Peanut Butter to the Rescue?

Ready-to-Use Therapeutic Foods

by
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Part I – The Flash of Inspiration

Andre Briend tells of a eureka moment, the moment when he suddenly realized that the answer he had been seeking for years in his laboratory was sitting on his breakfast table. A physician and researcher in a French government lab, Briend was working on the development of therapeutic foods for combating undernutrition in children. For more than 20 years, the best option had been a fortified milk powder, F100, but the need for clean water and refrigeration meant that severely malnourished children had to be fed in a hospital or feeding center. This often meant that mother and child had to spend as much as a month away from home. Briend had been experimenting for some time with putting F100 ingredients into a bar form, but had not been able to produce a bar that would hold up in hot weather. Then one day he watched his son eating chocolate hazelnut spread, and came to the startling realization that the ideal therapeutic food would be a sweetened and fortified nut butter. From this, he went on to develop a product consisting of peanut butter mixed with milk powder, vegetable oil and sugar, fortified with vitamins and minerals. Although now made by a variety of organizations, Briend's product was marketed initially under the name of Plumpy'nut, by the French company, Nutriset, which specializes in producing foods for relief organizations. The fortified spread is packaged in foil, has a shelf life of at least 2 years without refrigeration, and requires no preparation. Children can feed themselves the sticky paste directly from the foil pouch.

Questions

1. What advantages does a fortified nut butter such as Plumpy'nut have over F100?

2. What are some possible disadvantages of a fortified nut butter?

3. Based on the description of the ingredients, what macronutrients would fortified nut butter provide? What symptoms of undernutrition would be addressed by the macronutrients?

4. Plumpy'nut is also fortified with vitamins A, D, E, C, B1, B2, B6, B12, K, folate, biotin, pantothenic acid, niacin, calcium, phosphorus, potassium, magnesium, zinc, copper, iron, iodine, sodium and selenium. Based on the list of vitamins and minerals, what benefits would you expect that children would receive beyond gains in height and weight?

Part II – Testing in Malawi

Mark Manary is a pediatrician and researcher working on malnutrition in the School of Medicine at Washington University in St. Louis. Early in his career, he spent 10 weeks living in a village in rural Malawi, seeking to understand the full range of issues surrounding hunger and malnutrition in such a setting. He came to the conclusion that a new strategy was needed for treating severe malnutrition. Ideally, children should be fed at home with an energy-dense food that is non-perishable and needs no preparation.

Manary decided to put Andre Briend's fortified peanut butter to the test as a ready-to-use therapeutic food (RUTF) for severely malnourished children in Malawi. The purpose of the study was to see if fortified nut butter was at least as effective at recovering growth in children as more conventional foods used in hunger relief.

Malnourished children were assigned to three groups for treatment at home. One group received enough of the ready-to-use therapeutic food (fortified nut butter) for their entire caloric requirement in individual single serving packets. A second group received a smaller amount of the fortified nut butter, a snack amounting to 33% of their daily caloric requirement, to supplement the diet provided by the family. A third group received a fortified mix of corn and soy flour to use to make a soft dough, a Malawian staple. Each household in this group received enough of the corn/soy mix to feed the entire household, along with other traditional low-density Malawian foods, and a vitamin and mineral supplement for the affected child. Parents receiving the corn/soy mix were instructed to feed the child participating in the study 5–7 times per day.

Two features of the study design are worth noting. First, all children received a treatment, either a treatment in widespread use, or two proposed new treatments. Second, the researchers initially sought to assign children to different diets randomly. However, this did not fit with local perceptions of fairness, and they found it necessary to change instead to assigning all of the children seen in the clinic on particular days to the same treatment group.

Questions

1. What are some of the strengths and limitations of a home-based study?

2. Why were all children treated for malnutrition instead of leaving one group as a control?

3. Why was it necessary to modify the study design in response to a local understanding of equitable treatment (or more generally, to local conditions)?

4. Poor families in Malawi often eat from a communal bowl. How might this affect the nutrient intake of children, and the ability or willingness to follow the instructions provided by the researchers?

5. Why did researchers provide the corn-soy blend to the entire family, rather than for the child alone? Why did the researchers ask families to prepare the corn-soy blend 5–7 times a day, and what challenges would families face in doing so?

Part III – Examining the Evidence

Manary and his coworkers wanted to see if children fed the fortified peanut butter could catch up in growth as well as, or better than, those fed the more typical corn-soy product used for aid. To do so, they needed to use methods that pediatricians and researchers studying children's health routinely use to compare children's growth. They were particularly interested in wasting, one particular symptom of severe malnutrition. Wasting is defined as low weight for height. A child who exhibits wasting is most likely losing muscle mass as a result of inadequate calorie intake. Diagnosing a child with wasting requires comparing the individual child with other children, and this is done using Z scores.

