A NOTE ON THE PERCENTAGE LOSS OF CALORIES AS WASTE ON ORDINARY MIXED DIETS

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It is customary to state the energy needs of an individual, a family or some larger group in terms either of net or gross calories. If the original estimate has been made from a study of the actual or net intake, what extra percentage would have to be added to this net basal figure to permit the need to be stated in gross calories? A similar problem arises in the conversion of gross to net requirements.

The difference which exists between the two values arises in various ways, but it is very obvious that the outstanding contributory factor is the natural, although variable, loss as refuse and waste, i.e. the loss which takes place between purchase and actual consumption; in other words, the amounts lost in preparation and in cooking and the material discarded at table. There has grown up a convention, and indeed even a practice, that in calculating the gross needs all is well if, in an ordinary mixed diet, the net requirements are increased by 10 %. What is the justification for selecting this figure?

Atwater & Bryant (1896) some forty years ago clearly defined the terms refuse and waste. They wrote: "The words 'refuse' and 'waste' are used somewhat indiscriminately. In general 'refuse' in animal foods represents inedible material, although bones, tendons, etc., which are claimed as *refuse* may be utilized for soup. The *refuse* of vegetable foods, such as parings, seeds, etc., represent not only inedible material but also more or less of edible material. The *waste* includes the edible portion of the food as pieces of meat, bread, etc., which might be saved but is actually thrown away with the refuse." These general definitions may be accepted. It is very obvious that the extent of the losses thus incurred must, to a very large extent, depend on (*a*) the household skill and general sense of economy ruling in the kitchen, (*b*) the carelessness or indifference of the consumer, and (*c*) the nature of the food purchased.

It is interesting to note that the recognition that the second factor (*b*) plays (or did play) a prominent role was one of the reasons which led Atwater (1891) to lay down his standard for America of 125 g. of protein and 3500 cal. of energy as "appropriate for a man at moderate muscular work". He wrote in his criticism of the Voit standard: "Unquestionably we eat a great deal more than we need, but it would be very hard to believe that food with 3055 calories of potential energy per day...would suffice for men who live and work and can earn wages as do the labouring people in Massachusetts and Connecticut...whose food, including that which is so lavishly wasted is

estimated at from 4400 to 4660 cal. per day." Later he states that this wast[e]
applies particularly to fat. We doubt, we have no first hand information, i[f]
this lavish waste referred to by Atwater ever had a very wide existence eithe[r]
at the time when Atwater wrote or to-day. It certainly is not a feature in th[e]
modern European household.

This doubt as regards the wide distribution of lavish waste receives som[e]
support from data given by Atwater and Bryant (1896). They give estimate[s]
of loss in certain dietary studies as follows (Table I):

Table I

Dietary studies	Average calorie value of diet per man	Percentage loss
9. Farmers' families	3560	3·51
9. Mechanics' families	3605	5·13
9. Professional families	3530	2·83
5. Student clubs	3880	14·82
9. Miscellaneous	3500	2·57
General average	3695	5·01

Our present communication is based on a thorough re-analysis of a serie[s]
of dietary studies, each of one week's duration, on 263 families (149 in S[t]
Andrews, 53 in Cardiff, 49 in Reading and 12 in Glasgow). In each case th[e]
material discarded between the time of purchase and actual consumption had
been carefully kept. We believe that the study of this discarded materia[l]
would allow of some definite statement regarding the magnitude of the food
loss which takes place in a series of average British, for the most part working
class, households. In our study we have only considered the actual potentially
edible material loss, i.e. we have concerned ourselves with waste rather than
with refuse. Our data then refer to calorie losses.

The following table (Table II) gives the percentage loss of edible calories
from the food as purchased.

Table II

Families in	Aver. percentage loss of cal.		P.E. of mean	S.D.		P.E. of S.D.
St Andrews	2·67	±	0·074	1·345	±	0·053
Cardiff	1·06	±	0·070	0·759	±	0·050
Reading	1·85	±	0·071	0·740	±	0·050
Glasgow	1·48	±	0·119	0·613	±	0·084

It will be noted from Table II that the percentage loss for the families
studied in each place is not high, the greatest loss being in St Andrews where
the group of families investigated contained a higher percentage of those who
could obtain a wider selection of foodstuffs. The weighted average percentage
loss for the total (263) families studied was only 2·14.

