The Breakfast/Lunch/Dinner Ritual

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Introduction

Check with veterinary science experts. They will confirm that lower animals, like the rat, nibble. They seem to eat all of the time. Actually, we are told that they munch about every two hours ten or twelve times per day. These same authorities will attest that it is possible to *humanize,* as it were, the rat. Give it three-squares-a-day, it will promptly behave like a human. There will appear some of the most important risk factors for the common killing and crippling diseases. Under such conditions, there is obvious (almost human) adiposity. Very soon there are disturbances in lipid (hypercholesterolemia) and carbohydrate (adiabetogenic) metabolism.

Can one, in a sense, *dehumanize* the human? What can one expect when man is required to graze or nibble?

Much today is being written about diet/ nutrition. It is also a well-established fact that the principal emphasis is on *what* to eat. Only scant attention seems to be accorded *when/ how*. What do the experts tell us about nibbling versus gorging in the human creature?

- We wrote to the American Dietetic Association. Their public education initiative, the National Center for Nutrition and Dietetics, sent us a brochure. It never mentioned when to eat.
- We examined six recent, well-established standard diet/nutrition texts. For practical purposes, nothing was reported as to how to eat.[1-6]

This report, one in a series on *Medical Ignorance: Myths and Magics in Modern Medicine,* is intended to examine the known evidence on the subject of nibbling versus gorging in man.

Spotted throughout the literature are many interesting comments. However, in the interest of expedition and clarification, the story will center about the work of four different groups of investigators.

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The Prague Project

Paul Fabry and his group from Czechoslovakia have been one of the early and cardinal investigative teams in the nibbling/gorging debate. They have, in fact, published a score or more papers in reputable scientific journals with regard to this subject in lower animals and in the human. Their major contributions cluster around two areas.

In 1964,[7] they examined, under usual living and working conditions, 279 men (aged 60-64), the consequences of nibbling isocaloric diets on three prominent risk factors. The subjects were divided into five groups. One consumed three meals or less per day. The second ate three to four meals. The third subset ingested three to four meals with in-between snacks. In the fourth category, the consumption was three to four meals with an additional snack prior to bedtime. Finally, the last group consisted of those consuming five or more meals on a daily basis. Table 1 summarizes the results. It can be noted that overweight, hypercholesterolemia, and diminished glucose-tolerance tend to increase as the frequency of meals decreases. The difference between the extreme groups (I and V) in all parameters is clearly statistically significant.

In 1968,[8] the Czech Group once again surveyed, under epidemiologic conditions, 1133 men aged 60-64. In this analysis, the occurrence of ischemic heart disease (IHD) was investigated and evaluated using standardized criteria recommended by the World Health Organization (WHO). This delineated subjects with angina pectoris of grades I or II, a history of pain compatible with myocardial infarction, and/or electrocardiographic alterations which point to a probable ischemic myocardial lesion. Table 2 summarizes the percentage of subjects in which the IHD was diagnosed. There was a distinct relationship with meal frequency from 30% in the subgroup with gorging to 20% in the subset taking five or more meals per day.

There are many clearly identified possible •risk factors for ischemic heart disease. However, it is noteworthy that meal frequency has yet to be cited. Obviously, notwithstanding

Table 1
Percentage Incidence of Overweight, Hypercholesterolemia, and Diminished Glucose-Tolerance in Relation to Frequency of Meals

Group	Frequency of meals	Overweight	Hyper-cholesterolemia	Diminished glucose-tolerance
I	3 or less	57	51	43
II	3-4	42	35	22
III	3-4*	33	30	26
IV	3-4**	36	32	25
V	5 or more	29	18	19

* additional snacks between meals
** additional snack at bedtime

Table 2
Prevalence of Ischaemic Heart-Disease (IHD) in Relation to Meal Frequency

Group	Meal frequency	Percentage persons with IHD
I	3 or less	30
II	3-4	24
II	5 or more	20

the observation made by Fabry et al way back in the 1960s, additional work is necessary.

The Gwinup Group

We learned from the Prague epidemiologic projects of interesting, albeit correlative, relationships. Grant Gwinup and his team at Ohio State University[9] looked at lipid metabolism in a cause-and-effect model.