Researchers use Z scores as a way of standardizing normal curves so that two different curves can be compared to each other. Where values in two distributions are very different, it is easier to compare distributions with reference to the standard deviation. This is done by subtracting the mean from individual values and dividing by the standard deviation to yield a Z score. So in the case of growth patterns in children, Z scores are useful because human populations vary in height, and Z scores offer a way of comparing tall and short populations.

For wasting (low weight for height), the average weight for height (WHZ) is set to zero, and individual children are described by a z-score representing the number of standard deviations from the mean. Moderate wasting is defined as a Z score between –2 and –3 standard deviations, and severe wasting is defined as Z score less than or equal to –3. So a child who is two standard deviations below the mean or more in weight for height is definitely too thin, irrespective of height.

All of the children in the Manary's study were moderately malnourished, with weight-for-height Z scores of –2 or lower at the start, and the researchers were interested in how the three diets affected growth. They were particularly interested in the fraction of the children achieving catch-up growth, i.e., reaching a WHZ score greater than or equal to zero. Results of this comparison are shown in Figure 1 below, obtained from Manary *et al.*, (2004). They also examined weight gain, height increase, and mid-upper arm circumference (MUAC) in the children treated. These results are shown in Figure 2, also from the same study.

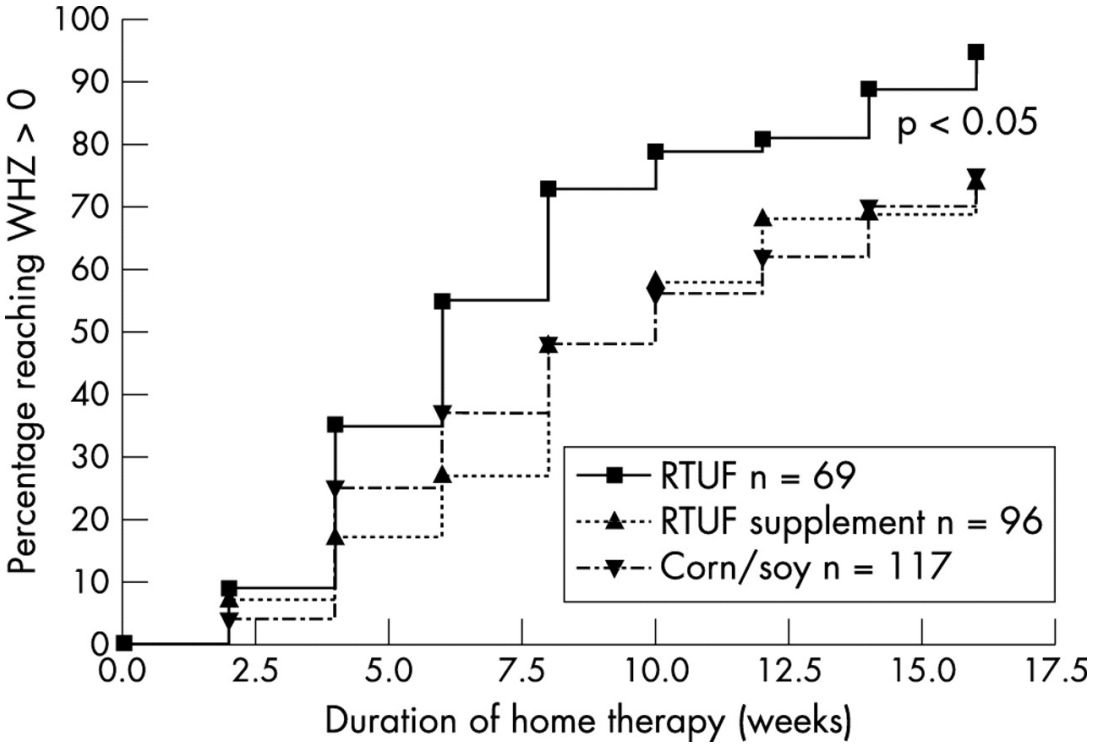

Figure 1. Time to catch-up growth (WHZ>0) with the three treatments. Reproduced from *Archives of Disease in Childhood*, M.J. Manary, M.J. Ndkeha, P. Ashorn, K. Maleta, A. Briend, 89, 557–61, 2003, with permission from BMJ Publishing Group Ltd.

Questions

1. Based on Figures 1 and 2, which group achieved full catch-up growth?

2. Children in the study group that ate only the fortified nut butter grew more slowly than expected based on a theoretical model. What could be some possible reasons for this?

3. What factors might account for the slower growth among children receiving the corn-soy mix in comparison to those receiving either treatment with the fortified nut butter?

4. The fortified nut butter product contains milk powder, whereas the corn/soy group were not given any animal products. What disadvantages might there be in an entirely plant-based diet for very young children, especially those that are already malnourished?