As regards the validity of our data we believe that speaking generally it
can be trusted. The various housewives were instructed by the investigator
to remember to put all their discarded material in the waste pail, irrespective
as to whether it arose during the preparation of the food, from the table at

the conclusion of a meal or at any other intermediate period. This material was subsequently sorted out by the investigator and its nature noted. The investigator visited each house at least once a day during the period of the study. It may be mentioned here that such instructions are on the whole adequate in the majority of urban households, but, as we have experienced with purely rural households, it is almost impossible to rely on the contents of the waste pail provided to obtain even an approximate estimate of the material discarded. The reason of course is that such households have live-stock like hens, pigs, etc., to be fed, and the housewives are often quite deliberate in the provision of excess food like potatoes as they know that all material left over, although technically discarded for human consumption, can be utilized, not wasted, in the feeding of their live-stock. Hence all excess food and table refuse does not find its way to the waste pail of the investigator but is given directly to the live-stock at their doors. The amount of excess foodstuffs cooked and the lavishness of the parings of vegetables like potatoes, turnips, etc. depend to some extent on the season of the year and the availability of the various food materials.

In view of the fact that the percentage loss of calories in the St Andrews study was somewhat greater than that of the other groups the question immediately arose as to·whether the social status of the group played any part in the extent of the loss. It was of course to be expected that where most money is available for expenditure on food the loss will be greatest. The following tables (Tables III, IV, V and VI) give the percentage losses in the various social groupings which we had adopted in our original studies (Cathcart & Murray, 1931, 1932, 1936).

Table III. *St Andrews*

Grouping	No. of families	Average percentage loss	S.D.		P.E. of S.D
All families	149	2·67	1·345	±	0·053
Professional	6	4·12	2·219	±	0·432
Intermediate	15	2·60	1·610	±	0·198
Shopkeepers	11	2·42	1·497	±	0·215
Skilled artisans	74	2·50	1·173	±	0·065
Unskilled workers	29	2·66	1·128	±	0·099
Unemployed	7	3·28	1·249	±	0·225
Mother and young family	7	3·09	1·279	±	0·231

Note. Professional class: doctors, clergymen, etc. Intermediate class: sub-editors, shop proprietors, cashiers, etc. Shopkeepers: drapers, tailors, butchers, etc. Skilled artisans: masons, slaters, plumbers, painters, etc. Unskilled workers: carters, coalmen, labourers, etc.

In Tables IV and V the classification is made on an economic basis as the bulk of the families studied belonged to the working class. The incomes are stated as per man per week. The man value scale used was that devised by the authors.

Table IV. *Cardiff*

Grouping income per man per week	No. of families	Average percentage loss	S.D.		P.E. of S.D.
All families	53	1·06	0·759	±	0·050
I. Over 23*s*.	5	1·01	0·527	±	0·112
II. Over 18*s*. to 23*s*.	10	1·20	0·609	±	0·092
III. Over 14*s*. to 18*s*.	9	1·29	0·487	±	0·078
IV. Over 10*s*. to 14*s*.	14	1·24	0·656	±	0·084
V. 6*s*. to 10*s*.	15	0·67	0·555	±	0·068

Table V. *Reading*

Grouping income per man per week	No. of families	Average percentage loss	S.D.		P.E. of S.D.
All families	49	1·85	0·740	±	0·050
I. Over £1	3	1·47	0·772	±	0·213
II. Over 18*s*. to £1	5	1·85	1·092	±	0·233
III. Over 14*s*. to 18*s*.	6	1·86	0·679	±	0·132
IV. Over 10*s*. to 14*s*.	20	2·05	0·626	±	0·067
V. 5*s*. to 10*s*.	15	1·66	0·654	±	0·081

Table VI. *Glasgow*

Grouping	No. of families	Average percentage loss	S.D.		P.E. of S.D
All families	12	1·48	0·613	±	0·084
Unemployed families	10	1·39	0·647	±	0·098

As we could not obtain full details regarding the actual income of many of the more well-to-do families of the St Andrews study it was impossible to treat our data as in the Cardiff and Reading studies. As, however, we had available the housekeeping allowance of 103 of the St Andrews families, we regrouped them on the basis of this allowance. The following table (Table VI) shows that there is a definite but small increase in waste calories as the allowance rises.

