The Addition of Preservatives to Milk and Butter

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The Addition of Preservatives to Milk & Butter.

At the present day this subject is one of very great importance, the use of preservatives for food being large & general, especially in connection with Milk & Butter. And it is proposed in this thesis to deal with this question entirely as it affects these two important articles of diet.

The chief matters of importance in this subject are:

(1) The effect of these substances used as preservatives on the article of food itself, and

(2) The secondary effects that they may or may not have on the person taking the Milk & Butter containing them.

Upon these two points a great deal rests—vi connection with the present Sale of Food & Drugs Act 1875, & it is
proposed hereinafter to deal with this subject as follows.

1. The preservatives in general use.
2. Effects of these preservatives on the substance preserved.
3. Effects of these substances when taken internally — are they injurious to the consumer in the amounts added to milk & butter.

4. Arguments for & against the use of preservatives for milk & butter.
5. How far does the existing law control or prohibit their use?
6. Proposals as to lines of future legislation.

The Preservatives in General Use.

There are various preservatives in the market, largely advertised as being suitable & harmless when added to milk & butter, to prevent their...
undergoing fermentative changes.
The drugs in common use for this purpose are —

Boracic Acid. v. Borax.
Formaline.
Salicylic Acid. v. Salicylate of Soda.

More rarely —

Benzolic Acid. v. Benzaldehyde of Soda.
Sodium Fluoride.
Potassium Nitrate.
Glycerine.
Potassium Chromate v. Bichromate.

These substances are sold under various names, the most common being —

"Preservin" or "Preservuline".
"Facialite".
"Jack Root".
"Teroglyceride".

These are mostly Boracic Acid or a mixture of this substance with Borax.
F. S. Pished in "Sicuijectioi and
Sicuijectants" quotes Schner as giving
the following commercial names in
common use in Germany for the
sale of Boric Acid as a preservative.
"Berliuhiu"
"Chinisee Preservative Powder"
"Brookman's Salt"
"Australiae Salt"
"Magdeburg Preservative Salt"
"Heydriueh's Salt"

By far the most common preservative
in use at present is the Boric
Acid, or a mixture of this with
Borax. Most of the French, Italian,
and Dutch butchers contain this, so it
is in large use as a butcher pre-
servative in England, especially
during the summer months when
the weather is warm or the produce
does not keep so well.
Latterly, as a preservative for milk,
Formalnlu has been somewhat replacing
the use of Boric Acid etc. in all
probability its use will become still more widespread, owing to the small amount that is required to be added to ensure a milk that will keep for several days.

Salicylic Acid is not of common use for Milk or Butter preservation in this country, but is largely used for preserving jams. In the Feb. 1897 number of "Food & Sanitation" - F. Hill of Birmingham is stated to have examined six samples of jams, and found this acid in no less than five. It is also in common use for Beer & Liqueur.

Potassium Nitrate + Sugar
These are noted by Dr. S. Rickard in "Disinfection & Disinfectants" as being occasionally used for Milk & Butter, but are not of common occurrence, nor is Benzoic Acid or Benzoate of Soda.
Sodium Fluoride has been mentioned as having been employed but is extremely rarely so - as for Pot. Chromate - its use as a preservative is not known in this country - but it has been reported as being used in conjunction with the Bichromate for Milk at Bordeaux. (Revue Scientifique)

Having briefly enumerated the chief preservatives used and their relative frequency, we will now pass on to consider the

Effect of these Preservatives on the articles - Milk & Butter.

Before proceeding to consider each substance in this respect, we must briefly refer to the changes which
Milk undergoes after it has been drawn from the cow is left to stand a variable time.

Milk as it is obtained from the cow under ordinary circumstances contains a large number of Bacteria - the number depending upon the care with which the milk is handled & upon the cleanliness of the udder of the cow, cowshed, & dairy. - & also upon the purity of the water with which the udder has been cleansed.

It is possible has been accomplished (Dr. Geo. Newman - King's College, London) to obtain the milk from a cow in a perfectly sterile condition, containing no bacteria, but under ordinary circumstances their presence to some extent is inevitable, & it is to these Bacteria that we have to look for the cause of milk souring.

When milk is fresh it is amphoteric in reaction - i.e. it bears red
litoses blue, it blue red, but upon standing it becomes slightly acid from fermentative change due to a Bacillus - the Bacillus Acidi Lacticici. The milk sugar is decomposed resulting in the formation of Lactic acid, this causes the milk to become sour, the sourer the milk, the more Lactic Acid.

The period of time that milk will remain sweet depends very largely on the cleanness of all things used in its manipulation, also on the free ventilation, absence of drain or sewage effluvia, also upon the temperature - it keeping fresh very much longer at a low temperature - so for this reason that at a low temperature the bacteria do not grow or multiply.

To some extent good milk is judged by the time it will remain sweet, according to Schadehmann - if kept at 40° C. for twelve hours coagulation occurs.
In that time, it is to some extent defective.
The curdling of milk is brought about by ferments even in the absence of an acid reaction.
The most well known ferments is Rennet, obtained from the stomach of the calf; but
Neuweebe (Deutsche Mediz. Wochenschr. pp. 48, 49.) point out that such
ferments are conveyed by way of different bacteria, so the process
of curdling is divided by
Purige (Journal of Physiologist, pp. 464.)
into two stages -
1st. The casein is decomposed into one or more products,
2nd. These products are precipitated by the lime salts in the milk.
The change in the casein is delayed by low temperature, is stopped by
alkalies, - hence the action of cold in preserving milk. - The
action of Borax referred to later.
Besides ordinary souring, milk is subject to various other conditions varying from normal, all having a common cause - bacteria of one sort or another. These conditions are known as "milk diseases", examples of these are:

The "Storngy Milk" - caused by the Micrococcus Viscosus.
The "Blue Milk" - caused by the Bac. Lactis Cyanogenus.
The "Red Milk" - caused by the Bac. Lactis Btythrogenus.
The "Yellow Milk" - caused by the Bac. Synxanthus.
The "Beetle Milk" - caused by the Bac. of Bleisch.
The "Soapy Milk" - caused by the Bac. Lactis Saponacei of Weigman "Zion.

The sour tarte of milk undergoing fermentation is, as mentioned above, proportional to the amount of
Sorbic Acid present.

Messrs. Pearson & Moor - "Analysis of Food & Drugs" Part I. - state that 4% Lactic Acid is distinctly recognisable by taste, 6% Lactic Acid is accompanied by curdling - the fatty & protein matter separating in the curd, the whey being a solution of milk sugar & salts.

Thus then we have briefly reviewed the change that Milk undergoes in keeping, we have found that they are due to Bacteria. That gives a Milk without Bacteria, i.e. Sterile, it will keep so if kept free of organisms. Inhibit the growth of these organisms by any means, i.e. the length of time the milk will remain sweet will be prolonged. - e.g. by cold.

What now is the action of these various preservatives?

They are all with the exception
of sod. carbunali & bicarbonati antibiotics, as such, i.e., they do not destroy the bacteria, at any rate in the strength in which they are used, but merely inhibit their growth and development.

From the table given below, it is confirmed by Koch (taken from "Methodica Medicinae Therapeuticae" by T. Lauder Brunton), the relative powers of two drugs which concern us as seen - beneath these is added those of formalin after D. J. Ruigoun of United States Marine Hospital Service. Also the results published in Lancet April 21, 1894 by Dr. S. Ricebak & Chas. Slater...
<table>
<thead>
<tr>
<th></th>
<th>Prevent Development Bacteria</th>
<th>Prevent, Reproduce, Undevelop Bacteria</th>
<th>Hill Developed Bacteria</th>
<th>Prevent, develop, of spores in boiled meal infusion</th>
<th>Ditto wi unboiled meal infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzolic Acid</td>
<td>1 ml 2867.</td>
<td>1 ml 50.</td>
<td>1 ml 410.</td>
<td>1 ml 2877.</td>
<td>1 ml 1439.</td>
</tr>
<tr>
<td>Salicylic Acid</td>
<td>1 ml 1003.</td>
<td>1 ml 343.</td>
<td>1 ml 60.</td>
<td>1 ml 3003.</td>
<td>1 ml 1121.</td>
</tr>
</tbody>
</table>

**St. Hygiene**

| Formic Aldehyde | 1 ml 40,000 | 1 ml 2000 |

**St. Radical Stator**

| Formic Aldehyde | 1 ml 20,000 | Prevent development of Bact. Lactius | Bac. Bulguires. |
From this table Formic Aldehyde is seen to be a very great deal more powerful than either Benzoic or Salicylic Acid; and were the other antiseptic substances quoted in this table, they would all be found of very inferior strength to Formic Aldehyde.

For full information as to their relative powers in the preservation of milk, turn to the table given on the next page, quoted from R. T. Thomson, F.I.C., given in "Food & Sanitation" Jan. 1898.

From this table it is readily seen that Formaldehyde, which is a 2.07% solution of Formic Aldehyde gas, is by far the most powerful of all the substances used to preserve milk. The amounts in grains per gallon experimented with, Mr. Thomson says he chose, because they are about what one meets with in the every day use of these drugs as preservatives, Formaldehyde as used by the dairymen.
<table>
<thead>
<tr>
<th>Pure Milk</th>
<th>Turned</th>
<th>Slightly Sour</th>
<th>Sour</th>
<th>Sour + Curdled</th>
<th>Toluic Acid %</th>
<th>Toluic Acid %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formic Acid</td>
<td>8.75 grs.</td>
<td>0.45%</td>
<td>Sweet</td>
<td>Sweet</td>
<td>Sweet</td>
<td>6.8</td>
</tr>
<tr>
<td>Formalin 40% Sol.</td>
<td>17.5 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
</tr>
<tr>
<td>&quot;</td>
<td>35 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>10</td>
</tr>
<tr>
<td>Boric Acid</td>
<td>35 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Turned Sour + Curdled</td>
<td>4.2</td>
</tr>
<tr>
<td>Boric Acid + Borax</td>
<td>35 grs.</td>
<td>0.25%</td>
<td>Sweet</td>
<td>Sweet</td>
<td>Sweet</td>
<td>2.6</td>
</tr>
<tr>
<td>Salicylic Acid</td>
<td>17.5 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Turned Sour</td>
<td>10</td>
</tr>
<tr>
<td>&quot;</td>
<td>35 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sweet</td>
<td>10</td>
</tr>
<tr>
<td>&quot;</td>
<td>35 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Slightly Soured</td>
<td>4.6</td>
</tr>
<tr>
<td>Benzolic Acid</td>
<td>17.5 grs.</td>
<td>0.25%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sour</td>
<td>3.1</td>
</tr>
<tr>
<td>Soda, Fluoride</td>
<td>35 grs.</td>
<td>0.05%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sour</td>
<td>2.3</td>
</tr>
<tr>
<td>Borax</td>
<td>35 grs.</td>
<td>0.05%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sour on 2d Day</td>
<td>31</td>
</tr>
<tr>
<td>Boring of Soda</td>
<td>35 grs.</td>
<td>0.05%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sour</td>
<td>2.3</td>
</tr>
<tr>
<td>Soda Carbonate</td>
<td>35 grs.</td>
<td>0.05%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Sour</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Note: The Samples of Milk were kept at 30°F. with a variation of not more than 5°F. above or below, during the whole time.
As a solution of five oranges pure Formalin (Formic Aldehyde ZII) to 1 gallon of water. Of this, ten oranges are added to a churn of about seventeen gallons, so making the Strength of Formalin to the Milk 1 in 8704 - approximately 0.05 gos per gallon or of pure Formic Aldehyde 1 in 21,760. Referring to the table on p. 13, we see that a strength of 1 in 40,000 will arrest the development of Bacteria. As we read by Mr. Thomson’s Table that this strength of Formalin will keep milk sweet for seven days or even eight, the amount of Lactic Acid present on the eighth day being unappreciable.