5. Why do you think that the group given fortified nut butter as a snack did not gain weight as fast as those who ate only the fortified nut butter?

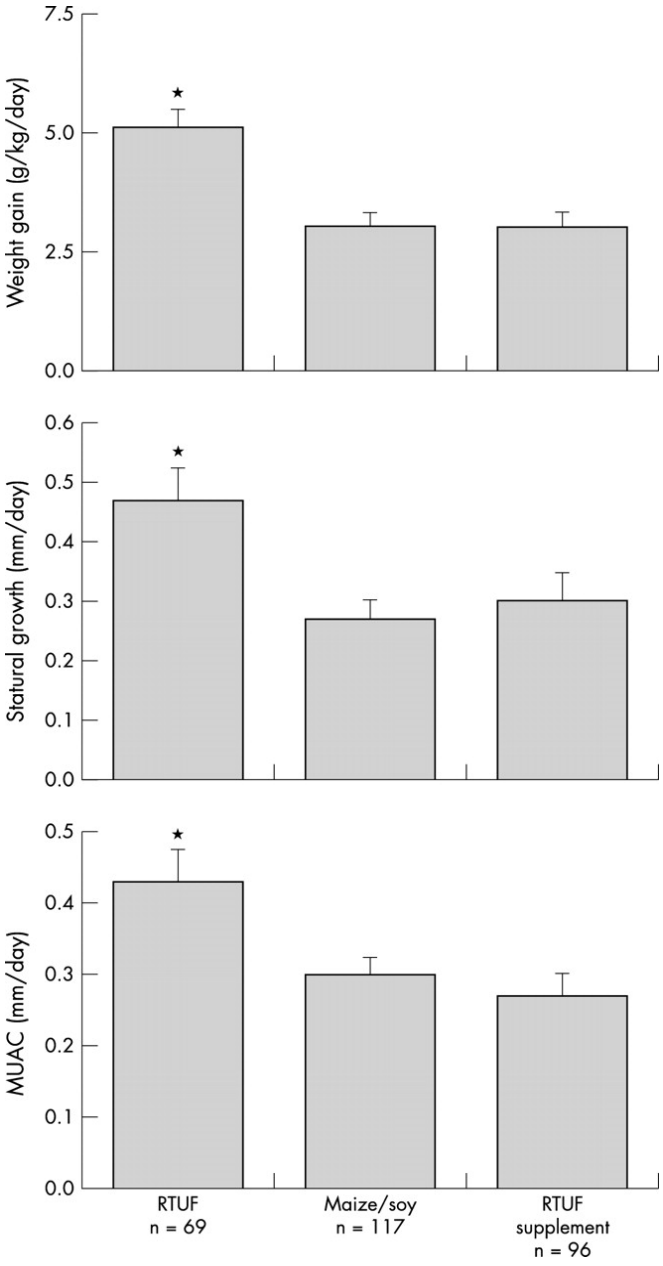

Figure 2. Gains in weight, height and mid upper arm circumference (MUAC). Reproduced from *Archives of Disease in Childhood*, M.J. Manary, M.J. Ndkeha, P. Ashorn, K. Maleta, A. Briend, 89, 557–61, 2003, with permission from BMJ Publishing Group Ltd.

6. The cost of the fortified nut butter diet is greater than that for the corn/soy mix. Do the improvements justify the extra cost?

Part IV – Preventive Supplementation in Niger

After Manary's pioneering studies, the use of fortified nut butters for treating severe malnutrition has become more widespread, and this led Isanaka and coworkers (2009) to ask a new question: could the fortified nut butter be used preemptively in situations of food insecurity to keep children from developing severe malnutrition? These researchers set out to investigate whether using a therapeutic food would be useful before children become severely malnourished. Isanaka and coworkers decided to answer this question in Niger, where families are often short of food during the two months before the harvest of millet and sorghum.

To answer this question, a different formulation of the RUTF was used, one that was designed for supplementing a regular diet rather than as a meal replacement. This product was packed in large jars rather than individual foil packets.

This time, the researchers were interested not only in wasting but also in stunting, defined as two standard deviations or more below the mean height for age. Stunting is another common manifestation of undernutrition in children, and is indicative that a child has enough calories to maintain but not to grow. Stunting, especially in very young children, is associated with cognitive delays and learning difficulties. If not addressed, stunting can become permanent.

Isanaka and coworkers initially proposed dividing each village in the study into two groups and assigning one group to receive the supplement. However, community members were uncomfortable with the idea of some children in a village getting a supplement and others getting none. They preferred that all children in the same village receive the same treatment, and that comparisons be made between communities. Children from villages with and without the intervention were compared for evidence of stunting or wasting, as well as for mortality and morbidity from malaria, diarrheal illness and respiratory infections. Results from the study are shown in Figure 3.

