BTNacademy

THE SCIENCE OF NUTRITION COACHING

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INTRODUCTION

Welcome to The BTN Practical Academy. This is book one in a series of the four which make up the BTN Practical Academy

The education of a nutrition coach needs to flow in a particular way. This is a journey that needs to be grounded in principles gained from scientific research because while the human body still does hold some mysteries, much of it is well understood. Once we have a clear understanding of the science behind nutrition, we are in a far better position to expand our horizons and look into the food environment, behaviour and psychology as well as sports performance and more. Learning only these finer points without the background is akin to building a house without foundations – it may look like you've achieved something but as soon as something comes up that you aren't prepared for, everything will crumble down.

This book will aim to set the tone for how we should operate as coaches, allowing us to form an open yet critical mind that is able to analyse science, as well as a skillset that helps us apply learned principles in the real world. A critical mind is not a cynical one – while there is a lot of pseudoscience and false information for those not aware enough to avoid it, it is also the case that we must constantly search for new information that challenges our pre-existing beliefs and refines our approach. Rather than cynicism, a critical mind is one that displays a large degree of scepticism, only really accepting a claim, belief or idea when it can be backed by sound reason and evidence.

We need to apply these ideas with people who have complicated lives and unique situations, so it is crucial that we don't only focus on hard science like chemistry and biology, but also soft science like psychology and sociology as well as our own expertise, intuition and people skills.

While this book might feel somewhat heavy at times, the learning that is covered provides the hard foundations upon which you can later build more practically applicable knowledge. Please do not rush or read while distracted – instead take your time and read each module at a time when you can do so without interruption. If it takes you more than one sitting that is perfectly natural so don't cause yourself undue stress by speed reading and not really taking anything in. If you feel overwhelmed, please refer to the key take homes and summaries, and remember that in the extremely unlikely occurrence that the third enzyme used in the Krebs cycle ever comes up in conversation, you can always refer back to this manual to find the answer.

As you read this book we want you to get excited. This is laying the groundwork for you to become a master nutrition practitioner. Embrace the challenge of learning something new, take it all in your stride, make notes and always reflect on how you'll use this knowledge with your next (or first) client. Here's to the next step in your nutrition education, learning about The Science of Nutrition Coaching.

Tom Bainbridge and Ben Coomber

HOW TO USE THIS MANUAL

The course will take on the following structure:

- **Module 1**: What is evidence-based practice?
- **Module 2**: What is a nutritionist?
- **Module 3:** Critical thinking
- **Module 4:** Reading research
- **Module 5:** The digestive system
- **Module 6:** The fasted and fed states
- **Module 7:** Energy production and protein synthesis
- **Module 8:** Energy balance and rates of loss/gain

Each module is to be considered pre-reading. We suggest that you endeavour to complete this before watching the related webinar (whether watching live or on playback), then re-read afterwards, taking notes if you'd like. This approach gives you the best chance to absorb as much information as possible without spending hours at your desk unnecessarily.

We hope you enjoy this book, and the associated course. Good luck!

MODULE 1

WHAT IS EVIDENCE-BASED PRACTICE?

1. MODULE 1: WHAT IS EVIDENCE-BASED PRACTICE?

1.1. Module aims

- To introduce students to the course
- To ask students to suspend bias and keep an open mind
- To fully explain the history and importance of evidence-based practice

1.2. Welcome to The BTN Practical Academy

We are extremely happy to have you with us and we can't wait to share this educational journey with you. Over the course of this book (and the other three) you will explore nutritional science, it's application, how to personalise it and much more, ultimately enabling you to be a world-class nutrition coach.

This course will be challenging, but it is our hope that with our support, this book and the following three will provide an enlightening and, dare we say it, enjoyable learning experience. At times the modules may stretch your abilities but stick with it because, over time everything will slot into place. From the outset we also ask you to suspend your biases and preconceived understanding of nutrition and instead view everything you learn on this course with a sceptical but open mind. As you will see, analysing what you are told and not accepting information at face-value is a highly beneficial practice and that counts for everything that you have learned up to this point, too.

Let's move on to our first topic.

1.3. Why are we here?

The BTN Academy exists to help individuals such as yourself develop a keen appreciation for evidence-based nutritional practice. Of course, this necessitates a broad understanding of key biological and biochemical principles, as well as some fundamental thermodynamic concepts and a little bit of gross anatomy and physiology. Beyond that it requires you to read about the broader science of nutrition itself – it's not enough to know how your body works and how various foodstuffs interact with it on a microscopic level, it's important to know what happens in real-world settings as a result of different approaches, interventions and applied principles.