Messrs. Notter & Forth ("Hygiene & Public Health") state that one gallon of the diluted Formalin as above is equal to rolls of Preservative Powder (containing 75% Boric Acid & 25% Borax).

This amount of Formalin in milk

unparts no taste or smell to the
milk, even after boiling. Little is known of the modes of action of this powerful antiseptic, but, in the current number of Sajou’s Medical Annual, Bardet states that it hardens nitrogeneous substances of the nature of gelatine so fixed become insoluble even in boiling water. This action he says may explain the antiseptic action of Formalin, which may in this way fix the chitinious envelope of bacterial spores, rendering them incapable of vital changes. Whether this is so or not can scarcely be said to be at present proved.

That Formalin has some effect upon the eural formation has been shown by Messrs. J. Weight and S. Merkel - I will be referred to in considering whether Formalin is misipirous or not to the consumer.
First let Formalin as a milk preservative according to Mr. Thomson's table comes Salicylic Acid 35.3 grs to the gallon a mixture of Boric Acid + Borax 17.5 grains of each to the gallon.

It is seen from the table that these substances used in these amounts keep milk sweet for just about the same time as Formalin 8.75 grs per gallon does, viz. 7-8 days.

It will also be observed that neither Boric Acid alone nor Borax alone have nearly such a preservative power as a mixture of these two substances, - milk with pure Boric Acid 35 grs per gallon becoming "burned" in six days, is sour & curdled on the seventh day, - while with a similar amount of Borax, the milk kept sweet only for four days, becoming sour on the fifth. Hence the Boric Acid preservatives sold are usually mixtures of Boric Acid with Borax.
From some other investigations by R. T. Thomson quoted in "Food & Sanitation" Jan 1898 the following table of the relative proportion of these two substances as they are used was obtained.

<table>
<thead>
<tr>
<th>Borax</th>
<th>Boric Acid</th>
<th>Water</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na₂B₄O₇</td>
<td>H₃B₃O₉</td>
<td>H₂O</td>
<td>P₂O₅</td>
</tr>
<tr>
<td>15.15</td>
<td>75.3</td>
<td>7.35</td>
<td>5.31</td>
</tr>
<tr>
<td>23.80</td>
<td>75.2</td>
<td>1.0</td>
<td>59.2</td>
</tr>
<tr>
<td>4.1</td>
<td>91.9</td>
<td>4.0</td>
<td>33.7</td>
</tr>
<tr>
<td>12.0</td>
<td>84.1</td>
<td>3.9</td>
<td>55.8</td>
</tr>
<tr>
<td>24.0</td>
<td>77.0</td>
<td>1.0</td>
<td>59.0</td>
</tr>
<tr>
<td>7.6</td>
<td>91.5</td>
<td>.9</td>
<td>56.9</td>
</tr>
<tr>
<td>0.0</td>
<td>104.3</td>
<td>0.0</td>
<td>56.6</td>
</tr>
<tr>
<td>23.4</td>
<td>74.6</td>
<td>2.0</td>
<td>58.3</td>
</tr>
<tr>
<td>26.8</td>
<td>70.0</td>
<td>3.2</td>
<td>57.6</td>
</tr>
</tbody>
</table>

Average 56.6.

Borax is considerably cheaper than Boracic Acid & this may account to some extent for its being used so largely. Boroglyceride which is sold a
good deal is a mixture of Boric Acid, 62 parts, v. Glycerite, 92 parts.

Dr. Hill of Birmingham, who has examined a great number of Milk samples, states that out of 361 samples examined by him 30 contained Boric Acid or Borax, in some of the samples he found it present in the following amounts:

<table>
<thead>
<tr>
<th>Amount (g)</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>6</td>
</tr>
<tr>
<td>60</td>
<td>35</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

In London some analyses were carried out by Mr. Chas. P. Cassatt, for the British Medical Journal Special Commission on Antiepilepsia in Food in the summer of 1895. The first report was as follows.
Of 30 samples of Milk 10 contained Boracic Acid or Borax = 33.3%.  

The report then states:

Of 20 samples of Milk 3 were found to contain Boracic Acid or Borax = 15%.  


Thus it is seen that the practice of adding this substance to milk is fairly common, and in all probability more common now even than it was 3 years ago.

The addition of Boric Acid or Borax to Butter is perhaps more common than to Milk. The butchers of the Cork Butter Market have recommended that 1/2 lb of salt + 1/2 lb of preservative be added to each 56 lbs of Butter, i.e., 62 1/2 gms of preservative to each pound of Butter - the preservative used probably being half Boracic Acid or half Borax.

At the Tynewiddel case Jan. 1898, the question was raised as to how much Boracic Acid good butter could dissolve. Butter should not
contain more than 12-15 %, or at
most 16 % of water. It was stated
by Mr. Sayler Public Analyst for
Gloucester that such Butter could
not dissolve more than 5 % of yeare
Boracic Acid so that the excess was
remained in crystalline form so that
in such a condition it would have
no preservative power. However it
was shown by Mr. Douglas of a
firm of preservative manufacturers
that a Preservative as sold is prepared
in such a way that it is 3½ times
more soluble than pure Boracic
Acid so that 1 lb of Butter containing
12-18 % of water would be able to
dissolve 12 2½ grs of Preservative.

Normandy Butter generally containis
23-24 grs per lb. All Brittany
Butters generally contain Preservative.

Mr. Otto Hehner F.I.C. in "Food +
Sanitation" March 12, 1898 states that
he has found that butter to
contain from .5 to 1 % of Boracic
Acid, but this is higher than
most other authorities give as the usual amount. In the "Analyst"
Sec. 1870 Mr. Nehmer gives the results of some analyses made by him —
Boracic Acid: 0.9:11 · 0.9:14 · 0.26 · 0.11
Borax: 0.19 · 0.16 · 0.15 · 0.23 · 0.33 · 0.53
S. Stevenson of the Home Office states that he has never in his
series of analyses found it in greater
amount than .5-.65%.

To milk the amount which is
usually added is 15 · 10% or 5½ gos to the
pint (S. Stevenson), ½ to cream
generally double this amount is
added. According to Lazarus
(Leitz v. Hygiene) milk can only be
preserved by Boracic Acid if the
quantity added exceeds that which
can be used without altering the
taste. This may be true as regards
preservation for long periods of
time, but 8½ gos per pint, which is
sufficient to preserve milk long
enough for the dairymen's or retailer's
purpose, cannot be detected by
Lately, Mr. R. P. Thomson states that he has found as a rule about 3.5 gals per gallon is in condensed milk to which it is also frequently added, as much as 1.05 gals per gallon.

**Salicylic Acid** which need in the strength of 3.5 gals per gallon is about equal in preserving power to Formalin 8.75 gals per gallon, but is not much need in this country for the preservation of milk. It is much more powerful than either Borax or Boric Acid need alone. But it is about on a par with the mixture of these two substances. There are two forms of this acid in use, viz.:

- **Natural Salicylic Acid** prepared from the willow tree.
- **Artificial Salicylic Acid** prepared from Carbolic Acid.

T. Hill of Birmingham examined 27 samples of various foods in one month and found one contained this acid. It is largely used in preserving jams, beer & cider. J. R. Ridley ("Disinfection & Disinfectants") states that it is used in this country for the preservation of butter under the name of "Lactacidium" which he says consists of:

- 2.65% Lactic Acid
- 38% Salicylic Acid

with a little Sugar & Glycerine added.

It is stated that this substance may be removed by washing before using the butter, but it is difficult to believe that all the Salicylic Acid could be removed except by the most careful washing such as anyone but one accustomed to work with Butter would be very unlikely to perform satisfactorily.

In "Landw. Veruche Nut." H. Portile states that "Salicylic Acid cannot be considered a success as
a preservative for either Butter or Milk as it gives to these an unpleasing sweetish odour which increases until decomposition takes place.

Of the less frequently used preservatives, Bengoite Acid is the most powerful. From Mr. R. T. Thomson's table it is seen that Bengoite Acid in the strength of 17.5 grs per gallon keeps Milk fresh for 4-5 days, but that on the sixth day it was slightly "burned". Bengoite of Soda is apparently not so powerful as the Milk became decidedly sour on the sixth day with 35 grs added to the gallon. Crystals of Bengoite Acid have a pungent aromatic odour s cannot be employed in large quantities on this account, so therefore it is not much used as a preservative.

Sodium Carbonate is sometimes added to Milk, but from Mr. Thomson's
Table it is seen to have very little effect; 35 gos per gallon only keeping the milk fresh for 3 days, it becoming sour on the 4th day. Sodium Carbouale has no aseptic power so therefore does not prevent the formation of Lactic Acid, but combines with the acid, delaying the recognition of sourness in the milk for a short time in hardening coagulation.

Sodium Bicarbouale is sometimes added to milk and acts on a similar way to the above.