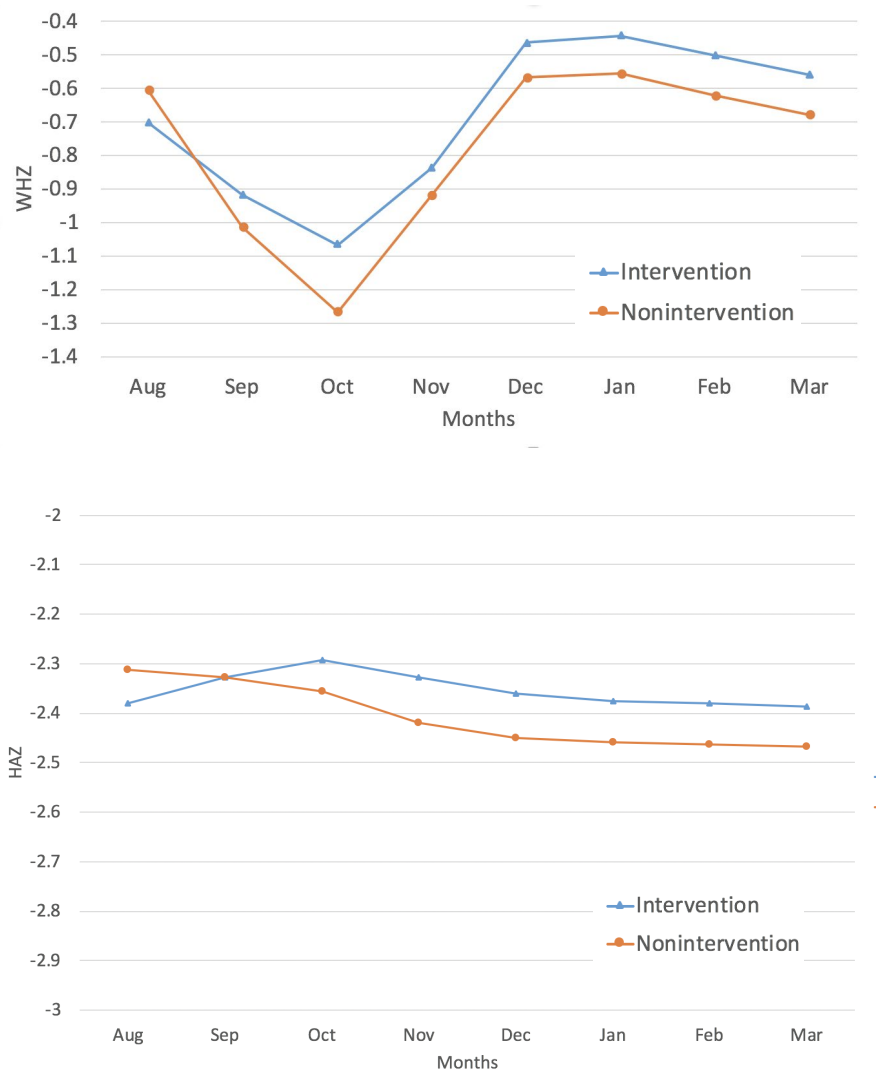

Figure 3. Weight-for-height Z scores (WHZ; above) and height-for-age Z scores (HAZ; below) from August 2006–March 2007. Based on data from Isanaka *et al.* (2009).

Questions

1. Why did the researchers adapt their study design in response to villagers' concerns?

2. What problems can you see in the design of this study?

3. Why did the authors also look at morbidity and mortality associated with malaria, diarrheal illness and respiratory infections?

4. According to the authors of the study, morbidity and mortality were higher in the children in the control group, but not significantly so. Why would the authors report these observations, even though there is no statistical significance?

5. Based on Figure 3, was the suppliment intervention successful? Look very carefully at August, September and October.

6. Given that improvements seen were fairly small, is preventive RUTF supplementation cost effective?

Part V – Applying Evidence in Decision-Making

You are working for a non-governmental organization dedicated to ending hunger in rural Africa, and are specifically assigned to a team focused on Niger. Your boss has asked you to evaluate the evidence for use of peanut-based supplements, and to make recommendations for her. In making your recommendation, you are free to consider the costs and benefits from the research you have already studied. You may also consider other data you would like to have in order to make your decision, while understanding that often professionals must act on the basis of imperfect data. You are also free to investigate other options and consider other related questions. Related questions you may want to consider are whether there is a way to reduce the cost of the ready-to-use therapeutic foods, and whether there are other other ways that an aid organization could help reduce hunger in Niger. Your recommendation should consider both immediate actions and long-term strategies.

- What recommendation will you make and why?
- With your group, write a brief, one-page bulleted list of your recommendations; provide a brief justification for each.

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Further Reading

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