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A new dawn is on the horizon for one of the world’s oldest foods. Seaweed. Currently being touted as the next big thing in food, seaweed has already been a critical component of nutrition throughout human history as evidenced in archaeological sites and historical documents. Today it is still a major food crop throughout the East, but it remains to be developed in the western world. In addition to addressing major global health challenges, seaweed holds the promise of a future of a more sustainable human existence through better food production practices.

A long nutritional legacy

The earliest humans to colonise the Americas did so with the help of seaweed. Middens (archaeological remains) in inland Chile evidence the importance of seaweeds for nutrition and health over 13,000 years ago, and how people travelled and traded over long distances to access seaweed and bring it back to inland communities. China is an outstanding example of how they have known about this type of health deficiency and practiced iodine supplementation with seaweed for close to 5000 years.

Throughout the Pacific Islands seaweeds were used for health boosting properties, and even Captain James Cook and his fleet were treated with seaweed by local Tongans to recover from the poor nutritional lifestyle of long voyages. Hawaiians were known to eat up to 75 species of seaweeds. Try counting up to 75 types of land crops that we eat from all over the world and you can begin to understand the breadth of seaweed diversity at even a small local scale. Australia as one of the biggest Pacific Islands also holds a uniquely rich diversity of seaweed species that have been unexplored in the modern world.

Global battles have been fought with the power of seaweed. The Maori Battalion marched and fought in the Second World War munching on nori, also a traditional food in New Zealand where it is called karengo. Packed with nutrients, it is also easy to dry and eat. Seaweed can be harvested and stored, taken on long journeys, and added to flavour any dish anywhere.

Ancient Europe and the Mediterranean nations also have a history of using seaweed; from Vikings to the Celts where seaweed was an essential part of nutrition in black salts and laver bread, to ancient Greek medicine. But the modern Western food plate has forgotten the power of seaweed, and this is to our detriment in health as well as the opportunity for a more sustainable future of food production.

A potent package of health solutions

So many of the population’s extensive and chronic nutritional deficiencies can be overcome with simple seaweed fortification of our food chain. Inland communities can suffer from trace element malnutrition
unless the geology adequately replenishes the soils, and thereby provide plants and animals with what they need. Trace element deficiencies in agriculture present global scale health challenges. Iodine deficiency is still one of the leading causes of hormonal imbalances and mental impairment around the world, while iron deficiencies lead to about 20% of maternal deaths in India (Anand, Rahi et al. 2014). These problems don’t just affect developing nations; it is estimated that up to one third of the global population is at risk of iodine deficiency still today, and this is measurable as a difference in the intelligence quotient (IQ) of up to 12 points on a population scale. All you have to do is add a bit of seaweed rich in iodine to your food as a sprinkle of salt replacement or condiment, and the daily dose is provided for. In India, anaemia has been overcome in teenage girls simply with seaweed fortified chocolate.

Other key chronic deficiencies include omega-3 fatty acids. Because modern world food practices generally do not include four servings of fish per week, we are not getting enough omega-3 fatty acids like EPA and DHA. If omega-3 is deficient throughout life the consequences can affect our mental capacity and function and potentially result in aggressive and impulsive behaviour. The many biological benefits of omega-3 include regulation of a range of inflammatory and aging processes. But fish don’t make omega-3 either. Like us they get it from the food chain: seaweed and algae are the original manufacturing houses of omega-3 molecules. Therefore, even if we don’t eat seaweed, it is important that our food chain does. Marine animals lose their marine omega-3 rich profile if they eat formulated feeds that are effectively made from the same ingredients as our mass processed foods from land. Adding seaweed to our animal feeds can recover this profile and turn seafood back into seafood, or even increase the omega-3 profile in land animals.