Table VI. *St Andrews*

Mean housekeeping allowance per man per week	No. of families	Average percentage loss
I. 8*s*. 6*d*.	13	2·34
II. 12*s*. 3¼*d*.	18	2·35
III. 15*s*. 10¼*d*.	16	2·76
IV. 18*s*. 3¾*d*.	20	2·77
V. 22*s*. 2¾*d*.	21	2·82
VI. 30*s*. 2¼*d*.	15	2·89

There is then very little evidence, except perhaps in the St Andrews data, to show that social standing plays any large part in excess loss. The experience recorded in the St Andrews professional class (Table III) is, as the standard deviation clearly indicates, a matter of individual families within this small group. As a matter of fact, the variation in these six households was from 1·22 to 7·84 % loss. On the other hand the Cardiff losses, which were universally low, reached their lowest limit in the least well-paid members of

the group, whereas, in the Reading group, the smallest loss was achieved by the best paid families. It is, however, interesting to note that the greatest losses over all, even after making allowance for the great variety in composition of the families, occur not in Wales, not in England, but in reputedly thrifty Scotland.

When we turn to the consideration of the form in which the loss of calories takes place it is found for the most part that the loss occurs in the preparation of the food. It is, of course, not to be forgotten that we, in this paper, are dealing with potentially edible (this includes potato parings) calories lost. It is fully realized that there are other losses of material, of little or no value however as energy sources, like bones in the case of meat and fish, rind in the case of ham, skins of certain vegetables like broad beans, etc. which have been neglected. It is difficult to state in the form of percentages the amounts of the various materials discarded as the number of families involved in each material loss varied so markedly. It would be obviously unfair to divide calories lost, say in the form of meat, by the total number in the group if, for instance, only two families in the particular group, say of 15, wasted meat. Generally speaking, however, the great bulk of lost calories is in the form of vegetables; bread stuffs come next and then meat. It is quite true that, in certain families, losses in the form of fish, cereals, etc., were often quite marked, but in the great majority of instances they were negligible.

We were anxious to know to what extent these losses might be considered average or exceptional. In order to reach some conclusion on this rather important point we analysed the losses in a group of thirty-two St Andrews studies carried out in duplicate; one study in the spring-summer period and the other in the autumn-winter period. The results are given in Table VII.

These results are in astonishing agreement. A maximum loss of just over 6 % in a single study and of only approximately 5 % in four more certainly speaks volumes for the care in household management exercised by these housewives. Incidentally it is interesting to note that there is a general tendency for the level of percentage loss to agree in the two series. One of the most marked of the divergencies in the two studies is that of family no. 26, where we have in the first series a percentage loss of 2·7 and in the second one of 6·2. The explanation of the higher figure of the second series was a heavy loss in the potatoes.

The figures for percentage loss recorded in the present communication, even if for safety they be increased by 100 %, make it very clear that the conventional figure of 10 % which is commonly utilized to express average loss in the form of refuse and waste overstates the real position. If the families studied can be taken as an average slice of the least well-paid members of the community in Britain at least, then an allowance of approximately 5 % for the loss of potentially edible calories in an ordinary mixed diet allows an ample margin for error.

Table VII. *Percentage of total potentially edible calories, purchased as food, lost by the housewife. Duplicate studies*

Family no.	Series I	Series II
2	5·7	5·6
7	2·5	2·8
11	4·4	2·9
12	2·1	2·4
21	1·9	1·9
26	2·7	6·2
28	1·2	1·4
29	1·9	1·5
32	2·4	1·9
38	1·9	2·8
44	5·0	4·9
45	4·3	1·4
56	4·4	3·7
58	3·3	1·6
63	2·7	4·2
70	3·2	3·2
73	3·3	2·8
74	4·5	3·0
90	1·5	0·7
92	4·2	2·1
97	2·3	3·0
100	0·8	1·9
101	0·4	1·7
106	3·3	1·5
109	2·3	3·9
125	3·9	2·5
136	2·8	4·8
139	0·9	0·8
140	1·8	3·0
144	2·6	1·4
150	2·4	2·0
154	0·6	1·4
Mean and P.E. of mean	2·7 ± 0·16	2·6 ± 0·16
S.D. and P.E.	1·3456 ± 0·1135	1·3438 ± 0·1133

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