GOOD QUESTION

Is an irregular meal pattern really that bad?

By Lorenzo Pansini

A very widespread hypothesis in recent years is that irregular meal patterns have negative metabolic effects compared to a regular pattern. These include reducing the thermic effect of food (TEF), worsening insulin sensitivity, lipid profile and appetite control, and increasing various risk factors, including fat gain.

A series of famous and often cited controlled studies have given credence to the common hypotheses that it would be better to maintain a regular meal pattern/frequency; not only for health, but also for aesthetic purposes. The topic had already been addressed in some AARR issues several years back, first by Alan himself in the June 2009 issue, and then by Vårvik in the March-April 2015 issue. Considering the existing scarcity of critical analysis alongside recurrent reference to this line of studies, I wanted to offer my take on this very controversial topic.

Common features of study design

The study design in the series of studies is broadly the same.[1-6] A group of 9-10 healthy women participate in two diet phases in a randomized crossover design, lasting 14 days each. In one phase the subjects follow the diet with 6 meals a day, while in the other phase they follow the diet but with highly variable meals from day to day, between 3 and 9 meals, a pattern that they call "chaotic eating." The two phases are separated by a 14-day washout in which they follow a diet with a habitual pattern. To avoid the confounding impact of the menstrual cycle on the various parameters, each intervention period always starts in the first 1-7 days of the same period of the cycle (follicular phase).

The first studies of the series

In the first two studies of the series, published between 2004 and 2005, the results of irregular meals were quite negative. In the first study on lean women, a decrease in TEF, an increase in total and LDL cholesterol, and a worsening of fasting and post-prandial insulin sensitivity were observed.[1,2] The second study confirmed the worsening of the same parameters on obese women (except fasting insulin).[3] In addition, in the regular pattern obese women ingested fewer calories, which was not observed for lean women.

Despite being considered significant, the differences in TEF in response to a test meal (15 kcal/kg) in lean women were just ~15 kcal over 3 hours,[1] and in obese women the differences were even smaller.[3] The differences in the lipid and glycemic profile were also minimal, despite the possibility of further worsening in the long run. Finally, the average energy intake in regular treatment for obese subjects was less than ~80 kcal compared to the regular one.

The important limitation common to this first series of studies was a poor energy balance control: not only was the diet habitual, but the activity was also not controlled. The results were therefore confused by an unmatched energy balance, probably more marked in the trial on obese subjects, as suggested by the greater intake reported in the irregular treatment, and the natural propensity of obese women toward underreporting.[4] Although the unmatched free setting better mimics a real world scenario, TEF, lipid, and glycemic profiles may be very sensitive to these disparities.

The latest studies of the series

In 2016, two co-authors of the original team published a new follow-up on lean women, greatly improving the quality of the study design to rule out the energy mismatch between treatments.[5] This time the meals were provided by the researchers ensuring calorie control at maintenance levels, while activity levels were also controlled with questionnaires.

Also, this time the irregular "chaotic" pattern caused a decrease of TEF and post-prandial insulin sensitivity, lower fullness ratings and hunger suppression, but lipid profile showed no worsening. The same researchers confirmed that the differences in lipid profile compared to previous trials could have been explained by the better energy intake control.

The TEF differences were irrelevant, just ~20 kcal on average over 3 hours in response to a ~580 kcal meal (15 kcal/kg). The post-prandial glycemic response

(incremental area under the curve; iAUC) which significantly worsened with irregular treatment, deserves greater consideration.

Further follow-up on obese women with the same design was published only as abstract that same year,[6] still showing a TEF decline with the irregular pattern (other parameters were not reported). But in this case the differences were even smaller, with a variation of ~5 kcal over of 3 hours.

Further limitations

It must be considered that these studies were authored by the same research team and with the same study design, with the strong risk that the general conclusions are biased. Before drawing firm conclusions, the topic should be explored by other research teams with more meticulous methods and possibly longer-term designs.