A less recognised potential of seaweeds for human nutrition, that is becoming evident, is as a potent source of non-digestible dietary fibre. This is the fibre that has an important role for the microbiome (bacteria) within our gut, which in turn supports a whole raft of processes that are important for human health; not least of which is the regulation of inflammatory processes and auto-immune disorders. There are now scores of inflammatory diseases, from heart disease and multiple sclerosis to diabetes and arthritis to psoriasis, that are associated with triggers from gut dysbiosis (imbalance in gut bacteria), in part due to a chronic global dietary deficiency of diverse fibres by about 50 percent. In Europe it is estimated that there are over 100,000 deaths and over 1.5 million Disability Adjusted Life Years (DALYs) annually linked directly to low dietary fibre intake. Seaweed could be considered the king of dietary fibres, as it does not need to have the tough lignin type fibres to support its weight against gravity, and therefore has a majority of fibres that can interact with our gut flora. However, it is important to select the species that can deliver high fibre without overdosing trace elements such as iodine, as well as the right types of fibre.

A long road ahead to regain lost knowledge

The tempo in seaweed and health-related research is accelerating, and we have a lot to learn. Vital health opportunities are lost each day that our limited knowledge leads us to poor food choices. But there are also health risks if we jump into solutions without understanding the big picture. Seaweed is not a uniform nutritional context. It is a bit like saying that plants are good for you, but a potato doesn’t have the same nutrition and health support as say a blueberry, and some plants are definitely poisonous. Different plants are healthy or risky in unqiue ways, and similarly seaweeds are not all the same. Indeed some mistakes have already been made by overdosing soy milk products with high iodine content seaweed extracts, without understanding that some brown kelp seaweeds can only be ingested in small doses. (Iodine is an essential nutrient but is also toxic in high doses.) This is the learning experience that science is going through now – which seaweeds will help us in which ways? An Australian report published last year outlines the basics of what to consider in terms of nutrition and safety aspects for seaweed in human health, and what things need to be considered for different types of seaweeds (Winberg 2017) (Fig. 4).
Ironically there are plenty of animal studies and particularly livestock studies using seaweed that are showing us the way to human wellbeing. Seaweeds are a regular component of many livestock feeds, not least of which is for the racehorse industry. Early human clinical trials in this space are now emerging. Recently a group of French researchers tested the relationship between seaweed and happiness. Their clinical trial may have connected seaweed to the brain via the gut. This study found that when over 40 participants who had adhedonia (depression in the form of a lack of happiness) took seaweed dietary fibre type supplements for 3 months, they significantly increased their levels of happiness, compared to a group of 40 who were on a placebo treatment.

Mental health conditions are increasingly being linked to gut health and inflammatory states, and the same research group previously showed that livestock eating seaweed had reduced systemic inflammation. Similar human studies are currently underway. Not only do the seaweed dietary fibres seem to be important for gut function and down-regulating inflammatory conditions, but the peptides in seaweeds have also been recently shown to reduce TNF-alpha; a system-wide inflammatory cytokine that was reduced in liver cells after exposing them to a particular types of green seaweed peptides. Rich peptide (protein) and phenolics (antioxidant) fractions might also be equally as helpful as the dietary fibre fraction.

**Seaweed and our future**

The sustainability aspects of seaweed production take us to a new level of why we should be farming seaweed for health. Its productivity rates in culture can be as high as 20 times that of other food production sources on a given area of land. Therefore seaweed starts to become competitive even in other food areas that are not deficient for the most part today. If you consider that seaweed can comprise up to 40% protein, depending on the species and the sources, and that this protein can be complete in essential amino acids and comparable to other protein sources (Fig. 5), then suddenly there is an opportunity to reduce the footprint on the environmental burden of agriculture. This includes efficiencies of carbon footprints, soil leaching and reduced freshwater use for food production. Seaweed really can take us back to the future.

*Figure 4. The iodine content in 10g different dried species of seaweed, and the upper limit of safe daily iodine intake.*

*Figure 5: The essential amino acid profile of seaweed protein from a species of Ulvacean seaweed, compared to other crop sources of protein.*
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THE TROUBLE WITH DIETING

Stephanie Osfield, Award Winning Health Journalist

Most people who want to shed kilos think that going on rigid diets or eating as little as possible is the best approach. Yet your body is hard-wired to fight weight loss, so in the long term, dieting may actually encourage weight gain.