Bichromale of Potash has never been found in milk or butter in this country, but M. Deugès reports in the "Revue Scientifique" that at Bordeaux he obtained three powders which were to be used for milk preservation. He analyzed them. He found that two consisted of Neutral Potassium Chromate, one third of 2 parts Pot. Chromate 1 part
Pot Bichromate. The amount added to the milk was 5,80s to the quart. He says they are powerful antiseptics and retard Lactic Acid fermentation, especially, but are most deleterious on the consumer. M. Demigès says that the retailers at Bordeaux use this to the extent of 2 grams to 30 litres of milk.

J. Froidevaux in the Jour. Pharm. Chem. 1896 - Analyt. Nov. 1896 - says the amount is quite inadequate. By his own experiments he has come to the conclusion that "2 grams per litre is necessary to preserve milk for an appreciable time, an amount which gives to the milk an evil taste and absolutely abnormal colour."

Sodium Fluoride is said to have been occasionally added to milk, but it is so rare in this or any other country that it need only be mentioned.
By referring to Mr. Thomson's table it is seen to have but weak preservative power - 35 grains per gallon keeping the milk fresh only for 4 days - it becoming sour on the fifth day.

We will now pass on to consider
(a) The effects which these substances have when taken internally,
(b) The important question, Are they likely to injuriously affect the health of the consumer when taken in the amount's added to Milk & Butter?

Boracic Acid & Borax. As being the most generally used we will consider these substances first, to avoid repetition as they are commonly used together as their effects are so alike, they will be considered together. Boracic Acid has been shown to inhibit the growth of Bacteria. In
the Alimentary Canal there are
normally many Bacteria; their
formation is imperfectly known,
yet surely they play an important
part in the economy of the human
organism. The constant taking of
an antiseptic must necessarily inhibit
the growth & activity of these organism
to some extent... to this action
of Boracic Acid possibly some of the
following effects may be due.
Boracic Acid is a drug that is not
used a great deal internally, what
is known of its action when so
taken has been chiefly gathered
from noting its effects when given
for Bladder affections. The same
may be said of Borax, but in
addition it has been given for
speaking of the use of Borax in
Epilepsy, says it is far more
dangerous than Bromides.
Intestinal effects are those most
often seen, occasionally the first
dose has caused nausea & vomiting. It goes on to say that sometimes there is loss of appetite, a sense of heat & weight in the epigastrium with nausea & vomiting, & pains in the temples. It produces a dryness of the skin & mucous membrane, the lips & tongue are reddened & deuced of epithelium, the lips & angles of the mouth are fissured & the conjunctive injected. Various skin eruptions have been observed following upon its use in France; notably Pemexa, Seborrhoea, & Seborrhoeic Acne. Graves has noticed vomiting & diarrhoea. Psoriasis caused even by small doses.

Cachexia & emaciation with oedema of the face & extremities are often present with these eruptions, or swelling of the eyelids, face, & extremities without any other symptoms. The urine will then be found loaded with albumen.

Ernest Reynolds of Down's Hospital
Manchester, (New Book of Treatment 1896) mentions a case of his in which the kidney trouble was very pronounced. in which the cessation of the drug failed to arrest the symptoms, owing probably to the early elimination. the patient died in coma.

Robert's (Scherbüh der Intoxikationen) says that cases of slight poisoning have occurred after the administration of Boracic Acid, occasionally death. The effects produced being: Irritation of the gastro-intestinal canal - Decomposition of the blood - Irritation of the nervous system. In large doses: Diarrhoea, Vomiting, Weakness of the heart muscle, Purpura.

Dr. L. C. Duncan in the 'Agricultural Students' Gazette 1896' stated that 1-2-3 grains of Boracic Acid in very dilute solution can be taken well, but that in a concentrated form it produces diarrhoea and violent gastric pain. Rabbits & dogs fed on 5 grains or 1-2 grains in 20-30 grains of water
Because unwell in a few days, with diarrhea, satiety, emaciation, in some cases a fatal result ensued.

Professor Katterer, experimenting upon dogs, gave 8 grains daily to a dog and found that it caused diarrhea and other symptoms of disturbed digestion.

Sometime ago the writer had under his care a man suffering from cystitis. He was aged 48-50. Boric Acid was ordered three times daily; but the patient was unable to take it as it caused violent vomiting, epigastric pain.

Dr. Forster, with Schleuker, have shown that 7½-45 grs of Boric Acid added daily to human food increases the secretion of bile, the excretion of albuminous matters, and induces very markedly the digestion of albumen. This was determined by analyses of the excreta.

Forster states that decomposition of albumen in animals is increased by Borsic acid.

(S. Roëtel, "Disinfektion des Disinfektions")
Besides these effects, T. Lauder Brunton in his "Therapeutics" states that Boric Acid stimulates the uterus to contract, and should therefore be given with great care during pregnancy.

Dr. Golding Braid agrees with this, stating that owing to this action of Boric Acid he has seen the internal administration of Borax cause abortion in two instances.

In the Dietetic 

Hygienic 

Gazette 

Feb. 1893

there is a notice of some experiments by C. T. Fox, Ohio, showing that the presence of Borax in food notably retards the action of the saliva in starch. This conclusion is confirmed by Prof. R. S. Chittenden, who extended his observations to the gastric 

pancreatic juices, with the result that he states that Borax in an alkaline or neutral pancreatic juice increases the digestive action of the fluid upon albuminous
substances. As regards the effect of gastric digestion, he found that moderate amounts of Boric Acid increased the activity of the ferment, while large amounts checked it. In the table given below the strengths of three drugs used as food preservatives, necessary to check the action of the Pijallic, Pepzonic, and Pancreatic ferments are seen. (Taken from table by Wernitz in "Therapeutics" by T. Sænder Brønden.)

<table>
<thead>
<tr>
<th>Substance</th>
<th>1 mi.</th>
<th>2 mi.</th>
<th>3 mi.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salicylic Acid</td>
<td>1250</td>
<td>250</td>
<td>9000</td>
</tr>
<tr>
<td>Benzoic Acid</td>
<td>2600</td>
<td>200</td>
<td>2600</td>
</tr>
<tr>
<td>Borax</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In R. A. Cripps F.I.C. published in the "Analyzet" July 1897 some experiments made by him on the action of...
Boric Acid on the digestive ferments.

In giving the results Mr. Cripps stated that "In so far as the processes of digestion in a living person are represented by such experiments in glass vessels, such processes are not influenced by the employment of Boric Acid in quantity considerably in excess of that necessary for preservation of food."

Mr. Otto Hehner also made some experiments in peptic digestion with similar results - the digestive action was not in any way retarded by the addition of Boric Acid.

Boric Acid is eliminated from the system mainly by the urine, it is said by Max Holzer to increase the elimination of urea. It reduces the acidity of the urine, increases the amount of urine passed. It is also eliminated by the saliva, sweat, and fascia.

F. F. R. Shoemaker of Philadelphia, "Malaria Medicina v Therapeutics," states
that the disadvantages of the
prolonged administration of
Boracic Acid are - Salivation,
Impairment of appetite & digestion,
Fissures, Emaciation, Swelling of
the face & oedema of the lower
extremities, Petechious rashes,
Conjunctivitis, Fissures of the lips,
Fall of the hair, & Alteration in
the urine.

In the "Savent" 1876 vol 1, S. F. J. Allen
of Mason College, Birmingham, refers
to the effect which Borax has upon
the curdling of milk & suggests a
way in which it may affect the
health. He says that

1. 36 grains of Borax added to 1 pt
of milk prevents curdling by rennet.
2. The addition of a little Calcium
Chloride before or after the addition
of the rennet, restores the curdling
power to the milk.
3. Boric Acid added does not delay
the curdling but rather accelerates it.

He goes on to say that if Borax
removes Calcium from the scene of action, not only the curdling function will suffer, but also many other functions of the body in which Calcium is needed; and, he says, even if the alkali of Borax is the only retainer of the curdling, it is not desirable to neutralise the gastric juice by its use.

To sum up then, what may be briefly stated to be the action or effect of Boracic Acid or Borax taken internally?

There is a consensus of opinion that their main effect is irritation of the gastro-jejunal tract, producing diarrhea or vomiting.

Possibly they interfere with Salivary digestion, but, according to laboratory experiments, in moderate amounts they do not interfere with Pepthic or Pancreatic digestion, but rather aid them.

They are said to decompose the blood's produce skin eruption.
They increase the secretion of urine & elimination of uric - reduce acidity of urine, sometimes cause albuminuria.

They have a decided oxytocic action, e.g. Borax that of an enemenaque (Safe White).
Borax may affect health by removing Calcium from its milk.

It is now fit to ask - what are the effects on the consumer of
milk or Butter containing Boracic Acid or Borax? In other words -
are these drugs present in these foods in sufficient quantity to
produce any of these effects on the consumer?

We will consider the first one relative to Milk.

Boracic Acid is a weak acid & its dilute solution is almost tasteless.
The British Pharmacopoeial dose is
given as 5-30 grs for an adult; we may conclude that 2-3 grs would
probably be generally accepted as
the maximum dose for infants
under 1 year. Allowing that this
dose may be taken three daily,
that will give a maximum of
b. q. g. s. for an infant of 0-1 year.
Are these amounts exceeded when
milk is given to an infant? If so,
is it not injurious to give
milk to such, containing such an
excessive amount of these drugs?

Evidence of a decisive
character as to whether the amount
of Boric Acid which would be
taken in Milk is injurious or not,
is difficult to obtain, it will
be well paid to notice the position
taken hitherto by the Local
Government Board & the Select
Committee on Food Products & their
adulterations. In 1879-81 the Local
Government Board in their report stated-
"There is no doubt that Boric
Acid, if taken in large quantities,
would be injurious to health,
but we have not sufficient
information to show whether such minute amounts as are generally added as preservatives could be regarded as having that effect, or more exact information is wanted before it can be decided whether a process, which prima facie may be regarded as intended to prevent the loss of valuable food, should be prohibited by law.

In July 1898 the Select Committee of the House of Commons, appointed to inquire into the viability of laws relating to food adulteration, presented their report—but, though they examined several witnesses on the subject of antiseptics in food for the purpose of preservation thereof, they did not commit themselves to any definite opinion. In the report they state—

"Your Committee think that
the matter is one which deserves further investigation by recognized scientific authorities, with the view to an expression of an opinion which would be regarded as authoritative.

In 1897 the Editors of the "Lancet" addressed a letter to the leading members of the medical profession in which they asked the following questions:

1. Is the presence of small quantities of Boriæ, Benzoe or Salicylic acids, or of "Formalin" in food, in sufficient quantities to preserve it, injurious to health?