This is because it is necessary to view a topic from multiple levels of analysis to gather a proper appreciation for it. If we look at the progression of allopathic medicine and medical diagnosis, for example, we see that results gained by physicians have dramatically improved over time because a greater number of analytical levels have been revealed to those who need them – owing primarily to improved technology. In the medical renaissance (1400-1700) doctors began dissecting and recording the gross anatomy of cadavers, and this knowledge revolutionised the ways in which cause of death was viewed. Prior to this, illness was believed to be due to an imbalance of four liquids or "humours", but afterwards it was seen that physical illness was, rather, caused by issues with bodily structures.

With the development of proper microscopy, it became possible for physical illnesses to be categorised (and therefore treated) by identifying the difference between a healthy and

unhealthy cell within a given tissue or group of tissues and this tied in closely to the development of 'germ theory', which states that illnesses can be caused by external pathogens, invisible to the naked eye and therefore impossible to study without newly developed scientific methods. In the modern world, with medical professionals being able to analyse subcellular and even genetic causes of disease, the practice of medicine is more accurate and more effective than it ever has been before.

Nutritional practice can be seen much in the same way. By having at our disposal knowledge of the interactions between subcellular structures and molecules and the way that nutritional interventions act upon those, we are able to predict the outcome for the body as a whole from those same interventions. At the same time, we are able to see the way that a person's health and body composition change due to a given alteration in nutritional intake and infer the way that the given change has altered the behaviour of smaller anatomical components.

At least, that's how it appears… Unfortunately, it doesn't quite work like that.

The above makes logical sense. If we know that changing a certain nutritional practice alters a certain cellular interaction, and we know the impact that the new interaction has on broader tissues or metabolism, then surely, we should be able to predict the outcome from an intervention. To flip that over, once you know that something happens in terms of body composition changes, performance, strength or another measure after you change a nutritional factor, then surely you can use that to predict relatively accurately what is happening on a cellular level?

To make this quandary a little more concrete we will provide specific examples of both ideas.

- As an example of 'we know what happens in a cell, so we should know the total outcome', consider that consuming a low carbohydrate diet reduces circulating levels of the hormone insulin (1). We also know that insulin is involved heavily in the storage of triglycerides in adipocytes (fat cells) (2). We should therefore be able to infer that a decreased carbohydrate diet would lead, logically, to reduced bodyfat
- As an example of 'we know what happens in the body, so it stands to reason that we can predict the subcellular mechanisms', consider that a lot of research data suggests that people who consume artificially sweetened drinks are more likely to end up overweight/obese than people who don't (3). Therefore, we should be able to state with some confidence that sugar free drinks lead to increased triglyceride storage in adipocytes

These are completely reasonable assertions based upon the information provided, and in fact these are both positions you will find documented in blogs, books and even in the mainstream media. The problem is that they are both patently false (4, 5, 6). So, what's going on?

1.4. The limitations of experience

Richard Dawkins, in his book The God Delusion, refers to a concept he calls 'middle world'. Middle world, he suggests, is the realm of human experience and understanding that goes somewhere between things the size of a house and things the size of an ant. Anything larger

than a house or smaller than an ant becomes incredibly difficult to properly picture in your mind – how big is a mountain? How big is a Skyscraper? How big is a red blood cell?

This is because, from an evolutionary perspective, we have never generated a need to understand things outside of this range. You need to understand things the size of an apple because you might be able to eat them. You need to understand things the size of a tiger because they might eat you. Things so small you can't see them and things so big you can't use them become 'background noise' to which you pay no attention because they are beyond your lived experience.

We can take this idea and apply more evolutionary theory to it in different situations too. It's easy to picture two people, or even 10, but picturing a room with more than 1000 people in it (unless you're used to standing and speaking to a crowd that size, for example) becomes incredibly difficult to do. Go into a coffee shop and look around, you'll know if there are closer to 10 or 15 people there without really counting. Go into a football stadium and 10000 looks an awful lot like 15000. This is because we evolved to exist in family units, not huge social groups found in cities or even towns. In fact, British anthropologist Robin Dunbar suggested in 1990 that we are able to maintain a relationship with a finite number of people (7); a number often pinpointed to around 150 (8).