The dieting backlash

When you slash your food and kilojoules intake, this stresses your body, which responds as though your survival may be under threat. Your body is very clever, so it activates defence mechanisms to fight weight loss. Rigid diets and eating approaches can lead to the following negative knock-on effects which can continue for months or years:

Higher levels of hunger

Many people complain of feeling hungrier when they go on a diet. This is not simply a psychological response, where restricting food makes you want it more. The change in hunger occurs because your body alters numerous hormones in an attempt to fight weight loss. When people diet, their body produces more of the hunger hormone ghrelin and less of the fullness hormone leptin.

Loss of muscle

When you diet, it’s often muscle mass that you lose. Although your body will try to restore this, it takes time. When you stop the diet and return to your usual eating patterns, the initial weight regain comes with a greater initial increase in fat mass and lower muscle mass. As muscle is more metabolically active body tissue and helps you burn more kilojoules - even when you’re at rest - having less muscle slows your metabolism.

Weight gain

A large review of 31 long-term studies by the University of California not only concluded that diets don’t work – it found they may actually make you gain weight. Although people may initially lose 10 percent of their weight, after the diet they often regain the weight they lost plus extra weight, the research showed.

A slower metabolism

Although you may at first shed kilos on fewer kilojoules, this eating style can then slow your metabolism. When people dramatically reduce their intake of kilojoules there is a reduction in their basal energy – the energy used to fuel basic body functioning. This is often called the ‘starvation response’ because as you eat less food your body stops using as many kilojoules. It becomes more ‘efficient’, because it shuts down any processes that are not essential to life. One of the first non-essential processes it shuts down is the production of body heat. This is one of the reasons why people often complain of feeling the cold more keenly on a kilojoule restricted diet. It is an indicator that you are burning less energy.

The effect may last for years, as shown by research involving 14 of The Biggest Loser contestants in the US, who were followed up six years later by the National Institute of Health. After being on the program, only one participant managed to maintain their weight loss. The others had all regained the weight. In short, the dieting had led their metabolism to become far slower than they were before the contestants went on the high-rating
TV program. This means that just to maintain a healthy weight they now have to eat less than they did before their extreme diets.

**Is Cutting Carbohydrates Healthy?**

Carbohydrates should not be avoided, as they are the main energy source for your body, muscles and brain. What’s important is to choose healthier carbs found in wholegrains, legumes (such as chick peas), rice, fruit, starchy vegetables (like potato and corn) and the lactose in foods like yoghurt and milk. It’s a myth that starchy vegetables like pumpkin, carrots and peas should be avoided if you want to eat a healthy diet and maintain your weight. Humans have eaten starchy vegetables like tubers and roots for a very long time with good reason, because they are healthy, highly nutritious and reduce hunger.

Cutting back on carbohydrates may initially cause what seems like rapid weight loss. In fact, what you are losing is actually fluid, and this fluid loss is related to your body burning its stores of an energy source called glycogen for fuel. Once you return to eating carbohydrates, the fluid levels in your body will return to what they were. Yet many of the most popular diets encourage eating less carbohydrates and restricting whole food groups including:

- **Dairy foods**: Skimping on foods like cheese and milk is not healthy in the long-term because the calcium they contain helps strengthen your bones.
- **Gluten and grains**: Foods that contain gluten (such as bread and pasta) and grains such as brown rice are important sources of energy, fibre and also B group vitamins, which are important for mood.

Avoiding or substantially reducing intake of certain food groups in your meals may mean that your food does not provide all the nutrition you need to stay healthy. So before you try any kind of diet you should consult with a doctor, nutritionist or dietitian to make sure that you are getting all the nutrients you need. Current popular diets that can lead to nutritional deficiencies include:

- **Paleo**
  
  This is a high protein, low carbs diet that cuts out grains, legumes and dairy foods.

- **The Ketogenic Diet**
  
  To adopt this diet you cut your carbs to 50 grams per day to put you in the ketogenic zone where you burn more fat. This level of carb is the absolute minimum required for the brain, nervous system, red blood cells and kidney function.