2. Should the use of antiseptics for this purpose be forbidden by law altogether?

3. Should legislation be brought to bear on the restriction of the amount?

4. Should the law require that when preservatives are used the
fact should be stated on the label?"

With the first only, of these questions are we now concerned. In reply Sir Henry Thompson wrote that: He had long held that the addition of antiseptics was undesirable; though unable to produce evidence that any one of these had given rise to deleterious action owing to the impossibility of isolating the precise influence of the drug. He strongly objected to the dietary use of drugs.

Sir Pavy wrote that: He did not consider our knowledge sufficiently extended to permit of its being taken for granted that no injury is producible, though there is no evidence of injury to health.

Dr. J. Allen pointed out that: The possibility of daily accumulation...
of antiseptics sufficient to produce a gradual lowering of the health standard.

Dr. Sims Woodhead draws attention to the ignorance's cumulative effect, to our ignorance of the action of certain drugs upon food. He pointed out that by the use of preservatives food of superior quality might be declined.

Sir W. Roberts wrote that:

There was no reliable information available, so an inquiry was needed.

Dr. T. Laidler Brunton wrote that:

Poisons produced by commencing decomposition of food were more injurious than the antiseptics in the food.

Sir B. W. Richardson wrote that:

Antiseptics in his opinion were not only necessary, but that where used in proper form a quantity, cause no injury whatever.
Now these opinions are interesting, but it is noteworthy that none of them are based upon actual experience of the drugs in question. It seems to be an almost complete absence of any evidence of this kind.

Dr. Walford (Mr. D. H. Cardiff Borough), who this year issued a report upon the subject, makes a statement to the same effect. But can nothing more definite be said than this?

Let us answer one of the questions asked above, viz., Is the maximum dose (6-2 grains per ounce) not exceeded when an infant is reared artificially on cow's milk, containing Boracic Acid or Borax as a preservative?

The results of some analyses by Dr. Hill of Birmingham, referred to on a previous page, show that in one sample he found as much as 70 grains per gallon, in another 689 grains per gallon; this means 8\(\frac{3}{4}\) grains per pint or 77\(\frac{3}{4}\) grains per pint. It may be said that
These two amounts are in excess of what is usually added, but at the Sydenham case (Jan. 1848), which will be referred to later, Dr. Stevenson stated that the usual amount added to milk was '1/4', which is 8 3/4 gms per pint.

Below is given a table largely used for the artificial feeding of infants. It is given in "Our Babies" by Mrs. Langton Brewer (Diplomate Obstetrical Soc). To this is added total milk per diet is the amount of Boracic Acid which would be taken per diet in case of milk preserved with '1/4'.

<table>
<thead>
<tr>
<th>Age</th>
<th>Meals</th>
<th>Low's Milk</th>
<th>Total Milk</th>
<th>Amount of Born Acid gas per child (1% added)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>10</td>
<td>½ oz</td>
<td>5½ oz</td>
<td>2·18 gas.</td>
</tr>
<tr>
<td>1 month</td>
<td>9</td>
<td>1½ oz</td>
<td>13½ oz</td>
<td>5·9”</td>
</tr>
<tr>
<td>2 months</td>
<td>8</td>
<td>3 oz</td>
<td>24 oz</td>
<td>10·5”</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>3½ oz</td>
<td>28 oz</td>
<td>12·25”</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>4 oz</td>
<td>32 oz</td>
<td>14”</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>5 oz</td>
<td>35 oz</td>
<td>15·31”</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>6 oz</td>
<td>42 oz</td>
<td>18·37”</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>7 oz</td>
<td>49 oz</td>
<td>21·43”</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>8 oz</td>
<td>56 oz</td>
<td>24·5”</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>9 or 10</td>
<td>64-60 oz</td>
<td>26·26”</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>9 or 10</td>
<td>54-60 oz</td>
<td>26·25”</td>
</tr>
</tbody>
</table>
It will be seen from this table that a child of six months would have given it one-twelfth the full pharmaceutical dose for a child of one year old; and a child of six months almost three times its full dose. Surely no one will dare to say that such large amounts may not be injurious, so it seems that the fact that these drugs are capable of producing the results given above, sometimes by even small doses, should be sufficient to condemn the use of these substances for milk—especially as so much milk is taken by large numbers of children, to a great many of whom it is their only food. Yet we give no evidence before the Select Committee of the House of Commons on food adulteration.

Mr. J. Preston Thomas, formerly in charge of the Department of the Local Government Board which deals with the administration of the Sale of Food and Drugs Act, stated that...
"The Board had no evidence as to actual injury to health having been caused by the use of antiseptics or food," and that "insignificant" amounts of the preservatives are used.

Infinitesimal amounts! Surely 2½ grs per annum to a child of 10 months can scarcely be termed an infinitesimal amount of a drug the dose of which for an adult is 5-30 grms.

S. Williams, M.D. N. for Glamorgan County Council, stated at the Tynefield case, at which he gave evidence, that it was his opinion that such drugs as these should not be given except under medical advice. Mr. C. T. Mackenzie, likewise called to give evidence at this prosecution, stated that he had seen Boracic Acid produce constitutional irritation & eczema, especially in young children & invalids, & he entirely agreed with S. Williams that such drugs should be given only under medical advice. Mr. Geo. Riddel Thomson stated at this case also that he had taken
5 grains of Boracic Acid daily, half an hour after breakfast, so that it produced its effect on the fifth day. On the 7th and 8th days he took the same amount after lunch instead of breakfast, with the same effect, this he attributed to irritation of the stomach. If 5 grs per os cause nausea and symptoms in a healthy adult man, it seems almost certain that 24-25 grs will often affect a child of 10 months vigorously.

Sir Andrew Clark's opinion was:

"That the continuous forced consumption of this drug in milk and butter cannot fail to be without effect; possibly to its dose may be laid a good deal of the obscure dyspepsia met with nowadays."

Sir Walter Blyth agrees with this opinion, and also includes the amelioration of coal tar colouring matters used, as possibly interfering with digestion.

Sir Henry Thompson gives it as his opinion that milk containing 8-10 grs
per pint would not be injurious to an adult taking 1 pint daily; but to children it might be, so he says. It would certainly be injurious to children under 3-4 years who took this amount daily. Surely then such a valuable and wholesome article of good for both adults & children should not be tampered with or anyway to render it possibly injurious.

Now though .1% is the usual amount added to milk, sometimes a good deal more than this is put in.

On the 22nd July 1897 at Bury Police Court, Wm. Bluer & John Connor were prosecuted for selling milk adulterated with Boracic Acid to the extent of .37%, or 26.25 pps per pint. It was held that this quantity constituted "Adulteration" i.e. a price of 40% costs was imposed upon each. ("Food & Sanitation" July 1897).

This case shows how much may be added - this amount was quite unnecessary to preserve it, yet how
often in all probability will milk contain a larger amount than 1 per cent. by the time it reaches the consumer. The cowkeeper adds preservative - the retailer adds preservative, sometimes the cook adds preservative as in case given below. In the case of milk with 3% a child of 14 months would be taking 98% of his per diem, surely sufficient to cause violent vomiting & purging. v it seems not at all unlikely that many cases in which the milk apparently cannot be made to agree with the child, the real cause was to be found in the presence of Boric Acid in the milk.

From the amount then of Boracic Acid + Borax which would daily be taken in milk to which it has been added, - it seems practically certain that there is great risk of its having an injurious effect. But can no evidence of actual injury done be brought forward?
Messrs Vigier, Ogilvey & Calwell hold that no bad effects follow on its being taken internally. Dr. Ogilvey's three premises each took a 4th of a lb of Borax in a mouth, i.e. fully 35 grs daily, profess to have suffered no ill effects. This may be quite true, but the fact that a healthy adult can take 35 grs a day, is no argument to prove the innocuousness of the same amount given to an invalid or an infant of 10 months old.

Mr. Arthur Robottom, manufacturer of Borax, stated that he had taken a piece of Borax the size of a pea each day for 40 years. This he may have done, he has suffered no ill effects, but Mr. Robottom is a manufacturer of Borax, i.e. not an infant of 10 months, nor a delicate invalid who may be ordered largely a milk diet.

A case is reported by Johnsson in which the ingestion of 3.6 grams of Boracic Acid produced headache,
fever, erythema, rash, papules, bullae, conjunctival injection. Dr. Lemoine (Targ. Med. Paris 1890) reports four cases of poisoning from Boracic Acid used in surgical dressings. He explained these by the fact that all four patients were suffering from affection of the kidneys, which allowed the drug to accumulate.

Dr. S. Rideal (Disinfectors's Disinfectants) mentions that a pupil of Dr. Forster's took 1.6 grams daily with his food, this produced disturbed digestion. Emmerich, quoted in the Analyst 1888, p.24, states that Boracic Acid is much used in Sweden for the preservation of Fish, & Milk, but cases of poisoning from its use have occurred in that country. Long continued use of the acid is not favourable to good health, so at all events its addition to Milk should be prohibited.

An important case of poisoning by Boracic Acid is reported by Dr. Robinson.
(From O. N. for Last Fleet. British Medical Journal Dec. 4th 1896). Dr. Robinson was called in to investigate a sudden illness which broke out in a religious house, the inmates of which were—five sisters, cook, and housemaid. The five sisters were all attacked within a short time of one another. The symptoms were severe—colic, diarrhoea, vomiting, in the worst case, suppression of urine. The convalescence of all was protracted. The fact that they were all attacked within so short a time provided us a common cause. Every possible avenue by which peritonitis might have been brought about was eliminated, till finally the milk was judged as the offender. Milk had been taken by these five sisters, alone, with tea, as a blancmange. To the morning of the afternoon supplies the cook had added a preservative, "Glacialine," consisting largely of Boracic Acid. A
sample of milk as delivered by the dairyman was also found to contain Boracic Acid. The rest of the hens and roosters was given to nine fowls. Five of these all largely of it died; the other four, which were sparingly, were very ill but recovered ultimately. The crop squizzard of one of the fowls which died was found to contain a considerable quantity of Boric Acid. The significance of this case does not need to be pointed out; it fully exemplifies the great risk there is of a large amount of Boracic Acid being added to the milk before it finally reaches the consumer.