What this means is that we are not tuned in, intuitively, to understand things on a very small scale like a cell or a cellular component, nor are we really able to generate an appreciation for the experience of a large number of people. When we are looking at something that falls outside of what we have evolved to understand we start to make assumptions, and this includes topics such as nutritional science. We often make assumptions based upon what we see and run with it. We will explore this fully in the critical thinking module, but for now know that there is often a disconnect between what we see, and what is really going on.

1.5. Why the limitations of experience matter?

This matters a lot, because it refutes our ability to really predict what happens at the opposite end of the scale if we know what happens at an extremely high level of magnification, or if we know the observable outcome of an intervention for an individual (a low level of magnification).

Sure, this intervention may cause that cellular action, but biology is excruciatingly complex, and the human body is full of interacting and redundant pathways that make up for changes in one part of the whole. In the above example of the low carbohydrate diet, it is simply the case that fat can be stored even on low carbohydrate diets thanks to mechanisms involving the molecule Acylation Stimulating Protein (ASP), which activates triglyceride synthesis in adipocytes (9).

Similarly, we may observe an outcome in one individual but because we aren't 'programmed' to consider broader populations or statistics, we are likely to assume that a result we see in one person, or even in a group of people, is both generalisable to a broader group (or, in short, everyone) and evidence of a causal relationship between the two factors observed (this causes that). In the instance of sugar free drinks and obesity, there are a great number of

alternative causes that could be considered, including weight loss attempts by overweight people that involve swapping to diet drinks, the "I had a diet coke, so I can have dessert" mind-set, and the simple fact that people with a sweet tooth may be simultaneously more likely to be obese and more likely to consume sweetened beverages.

Understanding that there is a significant gap between what we see and what we know and the broader realm of generalisable principles is a critical step in becoming an evidence-based practitioner. The scientific method is the means by which mechanisms can be tested in order to see if they impact upon a broader observable trait (if we know that X intervention increases fat oxidation, we can then test that in a controlled environment to see if it actually leads to fat loss, because something else might interfere and cancel out the effect) and it's the means by which observable patterns can be tested for causality (if we know that people who have Y behaviour generally present with Z trait, we can find out if the link is causal). This is the purpose of the scientific method and it cannot be stressed enough that everything we do as practitioners needs to be grounded in the scientific philosophy – we cannot accept assumption or observation at face value. It must be put to the test in rigorous scientific settings, or it can at best be described as a hunch.

Without looking to evidence, we reduce our options to:

- **Eminence-based practice:** The complete trust in perceived authority figures, who are just as flawed and full of bias as the rest of us
- **Experience-based practice:** The complete trust in our experience of 'what works for me'
- **Theory, assumption and assumed understanding:** Topics covered in great detail during the critical thinking module

These approaches are problematic to say the least. To go back to medicine for a moment, historically, medical practitioners operated in this very way – using interventions that eminent practitioners of the day would espouse (like lobotomies for depression (10)), doing things because that's how it was always done (like advising asthmatics to smoke to improve lung function (11)), or just doing whatever had worked before, even if the treatment didn't do anything – leeches anyone?

1.6. But I KNOW this works

Of course, it seems like the above examples are extreme and this is somewhat intentional, because extreme examples are always a better way to make something more concrete and understandable. However, the principles above are not the only ways in which our experience of the world can be flawed.

Grouping together the three alternative methods to evidence-based practice, there are two major themes: if we don't use evidence-based practice we need to use either our experience, that of an authority figure or the collective, or we need to do what we have always done. The second option here is obviously not a good idea because there's nothing to say that we

haven't always been wrong and so we won't pay a great deal of attention to it, other than to provide another short anecdote.

Earlier we noted that the genesis of microscopy and the associated increased understanding of human physiology coincided with what is referred to as germ theory. Germ theory is, simply, the idea that bacterial agents smaller than what can be seen with the naked eye can be responsible for disease – an idea that took over from miasmatic theory, the idea that 'bad air' caused illnesses like the black death, cholera and chlamydia (interestingly, although this idea has been thoroughly refuted, it's at least in part responsible for the invention of the modern sewage/sanitation systems that were created in an effort to reduce bad smells in urban areas).

At the time of its proposal, germ theory was not only viewed as an assault on miasmatic theory, it was seen as an assault on the medical establishment who adhered to it. One early proponent of the idea was Ignaz Semmelweiz, a Hungarian physician who worked in an Obstetric ward (one that dealt with new-borns and their mothers). He discovered that the wards in which doctors worked had three times the mortality rate than wards ran by midwives and this was primarily, he believed, because doctors didn't wash their hands between patients. Fixing this issue appeared to reduce mortality to less than 1% (12).