An important limitation is the short duration of the single treatments. It is possible that the relative worsening of the various parameters in the long term may re-establish over time and/or be overwhelmed by other more important factors, such as healthy nutrition and lifestyle (including exercise). The short duration also prevented to establish the effect of the different protocols on body composition, which ideally would require several weeks.[7]

Another very important limitation is that such a systematic meal frequency variation from day to day is completely unrealistic, although perhaps justified by experimental needs. The "chaotic" irregular protocol always provided for extreme variability within the two thresholds between 3 and 9 meals (ie 7, 4, 9, 3, 5, 8, 6, 5, 9, 8, 3, 4, 7), It is quite likely that the impact would have been very different with a more contained, realistic and sporadic variability. For example between 3 and 5 meals as most people would do in the real-world scenarios. From a practical perspective, these extrapolations are very relevant.

Hunger and fullness were measured with subjective ratings in single days, preventing a complete picture of appetite control and energy intake, even less in the long term. Furthermore, the subjects were women, so the generalization of conclusions to men remains open to speculation. Therefore, based on this series of studies, it cannot be extrapolated that the variation of meal frequency on weekly basis, in general, is deleterious on the various parameters assessed.

Is there any other research on irregular meals?

The studies discussed above are often considered to be the only ones that have investigated the effect of meal irregularity on metabolic and health parameters, but that's not the case. The term *Intermittent Energy Restriction* (IER) was originally used mainly to identify those intermittent fasting (IF) super-family patterns consisting of 1-4 so-called *fast days* in the week, alternated with the remaining weekly days around maintenance or ad libitum (*feed days*). Fast days usually consist of a *semi-fast*, with a calorie restriction of around 75% of energy needs.

Perhaps the most famous type of IER-style IF is *alternate-day fasting* (ADF), which alternates *feed days* and *semi-fast days* every other day over the week. The IER-ADF pattern inevitably alters the regularity of meals on a regular basis, because it goes from days of energy abundance to total or semi-fasting, so the number of meals is adapted to the daily calorie intake. Since in the semi-fast days those few calories are often located in a single eating occasion,[8] one could define the most common semi-fast ADF version as an "alternate-day OMAD" (one meal a day).

Well, the research that compared the IER-ADF to chronic calorie restriction shows similar, and sometimes better effects than a low-calorie diet with a more regular patterns on various parameters, such as lipid profile, blood sugar, insulin and appetite.[8-10] Most importantly, the IER studies are much more numerous and also of very long duration (>6 months), showing that weight/fat loss is overall similar to the regular patterns.[8-10] Although the inherent energy restriction of the IER could overcome the hypothetical side effects of the irregular pattern, this vast amount of data strongly challenges the hypotheses expressed above.

Conclusions: irregular eating is not necessarily chaotic eating

Claiming that meal irregularity is harmful to health and bodyweight seems a somewhat hasty conclusion, based only on three short-term peer review RCTs conducted by the same research team, and based on a totally unrealistic pattern that virtually no one would follow spontaneously.

On the other hand, other literature that tells another story refuting these widespread alarmist views is often ignored.

Although further research is required, I believe that from a practical standpoint, the irregularity of meals is not a problem if it is kept within certain moderate, reasonable, and realistic criteria. For example, it's hard to believe that varying the number of meals on a few days of the week from the habitual 6 to 3-4 meals (perhaps skipping breakfast or snacks occasionally) has some negative impact. That can be especially true for the physique population, accustomed to a precise calorie, diet quality, and activity control, and regular training.

Finally, I will share our friend James Krieger's thoughts on a question I asked him on the topic for his Weightology Research Review in 2019:

"There is likely little tangible benefit in terms of health for a regular feeding pattern versus irregular pattern. The tangible benefits of regular patterns may be more psychological (i.e., helping someone control calorie intake through the establishment of a routine and habits)."

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