1971</td>
<td>176</td>
<td>26.89</td>
<td>24.92</td>
<td>17.74</td>
</tr>
<tr>
<td>Total</td>
<td>551</td>
<td>28.13</td>
<td>27.14</td>
<td>17.67</td>
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<tr>
<td></td>
<td></td>
<td>± 2.39</td>
<td>± 3.12</td>
<td>± 1.80</td>
</tr>
</tbody>
</table>

**Sharma and Zariwala (1978)** reported the composition of khoa as moisture 9.9-44.8%, fat 12.5-36.0%, protein 19.8-23.3% and lactose 9.88-29.0 percent.

**Rajorhia and Srinivasan (1979)** reviewed the chemical composition of Khoa reported by various workers. There was considerable variation in the chemical quality of Khoa. They reported an aver-
age composition of Khoa as total solids 75.91 %, moisture 24.09 %, fat 27.04 %, protein 18.99 %, lactose 29.09 %, and ash 3.70 percent.

De (1980) analysed laboratory made Khoa for chemical composition from cow and buffalo milk. The values were found to be moisture 25.6 and 19.2 %, fat 25.7 and 37.1 %, protein 19.2 and 17.8 % lactose 25.5 and 22.1 % and ash 3.8 and 3.6 percent, respectively.

Indian Standard Institution (1980) prescribed that there should be fat 37 %, ash 6 % and total solids 65 % of Khoa.

Narian and Singh (1981) collected Khoa samples from different zones of varansi (U.P.) and analysed for chemical composition and compared with that of laboratory made Khoa from cow and buffalo milk. The value for market Khoa were found to be T.S. 68.65%, moisture 2.35%, fat 37.24%, protein 24.76 %, lactose 33.46 % and ash 4.56 percent. For cow milk Khoa the value were found to be total solids 76.85%, moisture 23.15%, fat 34.14 %, protein 23.14 % lactose 35.96 % and ash 4.94 % and for buffalo milk Khoa, the values were total solids 74.98%, moisture 25.02 %, fat 39.44% protein 23.00 % lactose 33.26 % and ash 4.20 percent.

Thompkinson and De (1981) prepared Khoa powder from cow and buffalo milks, analysed for their chemical composition and reported moisture 3.0%, and 2.9 %, fat 31.8 % and 33.9 %, protein 24.1 % and 24.0 %, lactose 31.0 % and 30.9 % and ash 4.9 % and 5.3 % for cow and buffalo milk khoa powder respectively.

Kumar and Srinivasan (1985) studied fresh buffalo milk Khoa in terms of moisture 22.34%, total solids 77.66 %, fat 17.73 %, ash
3.71% and lactose 27.70 percent.

Nasir et al. (1987) studied the composition of fresh market Khoa and found lactose 16.0% and true lactose 15.8 percent.

Ranganathan and Rajorhia (1989) Repotes that free fat content in khoa increased with the increase in fat level irrespective of the kind of milk. Free fat content in buffalo milk Khoa was higher than obtainable from cow milk Khoa at all fat levels. Homogenization of milk reduced the free fat in Khoa samples to about one half free fat content increased with increasing total solids in Khoa. Addition of 20 - 80 glycerol monisterate and sodium citrate separately @ 0.1% by weight of milk prior to Khoa making reduced the free fat in Khoa by about 9-14 percent.

Sharma et al. (1990) found that quality is influenced by various intrinsic and processing parameters. Increasing the fat content improved the acceptability for samples prepared from milk and having fat: S.N.F. ratios of 0.316, 0.549 or 0.659, for other fat S.N.F. ratios, the acceptability was percentage used. Similarly an increase in the holding period (for the period studied) led to a greater acceptibility of the product, in spite of the fact that the colour was seen to shift slightly towards brown. The other two factors studied, homogenization and citric acid addition were seen to reduce the colour development. At the same time, however, there was a poor acceptability of these Khoa samples. from the studies conducted on the manufacture from milk having fat S.N.F.ratios of 0.549-0.659 with a holding at 101-130°C for 10-12 minutes without using additives like citric acid and/or homogenization.
Homogenization leads to a sticky product and addition of citric acid at levels higher than 0.02% result in a sour product, which is undesirable in Khoa.

Prajapati et al. (1991) reported that Khoa having 65% total solids (TS) and 22% fat prepared from either fresh buffalo milk standardized to 50% fat (control, C) or concentrated buffalo milk 40% Ts (C) and 50% TS (C) was kneaded manually with simultaneous mixing of 10% sugar (coarse grade) for dough preparation. No other additive were used during dough making. The total solid content of dough were adjusted to 60 ± 2% to ensure uniform frying without desintegration of balls.