When he proposed that doctors wash their hands in a chlorinated solution in 1847 (13) owing to the observed ability of this practice to decimate mortality, you would expect that his discovery would be met with enthusiasm, praise and applause, but that didn't happen. Because he went against the status quo and was perceived to be insulting his fellow physicians by implying they were dirty and harming their patients as a result, the medical community unanimously rejected his theories and ostracised him. Semmelweiz was committed to an asylum in 1865, beaten by guards 14 days later and died due to his wounds. It wasn't until germ theory was proven beyond reasonable doubt by Louis Pasteur in the late 1860s (14), that Semmelweiz was truly vindicated.

This story is a stark illustration of the damage that an 'appeal to tradition' can do and also of the idea that something should not be done blindly, simply because it's being done by others right now and has been for a long time. With that explained we can move on to experience (either of yourself, of the collective or of an authority).

For three examples of this, consider:

- The person who claims that a certain supplement 'works for me' in the face of evidence for it being ineffective (or at least in the absence of evidence for its efficacy)
- A community of people who have successfully lost weight using a low-fat diet and so portray it as the only way to achieve this result
- 'Authority figures' such as a very famous strength coach who has, at the time of writing, 270,000 followers on Facebook page plus a further 500,000+ followers for his company page, who claimed that he observed a strange phenomenon – bellybutton piercings hinder fat loss (15).

The latter case of an authority figure in whom trust is placed mistakenly, doesn't just stretch to celebrities or those with a large following. Thanks to a number of factors it is the case that we will often believe someone who asserts something with confidence, simply because they affirm it and we believe that they are someone that others listen to, or they are someone we personally look up to. This is covered in depth on the critical thinking module.

When it comes to personal experience, especially when corroborated by a group of your peers, it can often be difficult to appreciate why your lived experience is 'wrong'. This however, is a false dichotomy. Your experience is never wrong, you see what you see. The mistake lies in taking that at face value, or in generalising your experience to the wider world. The critical thinking module explores the cognitive missteps we make when analysing what we see and trying to understand it, but here we will talk in more practical and concrete terms, by looking at the placebo and nocebo effect.

The placebo effect is the term used to describe a positive outcome from some kind of intervention, when the intervention doesn't actually have a therapeutic effect. The first person to recognise and test the placebo effect was English physician John Haygarth (16) although it had been spoken about for a few centuries by then, in one way or another. At the time a popular treatment was a product called Perkins tractors, small metal rods that could be inserted into a patient to 'draw out' disease. Haygarth suspected that these were being sold at an extortionately high price but were in fact ineffective and so were a scam. He tested the 'active' metal tractors against a dummy wooden set and noted that the effect was exactly the same (17). Sure, the patient got better, but it was because they believed they would get better, not because they were jabbed with rods.

Since then a great deal of research has been done on the placebo effect – research that is still ongoing. So far it is understood that:

- Placebos aren't always purely psychological. They can have measurable effects on physiological markers including heart rate and chemicals released in the brain (18). With that said, this is not always the case and it's possible for individuals to report feeling different, despite there being no objectively measured difference
- It's not the case that a placebo is a placebo. Experienced improvement differs when there is a difference in pill size and colour and the differences between using either pills, injections or sham surgeries are just as concrete (19)
- Placebos can work even if someone knows the intervention is a placebo, so long as they are told it will make them feel better (20)
- The placebo effect is always present and it plays some role in every treatment, even one that has therapeutic validity – the important thing is that a medication amplifies the positive effect
- The placebo effect impacts individuals, not so surprisingly, to a magnitude that is individual

The nocebo effect is a similar phenomenon, but it goes in the opposite way. If someone does something that they believe will make them feel worse, they more than likely will – even if the thing they do is inert.

Placebo and nocebo effects, of course, don't 'work' for everything. You can't fix a broken leg with a placebo and it's very unlikely that a nocebo effect would be the cause of a cut finger. It's very important to discuss this because there are some patterns observable within the conditions that **can** be impacted by both phenomena. For our purposes and for a lot of topics discussed within the health and nutrition sphere, it's worthy of note that both placebo and nocebo effects significantly impact upon symptoms associated heavily with nutritional intervention; including but by no means limited to acne (21), asthma (22), stomach motility (23), headaches (24), IBS (25) and nausea (26). That of course is not to say that all of these conditions are due to a nocebo, or that anything that helps alleviate symptoms is a placebo. However, it does bring in to question the personal experience of those for whom these things are brought on by certain foods or helped by the inclusion or removal of them, until the mechanism (the magnified view of the broader effect) can be ascertained. We will come to how you do this in the next section.