Five subjects were hospitalized during the complete experimental period on a metabolic research ward. Two of the volunteers had minimal to moderate hyperlipidemia; three were presumably normal. The participants received a diet containing approximately 38% carbohydrate, 18% protein and 44% fat. The caloric content of the diet was adjusted to maintain a reasonably stable body weight. This diet was provided as three equal meals per day for 14 days or longer during the first phase of the experiment. In the second study period, which also consisted of a fortnight, an isocaloric diet consisting of exactly the same foods was given in the form of ten identical feedings every two hours from 8:00 a.m. one day extending until 2:00 a.m. the next. In the third two-week session, exactly the same foods were eaten in a single daily meal taken between 4:00 and 5:00 p.m. Three times each week blood was drawn from the subjects in the fasting state for lipid analysis.

In every case, there was an increase of serum lipids during gorging and a decrease while nibbling.

The diagnostic value of the highly popular glucose tolerance test (GTT) is a function of many factors. A number of these are cited routinely in the literature. Perhaps the most common is a high pretest carbohydrate diet for approximately three days. One area, notably absent, is the effect of the frequency of meals prior to the initiation of the test pattern.

These investigators studied the glucose tolerance response to different pretest conditions.[10] In one instance, the 24-hour allowance of food was distributed evenly throughout the day (nibbling). Another subset was analyzed after the daily allowance was consumed as one meal (gorging). Four subjects remained in a metabolic research ward throughout the entire investigative period. Two had minimal hyperlipidemia, the other two apparently demonstrated normal serum lipid levels. It is important to underline that none was known to be diabetic. The calories required to maintain body weight were estimated from a careful dietary history and the subjects were placed on a regimen containing approximately 38% carbohydrate, 17% protein and 45% fat. This diet was initially provided as three meals daily. At the end of the period, a standard and

classical oral glucose tolerance test (OGTT) was performed. The second phase of the experiment consisted of 14 days or longer in which an isocaloric diet, consisting of precisely the same foods, was provided in the form often identical feedings every two hours from 8:00 a.m. until 2:00 a.m. the following day. At the end of this session, the glucose-tolerance test was repeated. The third period consisted of 14 days or longer during which precisely the same foods were provided in a single daily meal consumed between 4:00 and 5:00 p.m. The GTT was once again performed.

It is essential to underline that the effect of the periodicity of nutrient intake in the days preceding these tests had hitherto not been investigated and reported. Regardless of whether the previous diet had been gorged or nibbled, the body has been assumed to handle glucose in exactly the same manner.

The evidence in this experience suggests that, one can as it were, create a more or less diabetic glucose tolerance pattern by providing a gorging versus nibbling diet the day before the GTT. This gains in importance when it is recognized that diabetes is currently diagnosed largely on the result of a properly performed glucose tolerance pattern. The studies reported here suggest that proper dietary preparation for this test should take into account not only the quality and quantity but also the frequency of the ingested food.

The Cornell Studies

Charlotte Young and her associates in Ithaca have also made some innovative contributions to the grazing phenomenon. For one, they studied both presumably healthy and obese human subjects. Secondly, the experimental design included one, three, and six meals per day. Finally, her team was one of the early observers of the effects of nibbling on the serum triglycerides.

Eleven moderately obese young college men, engaged in their usual activities, were subjected to weight reduction on a rigidly controlled, 1800 calorie diet, fed either as six, three, or one meal(s) per day.[11]

The effects of the various frequencies of feeding on the utilization of carbohydrate and fat were carefully scrutinized. Several points warrant emphasis. For one, the OGTT was reduced when a regimen of one meal a day was followed. However, increasing meal periodicity above three meals daily did not influence the results. Secondly, serum cholesterol with one meal per day was significantly higher than on the six- or three-meal regimen. Lastly, serum triglycerides were convincingly higher on one meal a day versus the three or six.

The Cornell Group also studied healthy subjects. The effects of frequency of feeding of a constant diet as six or one meal(s) per day, following baseline measurement of three meals on a daily basis, were observed in ten normal, presumably healthy, college men during a 15-week weight maintenance study.[12] They discovered glucose tolerance appears to decrease on one meal per day in comparison with the three or six meals daily, whether measured by oral or intravenous tolerance testing. This, it should be recalled, had earlier been observed in obese subjects. Next, serum cholesterol was measurably higher on the one meal per day regimen. Finally, subjective responses on a confidential written questionnaire indicated that approximately 60% of the participants reported an overwhelmingly greater need to sleep after the one large meal experience. A like number commented on the distraction of extreme hunger during the day. In terms of preference for six versus one meal(s) daily, 40% preferred one meal largely for reasons of convenience; three out of ten voted for six principally for comfort; the remaining one out of three were ambivalent.