- **Low Carbs**
  
  Most people on a low carb diet aim to eat around 70g of carbohydrate per day. People often set a ‘carbs curfew’ where they avoid eating carbs such as grains after breakfast or lunch. Or they may aim to completely avoid grains, fruit and starchy vegetables altogether.

- **Vegan**
  
  This involves avoiding foods related to animals, including meat, seafood, eggs and dairy products such as cheese and milk. People on a vegan diet may become deficient in vitamin B12, found in meat (important for nerves and red blood cells), omega 3 fatty acids, found in fish (important for brain, heart and reducing inflammation) and iodine, found mostly in seafood (and important for healthy thyroid function). Protein is important to supply the body with amino acids which are important for proper bodily function. To ensure they are eating enough ‘complete protein’, people on vegan diets should make sure they eat different sources of amino acids over the course of the day via foods including legumes and beans, rice and nuts.

In the long-term, restrictive diets can lead to:

- **Excess protein intake**
  
  To compensate for the lack of carbs and feel more full, people on restrictive diets often eat more protein. But if they are having more than around a palmful at every meal they may be eating too much. In the long term, excess protein may cause health problems.

- **Tiredness**
  
  Lack of energy can lead people to eat more between meals and skip exercise, and in some people it may even lead to a lower mood.

- **Digestive issues**
  
  Reducing intake of grains and healthy wholegrain bread can reduce fibre which can cause some people to become constipated and may also lead to unpleasant smelling flatulence.

- **Increased intake of saturated fats**
  
  When people eat less carbohydrates they often eat more protein such as red meat, to help them feel full. This can lead to an increase in saturated fats, which may increase the risk of heart disease.

- **The Glycemic Index**
  
  When you eat a piece of bread or potato, your body breaks this down into glucose and releases insulin to help transport the glucose to your cells — for energy. The Glycaemic Index (GI) rates this effect that carbs have
on your blood glucose and insulin. Healthier carbs tend to have a low GI of 55 and are more slowly digested, absorbed and metabolised. They include whole grains and vegetables and are a win-win for your body and health because they:

- Contain high fibre: this means they take longer to chew and digest, so they keep you full for longer.
- Cause lower spikes in blood glucose: This means blood glucose is more slowly released from your gut and more slowly trickled into your bloodstream, causing less of a rise in insulin levels.
- Provide longer lasting energy: The slow release of energy also helps keep you feel full for longer between meals.

By comparison, foods with a higher GI – refined carbohydrates or sugar – are often higher in kilojoules and may often include extra unhealthy fats like the fat in croissants or sweet biscuits. Meanwhile, they are low in fibre so they are less filling, which can leave you hungry in a few hours and more likely to reach for a snack. If you eat too many refined carbohydrates over time, they may contribute to weight gain and increased risk of Type 2 diabetes and heart disease.

Setting Sustainable Food Goals

To maintain a healthy weight and avoid weight gain, dieting should be avoided. Instead, you should aim to adopt these sustainable healthy eating habits for life:

1. Eat to beat hunger
   Foods that are high in fibre actually take up more space in your stomach and quickly trigger hormones that tell you that you’re full. As a result, they keep you full for longer so you are less likely to reach for unhealthy morning or afternoon snacks. Simple tummy-filling tricks include:
   - Drinking a large glass of water about 30 minutes before a meal.
   - Eating legumes: Foods like chickpeas and lentils can increase feelings of fullness.
   - Choose chewy foods: Foods that take longer to chew are usually higher in fibre so they break down more slowly in your digestive system, keeping you sated for longer and giving you longer lasting energy. Good chewy choices include:
     - An apple or homemade fruit salad.
     - Carrot or celery sticks.
     - A home-baked whole grain bran fruit muffin.

2. Eat protein at every meal
   Protein helps to build and sustain muscle, so you should aim to eat a palmful at every meal. Protein also requires more energy to digest, so it increases thermogenesis – a process where your body boosts temperature after eating and in turn, your metabolism increases. Animal protein sources include eggs, yoghurt, fish, chicken without the skin and occasionally red meat, with minimal fat. Good sources of vegetable protein include legumes, nuts and seeds.