LAL PERA:

A. METHOD OF LAL PERA PREPARATION:

Freshly made Lal Khoa (225 gm) was broken into bits, 75 gms suger (preferably ground) was mixed into it. Contents were put into a Karahi and cooked over a very slow non-smacky fire, stirring with a khunti, crushed cardamam, if desired was added when mixture was ready to form balls when tested. Contents were then poured into a tray and left to cool and set. This Lal Pera was ready to cut in to desired size and shape to serve (De, 1980).

Lal Pera is generally prepared by mixing Khoa and suger in the ratio of 3:1. The Khoa suger mix is heated on a gentle fire till the mixture forms firm balls; and the colour of mix is changed in to red colour. The pan is removed from the fire and nuts and flavouring substance are added. If desired the contents are mixed throughly and made.
in to balls of 15-20 grams size by rolling between the palms after applying a little ghee to avoid sticking.

The product may also be prepared in to different moulds. Some traders also use permitted colours to Lal Pera. Lal Pera is usually packed in paper board cartons having parchment paper liner or grease proof paper liner and sale through confectionery shops. Lal Pera is light red in colour. Kesor (Saffron) pera is one of the preffered pera in which saffron is mixed for added flavor and colour (Dairy India, 1992).

**Parihar (1993)** reported that maximum yield 26.91 % from buffalo milk Khoa and lowest 20.86 % from toned milk Khoa and an overall highest yield from buffalo milk with 45 % suger. Overall maximum body and texture score from buffalo milk khoa having 35% sugar, lowest flavour score in toned milk Khoa, maximum colour and appearance score prepared from buffalo milk Khoa and lowest score from taoned milk Khoa, overall maximum score from buffalo milk 35% sugar, highest sweetness score from buffalo milk Khoa and lowest score from cow milk Khoa, overall maximum score of sweetness from buffalo milk Khoa having 35% sugar, highest overall organoleptic score from buffalo milk Khoa and lowest from toned milk Khoa. Overall maximum score of organoleptic quality from buffalo milk Khoa with 35% sugar.

**QUALITY OF LAL PERA:**

(1) **CHEMICAL QUALITY:**

**Dwarikanath and Srikanta (1977)** reported that Dudh Pera should obtain total solids 88.7% and sucrose 59.4% percent.

**Sharma and Zariwala (1978)** reported the composition of
pela range of the total solids 85.8-95.8 %, fat 7.0-25.0%, protein 1.2-2.1%, lactose 4.0-18.6% and sucrose 13.2-61.8 percent.

Garg et al. (1984) reported chemical composition of pela on the basis of samples analysed after collecting from Hissar market as total solids 95.01%, protein 13.77% and sugar 37.50 percent.

Pal and Gupta (1987) reported the composition of laboratory made Pera as total solids 75.00% and fat 26.00 percent.

Parihar (1993) reported chemical characteristics in Pera as maximum total solids content 87.35% in cow milk Khoa, minimum 85.00% from buffalo milk Khoa, overall highest total solids content from cow milk Khoa having 45% sugar, maximum protein content 15.54% from cow milk Khoa and lowest content 14.25% from buffalo milk Khoa, overall maximum protein from cow milk Khoa, having 25% sugar, maximum lactose content 24.02% from toned milk Khoa, lowest 18.11% made from buffalo milk Khoa, overall maximum lactose content made from toned milk Khoa having 25% sugar, maximum fat content 21.71% from buffalo milk Khoa and the lowest 14.98% from toned milk Khoa with 25% sugar maximum sucrose content 27.58% from toned milk Khoa and minimum content 26.93% made from buffalo milk Khoa, overall maximum sucrose content from toned milk Khoa with 45% sugar, maximum ash content 3.25% made from toned milk Khoa and lowest 2.93% from buffalo milk Khoa, overall highest ash content from toned milk Khoa having 25% sugar level.

MICROBIOLOGICAL QUALITY:

Bhat et al. (1948) reported that plate count of 5 samples ranged
from 1900000 to 56820000/gm with an average of 33664000/gm in the khoa of Bombay market. The plates were incubated at room temperature (28-39°C) and identified for species of moulds namely green, blue coloured Aspergillus spp., a dark green panicillium spp. and black pacytrim. Two species of Actinomycetes namely Actinomyces rutgerensis and varient of this were isolated from Khoa.