The Toronto Team

David Jenkins and his cohorts originally started their studies in Oxford. However, their principal and more recent work hails from the University of Toronto. We shall dwell on their work for a number of reasons. In the first place, their observations are the most contemporary information on the grazing phenomenon. Employed is the most exotic experimental design which includes nibbling 17 times per day. Finally, it is important in the history of the nibbling experience because it looks at the metabolic state in ways not previously considered.

These investigators studied the effect of increasing the frequency of meals on serum lipid concentrations and carbohydrate tolerance in allegedly normal subjects.[13] Seven men were assigned in random order to two metabolically

identical diets. One regimen consisted of nibbling 17 snacks per day (which incidentally covers the waking hours). The other consumed three meals daily (gorging). Each plan was followed for two weeks. As compared with the three meal scheme, the nibbling plan reduced fasting serum concentrations of total cholesterol about 9%, low-density lipoprotein cholesterol (14%) and apolipoprotein B approximately 15%. Of particular note is the fact that the average insulin level decreased about 28%. In addition, the mean 24-hour urinary Cortisol excretion was lowered approximately 17%.

Jenkins and his associates also studied food-frequency in 11 non-insulin dependent diabetics.[14] In one given day, they took 13 snacks (the nibbling phase) and on another day, the same food was taken as three meals and one snack (the three meal diet). The nibbling reduced meal blood glucose by approximately 13%. Serum insulin declined 20%. Serum triglyceride concentrations were lowered about 9%.

One other highly innovative experiment was also released from Toronto.[15] The design was prompted by the fact that modifying the rate of food absorption has been proposed as a therapeutic principle of specific relevance to diabetes. To corroborate clearly the metabolic benefits that might result from reducing the rate of nutrient delivery, nine supposedly healthy volunteers took 50 grams glucose in 700 ml water on two different occasions: over 5-10 minutes (the bolus regimen) and at a constant rate over 3.5 hours (sipping). Large reductions were seen in serum insulin (about 54%) after sipping. An intravenous glucose tolerance test (IGTT) at four hours demonstrated a 48% more rapid decline in blood glucose following sipping versus the bolus. Hence, it is fair to conclude that prolonging the rate of glucose absorption enhances insulin economy and glucose disposal.

Comments

As we have indicated at the outset, much today is being written about diet/nutrition. It is also a fact that the principal emphasis is on *what* to eat. Only scant attention seems to be directed to *when/how*.

Within these pages, we have historically summarized, by representative studies, the story of grazing (nibbling) versus gorging. The picture is obviously not complete. The answer would not all be available even if we reviewed the literature comprehensively. Surely, more work needs to be done. Sample sizes ought to be larger. Longer duration of the experiments would help better understand the phenomenon. Other metabolic pictures besides carbohydrate and lipid metabolism (and more on protein) would certainly add significance to the body of knowledge.

There are reports to remind us of our incompleteness. R. J. Jarrett of the Guy's and St. Thomas Hospitals emphasizes some of the shortcomings and pessimistically concludes, "Thus while sheep may safely graze, there is little evidence to recommend grazing for the man in the street and none at all for the woman."[16]

On the other hand, Thomas Wolever, one of the Toronto Team,[17] optimistically provides more specific and constructive caveats. He points out that there are indeed unanswered questions like, "How many meals are required to obtain an effect?" However, he is confident that the voids can be filled.

Perhaps the greatest contribution of this fascinating story is that it adds to the general body of fact regarding homeostasis.[18] No question ... how well we fare in health and sickness is largely a function of the human organism's ability to deal with the challenging external world. No question ... the capacity to adapt or resist these many and different outside challenges is variously described as host state (tissue tolerance, resistance/susceptibility, constitution, predisposition, coping and immune systems, or homeostasis). No question ... this internal world is measurable and map-pable. No question ... its cardinal characteristic is its stability. And, no question, from these nibbling studies, it appears that the reason why the organism improves is because of a return to homeostasis. This is borne out in many instances by the reduction in insulin and the changes in Cortisol.

Conclusions

Well known is that lower animals, like the rat, nibble their food. In their pristine environment, these creatures fare well.

Less known, but equally true, is that the rat, when humanized (provided with three squares-a-day) acquires human characteristics. One can expect, with reasonable predictability, some of the major risk factors for the most epidemic killing and crippling human diseases. The rat becomes

obese, the cholesterol rises, and there are blood glucose aberrations of a diabetic nature.

Less well-known is the sequence of events which follows the dehumanizaiton of the human in the sense of providing man with a nibbling diet. The admittedly limited evidence available all suggest that some of the human risk factors happily vanish. Obesity is muted. Carbohydrate and lipid metabolism are righted.

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