Boracic Acid, besides being directly injurious to the consumer via the amount which is added to the milk, may be injurious via an indirect way. The results of some analyses made by S. Hill of Birmingham have been given above. In one sample he found 10 ppm per gallon foreced. He came to the conclusion that this quantity was put
in not merely as a preservative but with the intention of masking the slightly burned flavour of the milk. In other words that Boracic Acid when used in such large amounts was added for the express purpose of making it possible to sell slightly stale Milk as fresh Milk. In St. Hill's opinion this is the cause of a good deal of the infantile diarrhoea in Birmingham during the summer months. In addition to this the practice of adding preservatives to Milk leads to promote carelessness in regard to the cleanliness of the vessels & utensils used for collecting & storing the Milk.

St. Stevenson in giving evidence at the Tynemouth case stated that in his opinion the addition of Boracic Acid to Milk should not be allowed at all as it enabled the salesman to palm off stale Milk as fresh. Now this is a very important matter & deserves serious attention. Whatever opinion may be held as to injury caused
to health by Boracic Acid, no medical man will hesitate to condemn milk which is intended for the use of children, especially infants, if it is "burnt" in the slightest degree, if it departs by any extent from the perfectly sweet condition that fresh milk should be in. No one who has had any experience amongst the poor will hesitate to say how much illness amongst infants, indeed infant mortality, is caused by the use of milk that is not fresh—either by its being preserved stale, or by being kept too long in a sour atmosphere before use, or by a dirty feeding bottle. Indeed infantile diarrhoea and bottle feeding have been found to be directly related the one to the other.

As Boracic Acid has the property of masking early decomposition of milk in the earliest stages, no words can be too strong to condemn the use of it for milk preservation.

Before leaving the subject of Boracic Acid
In milk, there is one other matter of some importance to be noticed. It has been observed above that albuminuria has been exaggerated sometimes caused by arsenic acid. Now it is universally accepted that milk is the diet par excellence for patients suffering from kidney trouble. How then can milk be given with any security or safety if one feels that one may be administering at the same time a drug which will exaggerate the disease? The four fatal cases cited by Dr. Semovice, referred to above, all of them fatal, because of kidney trouble, are highly significant. In hospital practice one might secure a supply of milk guaranteed to be without this drug, but in private practice, especially amongst the poor, the drowning of milk as it is at present is universally practiced, takes away that which is so valuable in the treatment of nephritic patients. On account of this danger the practice, in the opinion of the writer, should be
We have secondly to consider the question of Boracic Acid in Butter. As we have seen, this substance is largely added to Butter, it is a valuable preservative for such a perishable article of food. Salt is a common preservative added to Butter, it has long been in use; but to keep Butter for long, a very large quantity needs to be added, so the amount added is thus restricted by table. With Boracic Acid this is not the case. The same questions may be asked as in the case of milk. Is the maximum dose exceeded by taking Butter containing this drug? Has this drug an injurious effect on the consumer in the amount taken by means of Butter?

The case of Superintend. Cole v. Thos. Jones of Tynewicot, Rhondda Valley, Jan. 12, 1848, is very important, so a great deal of evidence on the subject was obtained. The Butter in question...
was found by Mr. A. C. Sayler, Public Analyst, Glamorgan, to contain .97% Boracic Acid or Borax or a mixture of both, i.e. 63 gos per lb. Proceedings were taken because it was considered that a larger amount of preservative had been added than was necessary for the preservation of the butter.

In the opinion of the Public Analyst .25% or 17½ gos per lb is sufficient to preserve Butter. It was stated that Australian Butter kept perfectly well, so that the usual amount added to that was .4½% or 28½ gos per lb.

Mr. Ridd Thomson stated that of 292 samples of Butter analyzed by him during the last two and a half years, the maximum amount of Boracic Acid found by him was .5½% or 36 gos per lb.

Mr. Stevenson also stated that .5–.6% was the maximum amount found to be present.

Normandy Butter usually contains 23–24 gos per lb. It would seem, thus, that .5% or 33 gos per lb may be...
taken as the maximum necessary to add to Butter, or plenty of Butter cold with this amount if it keeps well. Though Mr. Douglas of a firm of preservative makers gave in his evidence that 90% was sometimes necessary, Mr. Gibson, salesman of Pearson's Butter, concurred in saying that 90% was sometimes necessary. Mr. Otto Behner put the usual amount found in Butter as 8.5-17%. (Food Sanitation, F.E. 12-4.)
The average amount of Butter taken per week may be put down at 3 lb. (F. Stevenson); thus only 17/2 gos of Bovac Acid would be taken per week in the case of Butter containing 5%, or 35 gos per week in case of Butter containing 10%, which may certainly be taken as the greatest amount necessary under any conditions. This means only 5 gos per day at most for an adult, as this is only the minimum dose of the British Pharmacopoeia (which may be taken thrice daily), this amount would seldom, if ever, produce
harmful symptoms wi all probability. Though this amount as etablished alone has been observed to cause hicoucts wi one case. Then again infants take small amounts of Butter, so that wi all probability the maximum dose wi not exceeded. J. Williams, M.R.I. Glamorgan County Council, however etablished at the Rysewidd case that he would object to any amount over 50 pe, as it would probably cause dyspepsia from vitiation of the muceous memnbrane. Moreover there seems to be no proof on the part of the preservative to mask decomposition when it has already commenced wi Butter, as is the case when it is added to slightly stale milk, so the use of the preservative does not enable the salesman to sell stale food for fresh. The verdict at the Rysewidd case was against Jones, the defendant, on the grounds that an excessive quantity of preservative was used, so that the scene of proof of its being non-nijurious
Formic Aldehyde - "Formaline."

What are the effects of this substance on the human organism?

Very little indeed is known of the action of Formalin. It is said not to be poisonous, but the gas is irritating to the eyes and nose, so some people it is irritating to the throat if the solution is inhaled. It produces a tingling sensation.

Dr. J. H. Shermaker "Materia Medica" of Philadelphia states that undiluted Formalin applied to animal skin produces necrosis without evaporation. An injection of 6 gramine into the pound of bodyweight into a guinea pig produced coma and rapid death without convulsions, while the temperature was reduced some 2°-4° F. It was eliminated by the urine in twelve forty hours.

It has been argued that as Formalin
is volatile it will be expelled by
the heat of the body, but Dr. R. T. Thomas
found that a third of the milk had
to be evaporated before all the Formalin
was expelled.
According to Aroneohn, when Formalin
is heated it is converted into a white
crystalline solid: "Paraffin," which
is said to be an excellent cuticular
antiseptic.
In an extract from the "American
Druggist" given in "Foote's Sanitation"
Nov. 24, 1877, Prof. J. W. Hurst states
that he has used Formalin added to
milk in the treatment of children
suffering from fermentative indigestion,
with marked beneficial effect. He
has also used Formalin for acid
dyspepsia when troubled with it
himself, taking 10 drops of Formalin
with each oz of milk he lived on
that alone. He has noticed no
secondary effects from its use.
Messrs. T. Wiegels & S. Merkel (Forschungen
1875, II 91.) state that the saccharification
of starch by Diastase is favoured by Formaldehyde so that alcoholic fermentation is delayed.

Is Formaldehyde injurious to health when taken in the quantity added to milk?

We have seen that Formaldehyde is added to Milk in the strength of 1 in 8 704 (approximately 8.75 grs per gallon) as a rule, or Formaldehyde 1 in 21 760. Up to the present there seems to be no evidence of any injury to health caused by this as a preservative. P. S. Rideal (Journal July 1895) states that he has heard of no injurious effects, so that he has repeatedly drunk the 1% solution without effect; is of opinion that it is not injurious.

Messrs. T. Weigel & S. Morkel (Forschungshor 1895, II, q. 1.) give some interesting information as to the effect of Formaldehyde on the albuminoids of Milk. They say - Formaldehyde so changes the albuminoids of Milk...
that they are no longer soluble in a mixture of Sulphuric & Acetic Acids, so that the casein can only be precipitated in thick clots from milk which contains Formalin, not in the fine flocculent condition characteristic of the casein from normal milk. Also that Formaldehyde renders the albumenoids of milk less digestible. An addition of Formalin 1/500 renders the casein insoluble in pepsin and Hydrochloric Acid.

Now as milk enters so largely into the diet of very young children & invalids of all ages, this is a very serious matter. It is well known that many expedients are resorted to for making milk more digestible for children & invalids by - boiling, the addition of barley water, lime-water, in the case of invalids - soda water also. These expedients act by making the curd lighter & therefore more
digestible, now anything added to milk which renders the curd thicker or heavier, if not itself injurious to the child or invalid, is certainly far from what is to be desired—one of the difficulties in rearing children artificially being that the difference between the curd of human milk and that of cow's milk, (the latter being so much heavier or thicker,) has to be overcome.

**Salicylic Acid**

With the action of this substance which is so largely used, especially as the Isodium Salicylate for rheumatism (in which it has a remarkable effect reducing the joint pains) we are more familiar. In the treatment of acute Rheumatic symptoms of Salicylic acid poisoning have sometimes been observed, viz., headache, giddiness, vertigo, and the ears. Its chief effects are those just mentioned.
abort, but in addition J. V. Shermaker of Philadelphia in his "Materia Medica" states that in the opinion of some it reduces the temperature a little even in health. He quotes Vandeure Bonpland that it diminishes the functional activity of the Testes & Ovaries as causes congestion of the Ovaries & Thumus, so may produce abortion. It is supposed (Ryle White - "Materia Medica") that the injurious effects of Salicylic Acid when given in medicinal doses are due to the artificial form being used - which frequently contains tritoracic or orthocenicolic acids which are powerful cardiac depressants. It is eliminated in the urine as Salicylic Acid. It occasionally causes Jaundice from congestion of the Kidneys. The toxic doses it causes slow respiration, the pulse becomes slower & weaker, nausea & vomiting ensue, & there is burning in the throat & convulsions. Epistaxis is common, & other hemorrhages sometimes. Hematosis & Reliueal Hemorrhage. S urge...
doses have caused urticaemia. In ordinary cases it acts as a diuretic, but causes irritation to the kidneys, probably through Phenol being formed (Vaneel. Dec. 23: 1894). It sometimes causes albuminuria. In acute nephritis it diminishes the quantity of urine passed and increases the amount of albumen. The use of Salicylic Acid has sometimes been followed by anaemia (J. W. Shoemaker). His opinion is that it is injurious when used continuously for a long period. J. S. Ridel states in *Disinfection and Sterilization* that it has a disinfecting effect on the blood corpuscles. There is a good deal of evidence that it interferes with digestion. J. W. Shoemaker states that it arrests the action of saliva on starch. J. Holbe (Rideal's *Sterilization*) has shown that it prevents the action of the gastric juice. Messrs. Weber, Leippan & Beaum have shown that a solution of 1 in 4,20
completely checks salivary and pancreatic digestion of starch, i.e. that it has a depressing influence. St. Vincent Blyth also has given his testimony as to its interference with digestion.