3. Plate up with more plant foods
   Fill your plate with plant foods first and make them the biggest component of every meal. Non-starchy vegetables are low in kilojoules and high in fibre. This winning combination promotes fullness after a meal, which means that vegetables are also beneficial for weight loss and maintaining a healthy weight. Eating more plant food is also a great investment in your health. Spanish research involving the Andalusian School of Public Health has shown that for every 200 gram increase in your daily fruit and vegetable intake your risk of disease drops by 6%. Research has also shown that a Mediterranean diet high in plant foods and low in red meat and processed food is better for long-term weight loss and heart health than a low-fat diet.
4. Serve whole grains

Whole-grain foods are less processed, contain more fibre so they are more filling and contain higher levels of nutrients too. Wherever possible, choose the whole-grain version of a food – for example, oats/muesli, brown rice or wholegrain rye bread. As well as helping you maintain a healthy weight, whole grains can also help to lower your risk of diabetes type 2, heart disease and some cancers.

5. Start your day with breakfast

People who eat breakfast - and also people who make breakfast the biggest meal of the day - are less prone to gain weight over time shows research from the Loma Linda University School of Public Health in America.

4. Eat slowly and mindfully

Avoid eating foods from the packet, because you can’t really see how big your portions are. Whenever you eat, do it mindfully and make sure you are not looking at a screen. Take time to sit, savour each bite and notice the flavour, texture, taste and smell of the food – eating slowly and mindfully will leave you feeling more satisfied, which in turn can reduce your desire to overeat or snack between meals.

5. Minimise fast food and take away

Take-away and restaurant foods are usually higher in salt, fat, sugar and kilojoules – aim to eat them only once a week at most. Whenever possible, home-cook meals and make your lunch to bring to school.

The importance of exercise

Seeking out every opportunity to move can help to prevent weight gain and maintain a healthy weight over your lifetime. However, just as you can hit a plateau with weight loss after weeks on a low kilojoule diet, the same adaptation affect can happen with exercise. As your fitness improves, your heart rate increases less during a workout so you use less energy and burn less kilojoules. The antidote? Vary your workouts so that you are engaging in different exercises that encourage a range of fitness impacts such as strength, speed, stamina and flexibility. During the week, this might mean you mix up high intensity exercise that quickly makes you breathless with strength exercises, walking and some yoga, swimming, cycling or team sports. Meanwhile, increase the challenges in all your exercise so your body keeps getting pushed rather than adapting to the same familiar workout routine. Aim to move as much as you possibly can. The Australian Physical Activity and Sedentary Behaviour Guidelines recommend that children aged five to 17 years accumulate 60 minutes of physical activity every day.

Figure 5: Filling up on vegetables is an excellent way to keep the kilojoules down.

Figure 6: Avoid refined carbohydrates – they are nutritionally empty and will lead to weight gain.

Figure 7: Regular physical activity helps maintain a healthy weight.
Student activities:

1. Design a print advertisement listing five reasons why dieting is not good for losing weight in the long term. It should include a catchy slogan.

2. In pairs, research and write a television news presentation about the health and nutritional drawbacks of a popular diet such as paleo or low carb. Have one person play the journalist and the other person play the expert for your presentation.

3. On a weekend, eat different sandwiches for lunch – one on Saturday and one on Sunday then compare how full they make you feel – 10 minutes after eating, half an hour after eating and two hours after eating. One sandwich should be high fibre and made with rye bread and contain chicken, tuna or salmon and salad ingredients such as tomato and cucumber while the other sandwich should be made of white bread and be topped with vegemite, honey or jam.

4. Research the topic of ‘rebound weight gain’ and write a 1,000 word essay on how this problem can lead to an increase in weight after dieting.


6. Write a short 500 word report about protein. Divide the report into two sections – one should outline the problems with eating too much protein and the other should outline the problems with eating too little protein.

7. Write a list of 10 ways in which you can include more vegetables in your daily diet.

8. Make a poster which lists five points about good habits to maintain a healthy weight.

9. Write a short blog post for a health website about the most common myths about diets.

10. Create a list of 10 tips that guide people to make healthier food choices when they are eating out.

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