So, let's take all of the above and condense it down into a situation that happens every day:

- Person A is suffering with severe Delayed Onset Muscle Soreness (DOMS) after starting a new training program. On Monday, his biggest challenge was the heavy squat session, on Tuesday it was getting up off the toilet
- Person B (a peer) tells Person A that they felt the same until they took a glutamine supplement. Now they feel far better after training (personal experience – this could be a placebo, or another factor not yet considered, such as improved conditioning to the training)
- Person A goes online to find out more info and a lot of people agree with person B (the experience of the crowd) including a lot of 'old school' bodybuilders who have been training and using glutamine for decades (appeal to tradition)
- Person A then goes into a supplement store and meets Person C, a perceived expert in the local area. Person C tells a similar story to Person B (personal experience) and then recommends Person A gives glutamine a go (appeal to an authority)
- Person A takes his glutamine and he feels better (personal experience and maybe a placebo or other factor)
- Years later, Person A is a nutritionist and now he recommends glutamine to his clients. Why wouldn't he? He knows it works because loads of people say it works, an authority figure agreed, and his personal experience says so too

Of course, the critical thing here is that no, glutamine supplementation doesn't prevent DOMS (27). It's extremely easy to understand why Person A felt this way though and it's not at all surprising to note that this situation (or others like it concerning macronutrient manipulation, meal timing, food avoidance, supplementation and more) arises so often.

Non-celiac gluten sensitivity is another example. Those who experience gastric upset upon consuming gluten-containing foods often feel better when they cut those foods out, but this experience does not tell the whole story because although it's the most popular talking point, gluten isn't the only thing in those foods. In fact, a growing body of evidence indicates that while the improvement isn't always due to a placebo effect (though it absolutely can be, note the symptoms impacted by placebo/nocebo above and check out the symptoms from self-diagnosed non-celiac gluten sensitivity), it's usually not due to gluten either. FODMAPS (fermentable oligo-, di- and monosaccharides and polyols which are kinds of carbohydrate) and specifically fructan (a polymer of fructose molecules) appear to cause reactions in these individuals when tested but gluten does not (28).

Evidence-based practice exists therefore, to close the loophole. We experience things and are able, in some fashion, to draw connections between what we do and what happens as a result. But as we have seen we aren't really equipped to look at the very small or the very large, we're not that great at considering the idea that what appears to work in one instance may not work across a population. We often believe authority figures or tradition too readily and to top it off, the things we experience may not actually be all that trustworthy because either it could be a placebo or nocebo effect, or because we miss out some really important factors of which we aren't entirely aware. Then from another angle, we will often be told that something does something physiologically (this is more often than not a true claim, such as is the case for the low carbohydrate diet lowering insulin above) and we will then assume a physical result from it because, very simply, most nutritionists (BTN tutors included) don't have a PhD in biochemistry and so are more than likely to miss an important factor that needs to be considered.

So, we need to remove the subjectivity. Evidence-based practice suggests that it doesn't matter what you think, what you believe, what you have always done or what you are told – what matters is what the evidence shows is effective, and the context of the situation at hand. Because we are so poorly equipped to objectively analyse a situation (I cut out bread and lost fat, was bread preventing fat loss?), we need to look to a body of objective facts and infer from that what the truth is (no, the evidence suggests that no individual food causes weight gain, but I cut out a lot of calories when I cut out bread and the evidence shows that that causes fat loss).

Evidence-based practice doesn't guarantee success of course, nothing can. However, it does guarantee the best chance of achieving success, ensures a practitioner offers sound, efficacious and safe advice and it increases the level of trust a client has. Evidence-based practice is the only approach that should be considered, and it is the approach that BTN Certified Coaches must adopt.

1.7. What is evidence-based practice?

Evidence-based practice is often misrepresented. While evidence-based practitioners rely on scientific data to make their decisions, that does not mean that anything that has a study backing it up is correct. Reasons that a given research paper may not be as good as it could be will be explored in the module on reading research, but for now consider that a small