Referring to the table later, it is seen that Salicylic Acid is an antiseptic, preventing the growth of Bacidia, i.e. that if used in sufficient strength will act as a disinfectant, killing the organisms.

Is Salicylic Acid injurious to health when taken in Milk or Butter? In 1881 the French Committee of Public Hygiene issued an Edict which is still in force — as follows —

"Et interdit la vente de toute substance alimentaire, liqueur ou solide, contenant une quantité quelconque d'ácide salicylique, ou d'un de ses dérivés."

In accordance with this, the food arriving at the city barriers is examined.
If it is found to contain any Salicylic Acid, it is seized & the owner punished.

Mr. R. F. Thomson in the table by turn given on page 15 gives as the usual amount of Salicylic Acid added to milk 17.5 gms per gallon to 35 gms per gallon. Taking the lowest figure this means 0.187 grains per pint, so that by the table given on page 47 a child of 10 months would take 6.561 grains per dose. The recognized dose of Salicylic Acid is 5-30 gms, so considering the powerful action of the drug in many persons, the maximum dose for a child of 10 months should not, it would seem, be over 2 gms. Taking 6 gms per dose if taken three daily. Dr. Bonnardel is quoted by Dr. Pictet (reference as above) as having noticed daily doses of 2 gms to produce great symptoms of intoxication and poisoning in an adult. This may be taken at 30 grains, 1/3 the maximum daily dose in an adult. Therefore 2 gms
may be considered as its equivalent to a child of 10 months, but it has been seen that 6 drs may be taken by means of milk preserved with this substance.

Now considering that 60% of patients to whom Salicylic Acid is given show symptoms of Salicylic Acid poisoning (Hale White "Malaria Medica"), it is surely not justifiable to administer this drug in its maximum dose in such a largely used food. Apart from this there is the question of its effect on the salivary, Gastric & Pancreatic secretion, interfering with digestion, its effect on the blood, causing anaemia, by distillation of the blood corpuscles, - surely a highly undesirable effect, especially in weakly children. F. S. Polden states that in his opinion that the addition of this drug to milk is most objectionable, especially as regards young children, as it is very likely to cause chronic dyspepsia. He also states that:
Salicylic Acid is probably cumulative in its action as are lead and arsenic. Here is one more consideration in connection with the injurious action of the drug. It has been seen that it may cause albuminuria - at any rate it diminishes the amount of urine passed - increases the amount of albumin in nephritic cases, so it seems highly unadvisable to render so valuable a diet as milk is in the cases useless if not harmful.

Like Boracic Acid, Salicylic Acid apparently has the property of concealing the quality of the milk, i.e., of rendering slightly hirned milk apparently sweet thereby making it's sale possible, i.e., endangering the health of the child consuming it. In Vallin, "Desinfectants" shows that Salicylic Acid is nefariously used to secure the disposal of inferior articles that would not otherwise be salable. Enough has been said in this connection when speaking of Boracic Acid, so on this score alone the
use of Salicylic Acid should be unhesitatingly condemned, both because of the fraud perpetuated, and the danger to health.

As regards the addition of Salicylic Acid to Butter, there is nothing needing special mention. The small amount of Butter taken comparatively to Milk renders its subject of less importance, but if a preservative be used at all for Butter, it seems advisable that one less dangerous to the consumer should be employed.

We have now considered the three chief preservatives used, it only remains to consider briefly the remaining substances which have been used occasionally.

*Benzole Acid*

As has been said this substance is not much used either for preserving
Milk or Butter, is not a very great deal is known as to its action when taken internally. It is considerably used to acidify alkaline urine in cases of pyelitis & cystitis, as its action in this respect is due to the fact that in the kidney Uricuric Acid is formed & it is eliminated as such. It is slightly diuretic. It is also an expectorant, as it is exerted in the bronchial secretion. F. J. V. Shremaker states that it may give rise to erythematous redness, small pustular eruptions, & in some cases of idiosyncrasy urticaria has been produced. F. Riedel states that it diminishes the amount of urea.

Referring to W. de la Croix's table on page 13, it will be seen that it is an antiseptic, as a strong solution a disinfectant, & is more powerful than Salicylic Acid in these respects. By Wernitz's table on page 35, it is seen to inhibit Salivary gastric & pancreatic digestion.
As to whether Benzoic Acid in Milk or Butter is injurious to the consumer, there is no evidence to be obtained, but it cannot be used in large quantities owing to its pungent aromatic odour, so it is of weak power as a preservative, therefore its use is rare, so it deserves no further comment.

Chromate of Potash, the Bichromate.
As has been already mentioned, these substances have been used, but there is no evidence or record of their use in this country. It is unnecessary to do more than merely mention these substances, as their use would be universally condemned as extremely injurious.
Sodium Carbonate.
That this is a very weak preservative is its methods of acting have already been pointed out.
Process regards the addition of Sodium Carbonate as very hurtful to children. It merely serves to deceive the public as to the freshness of the milk as it neutralises the Lactic Acid formed up to a certain limit, according to the amount which is added, therefore is simply an aid to fraud, is not a preservative in any way, its use therefore should be condemned absolutely.

Arguments for, against, the use of Preservatives in Milk & Butter.
The Local Government Board in their report for 1890-91 refer to the bona-fide solution with which these
Drugs are used, e.g., "to prevent the loss of valuable food". Now though this is the case, it is also true that some are used to enable the unscrupulous salesman to sell milk which is not fresh. The latter will be discussed later on.

First as regards milk. What are the arguments for and against the use of preservatives?

For:

1. That milk is an extremely perishable article of food, i.e., this renders the addition of a preservative necessary, so that the consumer may obtain fresh, sweet milk; especially does this apply in the summer months.

2. That the retailer is unable to carry on the sale of milk with profit without the use of some preservative.

3. That much valuable food would be wasted without the use of a preservative.

4. That they are used only in such
small amounts that they are harmless to the consumer.

5. That they are less injurious than the products of commencing decomposition. (T. Sauer Brunton's reply to letter from "Editors" of Zaud 1897).

Again:

1. That as regards Milk there is no necessity for their use - that other means may be employed for the preservation of Milk.

2. That, considering the amounts in which they are added, preservatives may be taken to be decidedly injurious to young children, especially who are the largest consumers of Milk. And also in some cases of disease they would be decidedly harmful.

3. That drugs should not be given except under medical advice, especially considering the chances of repeated additions to the same
sample of milk, the great risk of very large quantities being added.

4. That they aid fraud.

5. That their use tends to promote carelessness as to the cleanliness of the cows, cowsheds, dairies, milking helmets, as it is known that by their use the milk will in all probability keep sweet long enough to be able to be sold as such, no matter what its surroundings are.

As regards the arguments for preservatives.

No. 1. It is of course highly desirable that sweet milk be obtained when asked for by the purchaser. But more than this is required, viz. that it be "fresh". Now preservatives will keep milk sweet, but if milk has been kept over two days it cannot be considered as "fresh". Therefore these preservatives do not help the dairyman or retailer to supply fresh milk, but
they enable them to sell milk which has been kept, therefore exposed, even with the best care that can be bestowed on it, to many contaminating influences, thereby tending to the spread of disease.

No. 2. As to the profits of the retailer. The profits of the wholesale dairyman are not so much at stake because he can as a rule get rid of his milk, the same day as it is drawn from the cows, or at least the next morning. He knows also more exactly what the demand on him is, also if he has more milk than the retailers take from him, he can utilize it for butter making. The case of the retailer is very different. The demand on his milk is very uncertain. On some days he may sell a great deal, on other days he may have small demand upon it. Then again, when the milk is brought to him, it is already some hours old—perhaps 16-18. Assuming it is the milk from the
previous evening's milk, if it is the hot summer weather he knows that there is every risk of it "turning" before the day is out or by the next morning if he is not fortunate enough to sell out in the evening. It will then be useless to him, a dead loss. He has not, it will be observed, the resource that the dairyman has of butter-making to utilize his surplus milk. Now from the retailer's point of view this argument for the use of preservation is very strong; in fact it may be said, the retailer profits but the consumer suffers by their use. However if this use be detrimental to health this is an argument that cannot stand but the method of sale of milk must be allowed to suit the necessities of such a perishable article, or some harmless method of preserving must be used.

No. 3. As to the waste of valuable food. This of course is highly undesirable, every means should be taken, consistent
with safety & health, to obviate this as much as possible. But this waste of food is not so serious a matter as the waste of health.

Now that the amounts used are so small that they are quite harmless to the consumer. This it has already been attempted to reply to in the preceding pages, requires no further comment here.

Yes. That they are less injurious than the products of decomposition.

This was put forward as a reason for the use of preservatives by T. Saunders Brunton (reply to Editors of Lancet 1877), but it seems to admit the impossibility of obtaining fresh, sweet milk, advises the choosing of the lesser of two evils.

It also implies an ignorance apparently of the fact that Boracic Acid, that preservative most commonly used, marks the early signs of decomposition in milk, instead of avoiding the danger, in reality it makes it more dangerous by hiding it. There is in addition the danger of the injurious action of
the drug. This argument will not hold thee for a moment, indeed it is no argument at all.

As regards the arguments against preservatives.

No. 1. That as regards milk there is no necessity for their use. Other means may be employed, which are entirely successful & certainly non-injurious.

In reply to a letter from T. Williams, M.A. I. for Glamorgan - an important dairy company in London wrote. 

"We do not use Boric Acid or any preservative in milk, as it is quite unnecessary in London. If the milk is properly cooled after milking. We have no trouble either in summer or winter in delivering milk in a perfectly sweet condition twelve hours after milking."

The Pasturization Process. Strictly after being drawn from the cow the milk is passed over a refrigerator. This is a vessel through which ice cold water is continually flowing, the milk being
passed over the outer surface of it, by which it is cooled down to about 43° F. in a short time.

The length of time that milk is preserved by this process depends on:

1. The suddenness of the cooling—the more rapid the more effectual.

2. Subsequent condition of storage etc.

By this process it will sometimes remain sweet for ten days. Even during the hot summer months the milk is preserved long enough to enable the dairymen to deliver it in a perfectly fresh and sweet condition.