Naidu and Ranganathan (1965) examined 35 samples of khoa collected from different Halwai's in Karnal. The total plate count ranged from 1300 to 1500000/gm and coliform were missing which indicated post processing contamination, mainly through handling, and the yeasts and moulds count ranged from 50 to 1000/gm.

Ghodekar (1969) observed that market samples of khoa scoring good (organoleptically) contained minimum bacterial count of 150 million/gm. This was the minimum bacterial count as compared to other milk products containing sweetener.

Sharma et al. (1969) analysed Agra khoa samples and reported the range of coliforms $1.4 \times 10^4$ to $6.5 \times 10^5$/gm and yeasts and moulds count $6.5 \times 10^3$ to $8.0 - 7.8 \times 10^3$/gm.

Kumar et al. (1975) analysed Khoa samples and reported the range of standard plate count as $8 \times 10^5 - 21 \times 10^4$ gm and yeasts and mould count as 10-30/gm.

Ghodekar et al. (1980) reported yeast and moulds in Khoa samples ranged between 30 and 6500/gm. Saccharomyces was the main yeasts followed by Candia and Rhodotorula, while Penicicullium, Aspergillus, Geotricum, Mucor, Syncephalastrum, Fusarium, Rizopus
and Cladosporium were found among moulds.

Indian Standered Institutuin (1980) prescribed that there should be 50 and 90/gm yeast and moulds and coliforms count of Khoa respectively.

Agrawal and srinivasan (1982) reported standard plate count as $2.5 \times 10^6$ to $3.1 \times 10^8$/gm of Khoa samples collected from Banglore market.

Prajapati et al. (1986) reported that cow milk made Khoa mixed with 30, 40 and 50% sugar and stored for 0 and 6 days resulted in total count of $(13.74 \times 10^3, 8.14 \times 10^3$ and $7.29 \times 10^3$/gm) and $(12.99 \times 10^3, 12.10 \times 10^3$ and $16.87 \times 10^3$/gm), respectively. Yeasts and moulds was found to be $(20, 28.33$ and $26.77$/gm) and $(28.33, 55.00$ and $38.33$/gm respectively.

Rao et al. (1986) reported on the basis of analysis of 36 cases of Khoa that 18 samples contained Enteroccoci. The enterococci ranged from 66 to 960/gm of Khoa and the average count was 219/gm of Khoa.

Gautam et al. (1987) found average number of standard plate count to be $51220$, yeasts 5 and moulds 41/gm (the average number of different moulds in Khoa was Aspergillus 32, Alternaria 7, Mucor 2/gm.

Rajmany et al (1989) found that total bacteria in Khoa ranged from $103 \times 10^7$ to $300 \times 10^7$ with an average of $235.9 \times 10^7$/gm.

**KEEPING QUALITY :**

Davis (1940) pointed out that deterioration of Khoa is caused
by bacteria and moulds during its storage.

De and Ray (1953) stated that the addition of sugar during preparation of Khoa might have significant effect on reduction of activity of water.

Naidu et al. (1965) studied the keeping quality of Khoa by storing samples for varying periods at room temperature. It was observed that the product rapidly deteriorated depending upon the period of storage, and the number of organism progressively increased during storage. Mouldy growth was clearly noticeable on the surface and sides of the samples stored for 72 hours. The product became soft and exhibited a sour flavour and flat taste due to an increase in number of lactic acid formers and proteolytic organism.

Kumar (1974) studied Khoa sample packed in Parchament paper and Polythene, it was observed that the sample were acceptable up to 5 days at 37°c and up to 14 days at 8 + 1°c.

Deshmukh et al. (1977) reported that is keeping quality increased with increasing T.S. content. The self life of Khoa containing 70, 80 and 90% T.S. was respectively 4, 6 and 9 days at 30°c, 7, 8 and 15 days at 22°c and 35, 40 and 60 days at 5°c keeping quality was more closely related to yeasts and moulds count than bacterial count.

Jha et al. (1977) studied khoa containing approx. 70% T.S. packed in sterile polythene bags and stored at 5°c. The shelf life of Khoa could be increased up to 10-12 days at 30°c and 40 days at 5°c by adding potassium sorbate. The keeping quality of Khoa was related to microbiological and chemical changes.
Ghodekar and Dudani (1982) inoculated pathogenic strains of E. coli in Khoa stored at 37°C and found that organism multiplied rapidly in the product and remained alive for a longer period i.e., up to more than 22 days.

Prajapati et al. (1986) studied shelf life of Khoa and reported that the shelf life of control Khoa was found to be 3-4 days, while 30, 40 and 50 percent sugar added samples showed 9-10, 12-14 and 15-17 days, respectively.