The fact that milk can be thus preserved by such a simple process, and at the same time one which is so perfectly harmless, renders void all arguments for the use of artificial preservation, most of which may be considered to be, sometimes at any rate, injurious.

Another process which is more troublesome but equally effectual in preserving milk is that known as —
Pasteurisation.
This process depends on the fact that a certain temperature will check the growth and development of bacterial spores temporarily. The milk is raised to a temperature of 140-147°F. and subsequently cooled as rapidly as possible.
This process has been introduced for the milk supplied to the poor of New York during the summer months, and it is said has had a marked effect in the reduction of infantile mortality, no doubt because the use of this milk lessens to a very great extent the prevalent diarrhoea.

Sterilisation.
This has for its object the destruction of all germs and their spores.
1. The milk is first subjected to a process of upward filtration to remove all solid matter.
2. It is then passed into a bottling bag, from which syphons fill all the bottles.
bottles placed in the tray.

3. The milk is then subjected to steam raised to a temperature of 190°F. in a sterilizing chamber. This is known as the "Steam warming." The milk is kept at this temperature for 40 minutes, which kills all the living Bacteria in the milk and destroys any spores present, which are killed in the process of sterilization proper.

4. Sterilization. The milk is raised to a temperature of 212°F. and maintained at that temperature for one and a half hours. Air is totally excluded from the milk, the stoppers of the bottles must be perfectly airtight. If large cans are used, the process takes a proportionately longer time. Possibly milk which has undergone this process may not be of such high nutritious value, but it is more easily digested, for infants & invalids may be considered as poor
excellence the method of milk pre-
Servalon - the great advantages being that:

A close of milk can always be kept ready at hand.
It will keep for some days after the bottle has been opened.
It contains no preservative.
It is proof against adulteration and contamination.

This however is not a practical method for the general milk supply, but is especially good for special cases as observed above.
It will be seen then that there is no necessity for the use of artificial injurious preservatives in milk, that this is not theoretical but practical.
As the result of the above mentioned methods is successfully used by at least one large dairy company in London.

No. 2. That preservatives are injurious to the consumer of milk containing them. This has already been substantiated in the preceding pages.
No. 3. That drugs should not be given except under medical advice. This was an opinion pretty freely expressed at the Tynemouth case already referred to, so it certainly seems highly desirable that drugs, some of which are decidedly powerful, should not be administered, whether the consumer wishes it or not, in such a valuable universal article of diet as milk, by ignorant tradesmen or milk-sellers. The risk of two or three additions of preservative to the same sample of milk has been pointed out, has been instanced by the case of poisoning reported by Dr. Robinson of Dorset (see above). The administration of drugs should be in the hands of capable persons, not those who are entirely ignorant of their action and effects; especially is this true when so large a number of the consumers of milk are delicate infants, who require the very greatest care in nursing. The Commission of the
Académie de Médecine of Paris, on the action of Salicylic acid in food, reported that it is injurious — not a constituent of food, but a drug, as such should only be administered under medical advice, so that the continued administration of it would cause serious gastric disturbances. ("Medical", Dec. 1890).

Since then they have included all antiseptics in food, prohibited their use.

Note. That preservatives aid fraud.

This has been referred to under Boracic acid & Salicylic acid. That by these means milk slightly laced can be sold as fresh, as they have the property of masking slight staleness. This is a strong argument against the use of these drugs, for not only is the consumer drugged by means of these substances, but at the same time he has stale milk administrated which may have disastrous effects, while the consumer has no opportunity of ascertaining the milk to be other than
fresh sweet milk.

No. 5. That their use tends to promote carelessness as to cleanliness.

It is well known nowadays how many epidemics can be traced to milk infection, - epidemics of Scarlet Fever, Sulfuric fever especially. Also it seems not at all unlikely that a great deal of typhoid-diatarrhea may be set up by milk already infected from the dairy, by some poison, although in the majority of cases the fault will probably be found in the house, at any rate among the poor population, - not omitting the ground water temperature.

But this necessity for perfect cleanliness of the cowsheds, dairies, utensils etc., cannot be too strenuously insisted on, as also the cleanliness of the cows themselves. The Dairies, Cowsheds, & Milk shops Order makes provision for this, - also for the making of bye-laws, - the dairyman knows that if he attends to these things
his milk will stay nice better, for
it will keep sweet for a longer time.
Preservatives however offer a great
temptation. They will keep the
milk sweet, will mask all detection
of contamination, consequently the
necessity for scrupulous cleanliness,
vanishes, the second is third rate dairy
man has nothing but the inspector
to keep him up to the standard of
cleanliness, it can well be understood
how unperfect this is when there is
no desire, because apparently no necessity,
in the mind of the dairyman, for
cleanliness. This is an aspect of
the question which it seems has
been little considered on, but is none
the less of very great importance
for the Public Health.
To conclude these arguments against
preservatives Mr Otto Behmer is quoted,
"Analyst" Dec. 1890.
"No one surely can contend that
"preservatives are necessary for the
"production or preparation of milk,
Butter, beer, wine etc. in a fit chale for carriage or consumption, for the great majority of the samples analysed are free from anti-epileptics. Good milk, good butter, can be sold without anti-epileptics. As a matter of fact they have been so sold for centuries until chem science came in and taught that dirty is the careless producer how to evade the natural punishment of dirt and mismanagement. Anti-epileptics are convenient to such producers, but they are not required. Hence we have no option but to consider them as adulterations.

The practice is utterly unjustifiable except from the point of view of a dealer who wants to make an extra profit, who wants to palm off an ill-prepared or stale article upon the public.

Secondly as regards Butter. What are the arguments for or against the
use of preservatives thereof.

For

The same arguments may be used as in the case of milk, substituting the word Butter, the only difference being that the question is not so urgent in the case of Butter, as it is not such a perishable article of food.

No. 1. As is the necessity for their use in Butter, so that the consumer may obtain fresh Butter.

Butter is a perishable article of food, so it is impossible to keep Butter fresh, it sweet for long without adding something. Salt is that which is commonly used, but this is a food, not a drug, so besides the consumer recognizes at once by taste if salt be present, so can avoid it or not as he pleases. But many persons do not care for Butter with salt, so demand fresh, sweet Butter. Can this be provided without the addition
of preservative?"

In reply to a letter addressed to a large Butter importer, the writer received the following answer:

"We do not advocate the addition of preservatives to Butter. We consider they do not improve the taste, but without them, it is necessary to secure the immediate sale of the Butter, as soon as it is opened."

The writer has had Butter sent from the country all the year round, containing no salt or other preservative, and during the summer time it is perfectly possible and practicable, the Butter keeping perfectly sweet and fresh for 4 or 5 days with care, in hot weather, much longer in cold.

The case of Butter as well as Milk, but then there is not so much risk of loss to the retailer, or loss of valuable food as in the case of Milk. If he finds that his demand is less than he expected, he can quietly sell his surplus.
butter before decomposition commences, I sell it as salted fresh butter, or, "powdered" butter, at not very much below the price he would have got without salt.

That they are used only in such small quantities, that they are harmless to the consumer.

In the case of butter this is perhaps so. In the first instance, butter is consumed by people of years, not months as in case of milk, so the amount taken is small comparatively, say as an average ½ lb per week per head. It has been seen that the amount of acetic acid thus taken would probably not be injurious, so perhaps, with certain restrictions, the addition of this substance to butter should be allowed; but of no other preservative can this be said, for of formalin not sufficient is at present known of its action to say such permission to use it should be withheld till such
Information can be obtained, and Salicylic Acid may be unhesitatingly condemned in any quantity.

No. 5. That they are less injurious than the products of decomposition.

This argument does not apply much to Butter, as people are not likely to eat Butter in such a rancid condition. Butter when it has become what is known as "cheesey" is generally avoided, but it does not seem to be injurious in the small quantities taken when in that condition.

Argued:

No. 1. That there is no necessity for their use has already been seen to be true in the case of Butter as of milk.

No. 2. The question of whether they are injurious has been fully discussed.

No. 3. That drugs should not be given except under medical advice. This argument applies in the case of
of Butter also, perhaps on this score, these additions should be prohibited, unless a limit be fixed that can safely be said to be non-injurious, at the same time effectual as a preservative.

No. 4. That they aid fraud.

It has been seen that preservatives have no power to check decomposition in Butter as they have in Milk. Still there is a way in which they may aid fraud. It is well known that Butter containing more than 15-16% of water will not keep well. Now frequently water is allowed to remain in Butter to an amount exceeding this percentage, for the purpose of increasing the weight, with the addition of a preservative it will probably keep a sufficient time to ensure its sale, thereby increasing the profits of the dairyman, fraudulently taking advantage of the purchaser.

No. 5. That their use tends to promote
carelessness as to cleanliness.
This may apply to Butter, but in a far less degree than to Milk, a need no further mention.

Brief Conclusions

Milk
That the use of preservatives be condemned, on strength of there being
1. No necessity for their use.
2. Evidence of injury to health.
3. Evidence that they aid Fraud.
4. Evidence that they promote carelessness as regards cleanliness.
5. Opinion that drugs should be administered only under medical advice.

Butter
That the use of preservatives (with one exception possibly: Boracic Acid) be condemned - on the strength of there being
1. No absolute necessity for their
use (though it would be extremely useful if a harmless preservative could be found which can be safely employed: this - Boracic Acid - with certain restrictions, maybe).

2. Probability that they aid fraud.

3. Opinion that drugs should be administered only under medical advice.

4. Opinion that other preservatives than Boracic Acid are too poisonous to risk their use even in Butter - Formalin - sub judice.

How far does the existing law control or prohibit the use of Preservatives for Milk & Butter?

There have not been many prosecutions for adding preservatives to butter, the main reason being that it is a question
to what amount they may be added
still regarded as preservatives, not
adulterations.

The first case is noted by Mr. Otto
Rehner in the "Budget," Dec. 1890.
A few weeks ago a milk-seller was
summoned before the court for selling milk
from which some of the cream had
been abstracted, which contained
a poisonous ingredient—Boric Acid.
The Boric Acid in this case was regarded
as an adulteration.

Now what powers have the authorities
for dealing with this matter?

Powers are granted for dealing with
the adulteration of food by the
Sale of Food & Drugs Act, 1875, and
Sale of Food & Drugs Amendment Act, 1879.
The Sale of Food & Drugs Act, 1875

Deals with two distinct classes of
adulterations—those which are injurious
health. Section 3—those which are
not injurious. Section 6.

Section 3. Prosecutions are not often
taken under this section nowadays, as
the practice of adding acknowledged injurious substances to food is almost extinct, as a thing of the past, e.g., alum to bread, poisonous colouring matters to confectionery. Besides, where doubtful substances are those in question, there is the necessity of proving injury to health, so the penalties are much higher than under section 6, so it is necessary to prove a guilty knowledge on the part of the person charged. The section runs as follows:

"No person shall mix, colour, stain, or powder, or order or permit any other person to mix, colour, stain or powder, any article of food with any injurious or material so as to render the article injurious to health, to the extent that the same may be sold in that state, so no person shall sell any such article so mixed etc. under a penalty of each such sale not exceeding £50 for the first offence." It will be seen that to prosecute under this section for adding a
Preservative to milk or butter, it is necessary to prove in the first place that such preservative causes injury to health, such proof as is obtainable at the present time, though it should be sufficient to satisfy medical men as to the extreme unadvisability of the use of preservatives, (for milk at any rate) is probably not sufficiently startling to convince laymen, who too often require evidence that someone has "been done to the death" to satisfy their suspicions as to the action of a certain drug.

Section 6.

"No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, quality demanded by such purchaser, under a premium not exceeding twenty pence."

This section is intended to prevent the addition of substances to food to fraudulently increase the bulk, weight or measure of the same, or to
conceal inferior quality.

Under this section it is not necessary to prove that the person charged had a guilty knowledge of the addition, nor is it necessary to prove injury to health, & for ordinary cases of adulteration as commonly practiced now, e.g.- adding chicory to coffee, proceedings are taken out under this section. So too are proceedings for the addition of preservatives, but in their case a proviso which is appended to this section materially affects the result, as follows.

"Provided that an offence shall not be deemed to be committed under this section in the following cases- that is to say-

(i) Where any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, or a container fit for carriage or consumption, is not..."
fraudulently, to increase the bulk weight or measure of the food or drug, or conceal the inferior quality thereof.

First as regards the section b itself -
Is Milk or Butter containing preservative of the "nature, substance, or quality," demanded by the purchaser?
Is it of the "nature" - Milk or Butter.
"Substance" - nothing has been abstracted.
"Quality" - can it be argued that it is so.
Instead of being fresh Milk it is preserved, drugged Milk, the same applies to Butter.

Mr. Chas. J. Cassal in the "Analyzet" Dec 1849 states his very strong opinion on this point - that it is not of the "quality" demanded by the purchaser.
S. Bernard Roger, President of the Society of Public Analysts, in the "Analyzet" May 1847 states that -
"Having regard to the present state of the physiological problems he did not think that it could be said that
Boric Acid was an adulteration unless
it was undeclared; but if its presence were undeclared, since Boric Acid was undoubtedly a foreign substance, the case was different, for anything sold as Milk which contained an added foreign substance ceased to be Milk, even irrespectively of the possibly injurious nature of the article added. In other words it is not of the quality demanded. If a purchaser asks for Milk he does not expect, is not at all prepared to receive a solution of a drug which may prove injurious to his delicate child.

By the Amendment Act of 1847, it is expressly stated: Section 2. that it shall not be a good defence to prove that the article of food or drug in question, though defective in nature, or in substance, or in quality, was not defective in all those respects. It would seem therefore to be an adulteration. But the proviso above matters considerably, as also does the
Definition of Butter given in the
Margarine Act. - Butter is "that made
exclusively from Milk or cream with
or without colouring matter, with or
without salt or other preservatives."
This is the proviso to section 6, seem
to sanction the addition of preservatives
to Milk if Butter, is for a successful
prosecution it remains to prove that
such are,
1. Not necessary for the production
or preparation thereof as articles
of commerce, or in a state fit for
barriage or consumption
2. Injurious to health.
3. Added for the purpose of fraudulently
increasing the weight.
4. Added to conceal the inferior quality
as may be in case of some preservation
when added to Milk.
These four points have been referred
to in the preceding pages of this paper.
The conclusion drawn being,
That for Milk, there is no necessity
for the addition of preservatives, that
to the medical mind there should be proof enough of the injuriousness of these, so that they are sometimes added to conceal the inferior quality of the milk.

For butter there is no absolute necessity for preservatives, but their use is advantageous and convenient, considering the small quantities of butter taken comparatively to milk. Their injuriousness is likely to be very small, if any at all; but that they may be added by the unscrupulous to permit of butter being sold containing too much water, is therefore indirectly, fraudulently, increasing its weight.

Proposals as to the times of future legislation.

That it is highly desirable something should be done in regard to the prevalent use of preservatives for milk.
 Butter there seems to be no doubt whatever, it only requires to elucidate the lines for future legislation that will prove most advisable and serviceable.

In giving evidence before the select Committee of the House of Commons on Food adulteration, Mr. Otto Kehrer stated -

"Under the Sale of Food and Drugs Act preservatives like Boric Acid, Salicylic Acid, Sulphuric Acid, &c. &c., are almost universally added to food such as milk, cream, butter, bacon, meat, fish, wine & beer, to make these articles "fit for carriage", or no limit whatever is imposed upon the vendors. These substances are chemicals; they are antiseptics which prevent the growth of Bacteria, but they almost certainly are liable to produce disorders of digestion."

"Every country of the world almost has legislated against their use, thus prohibited the use of antiseptics generally in England almost every perishable.
food is substance so chemically preserved.

It is remarkable that England is to far behind other countries in this matter. The Edict of the French Committee of Public Hygiene has already been noted. In Nov. 1895 a Royal decree was issued in Belgium as follows:

"It is prohibited to sell, exhibit, keep, or convey for sale as human food, milk to which water or a preservative substance has been added.

Italy, Spain, the Argentine Republic, the German army are all at one in prohibiting the sale of preservatives. From July 6, 1897 the police of Berlin prohibited the addition of any kind of preservative to milk.

Should England follow the example of these countries?

To point out the feeling in this country on this question, the Editors of the "Lancet" in 1897 addressed a letter to leading medical men - which has already been referred to above. The reply to the
First question in this letter have been noted there in the other three questions (page 13) as to "Prohibition" "Restriction" vs "Statement on the Label" may now be conveniently considered.

Sir J. Thompson, Sir Pavy, Sir F. J. Allen, Sir Tomis Woodhead, Sir A. W. Richardson, Sir Whitelegg, Sir J. Launder Brunton, all replied that the name of the antiseptic used and the amount added, should be stated on the label. The last named stated that in his opinion the amount should not be restricted, as the makers & vendored would probably add the minimum amount necessary. Entire Prohibition of the use of preservatives does not seem to have met with much favour. These three sides of legislation will now be considered separately.

1. Prohibition

Should the use of preservatives be prohibited absolutely?

In the case of Milk - Yes. And...
Should preservation of this substance be necessary in the hot summer months, the dairy companies should be forced to employ the most profitable and hygienic method of milk preservation, viz.cooling. This it has been seen works exceedingly well, the only argument against it being that it is more expensive than adding preservatives. The addition of preservatives to milk should be made illegal on the ground of the great risk to the health of those who are the largest consumers – infants & children, so that they enable milk slightly turned to be sold as sweet, thereby endangering the health of the consumer. As regards milk, the other two proposals, "Restriction of the Amount", "Statement on a Label", should not be considered for a moment.

The question as regards butter is different. As has been already pointed out, the amount of butter
taken is small comparatively to the amount of Milk, it therefore also the amount of preservative taken is small. There is no known way of preserving Butter without preservatives, unless by ice, this is not practicable, so it seems that "Restriction of the Amount" would be common sense legislation in regard to this article of food.

II. "Restriction of the Amount."

Coupled with this there should be restriction as to the preservative used. From evidence given above all preservatives should be prohibited for use in Butter except Boric Acid + Boric - perhaps Formalin; but of this substance there is not sufficient known at present; tither to condemn it as injurious, or to allow it to be used. Therefore, for the ease being, it would seem advisable to prohibit the use of Formalin till its action and effects on the human organism are
better known.

Let it be understood then that what
follows is in reference to the use of
Boric Acid & Borax only for the
preservation of Butter.

To restrict the amount it is necessary
to consider two things:

1. The maximum amount which may
   be taken without injury to health.

2. The maximum amount ever necessary
   to preserve Butter.

It has been observed that the general
opinion as to the maximum amount
ever necessary for the preservation of
Butter is .006, or 33 grains per lb.,
so that there are plenty of Butters sold
which keep sweet for a sufficient
length of time, yet they contain a
less quantity than this. Therefore 33
grains per lb. should be the limit as
to the amount, so with this there would
certainly be very small risk of any
injury to health, as it would mean
only about 2½ grs per day for the
average consumer who takes half a
found a week.
But restriction of the acid + amount of preservative is not sufficient; there should also be legislation to procure the statement of the addition on the label.

III. Statement on the label.
Coupled with this restriction of the amount, all that would be necessary is that there should be a statement to the effect that each sample of butter does not contain preservative (Formic Acid + Borax) in excess of the permissible limit - 35 grains per lb. Any excess over this amount being regarded as an adulteration as also any butter sold or exposed for sale without such label is found to contain this or any other preservative, to be regarded as adulterated butter.
It is to be hoped that when new legislation on food is introduced, that the question of preservatives in Milk + Butter will not be omitted. Had we the above
legislation as regards Butter it would be a distinct advantage, besides it is only what the public and medical men have a right to demand that the addition of drugs to food should not be left in the hands of the ignorant without any restriction, so that if such addition be made, the fact should not be concealed.

As regards Milk, if our legislators do not yet see the necessity for absolute prohibition of the use of preservatives, let them by all means make it illegal to use any but Boracic Acid + Borax. (The question of Formalin to be decided when more is known concerning it - at present let it be prohibited) so let them restrict the amount of Boracic Acid + Borax, if they can fix on an amount which will at once be non-poisonous to the infant - yet preserve the Milk sufficiently. So let them make it compulsory to make known the presence of such preservative in the
Milk by a label attached.

There is no doubt that such would be a great step in advance, though not as thorough as would seem advisable. Mr. Chas. S. Pascal in the
"Analyser" Dec. 1840 says—

"In my view the absolute prohibition of their use is the only safe and proper course to take, although if it be deemed to throw a cop to that large class of persons who are always morbidly anxious to follow middle courses, it may be admitted that the compulsory labelling of such preserved articles, with the name of the substance or substances used, would be productive of great and immediate benefits."