SOLUTION

NUTRITION FROM PRIMARY SCHOOL TO MEDICAL SCHOOL

MAKE NEW ZEALAND HEALTHY

THE PROBLEM: New Zealand's current education system engages with food, health, and wellbeing, but does not provide a coherent, cumulative, or scientifically grounded framework for understanding nutrition as a core component of human biology. Across primary, intermediate, and secondary schooling, nutrition is largely treated as a matter of behaviour, culture, or personal choice, rather than as a fundamental driver of physiological function. While elements of biological science exist within the curriculum: cells, enzymes, respiration, and homeostasis, these are not systematically connected to food, digestion, nutrient handling, metabolism, brain function, or long-term health outcomes.

This results in a fragmented educational experience. Students may learn about food preparation, cultural food practices, or social influences on eating, and separately learn abstract biological mechanisms, yet are not taught how these domains relate. There is no structured progression linking dietary intake to digestion, absorption, blood glucose regulation, energy stability, or cognitive and emotional function. Nor is there consistent teaching of micronutrients as essential cofactors in metabolic and neurological processes. As a consequence, students are left without a scientific framework to interpret their own lived experience of hunger, energy, fatigue, concentration, or mood.

This gap is increasingly significant in a modern food environment characterised by the widespread availability of ultraprocessed, highly palatable foods and pervasive marketing. At the same time, New Zealand faces rising rates of chronic, non-communicable diseases and mental health challenges among young people, conditions for which nutrition is a major, modifiable determinant. The curriculum's emphasis on neutrality and non-prescriptive teaching, while well-intentioned, has resulted in the absence of a shared, evidence-based foundation of knowledge. Students are therefore expected to navigate a complex and biologically influential environment without the tools required to understand it.

This policy proposes a shift to an iterative, science-based, and developmentally staged framework that integrates nutrition across the educational curriculum from ages 8–18. Learning would build cumulatively from simple concepts of energy and body systems, through digestion, metabolism, and nutrient function, to integrated understanding of brain health, chronic disease risk, and environmental influences. Nutrition would be positioned as a foundational biological input, taught alongside physiology and health education, and revisited with increasing depth across years.

By embedding nutrition within a systems-based understanding of human biology, the curriculum would equip students with the capacity to interpret their own physiological experience, critically evaluate their environment, and apply scientifically grounded reasoning to health decisions. This approach supports both individual wellbeing and broader public health goals.

CONTENTS

MNZH POLICY RECOMMENDATIONS

(1) THE SCHOOL CURRICULUM: AN ITERATIVE LEARNING-BASED FRAMEWORK

Learning is cumulative. A staged, age-appropriate health education model (see the example which is provided in Chapter [7]), builds from basic concepts of energy and body systems (ages 8–10), to integrated understanding of metabolism, brain function, and nutrient roles (ages 11–15), culminating in senior students (15–18) applying mechanistic knowledge to analyse food environments, evaluate health issues, and design biologically grounded health interventions.

Introducing physiological and nutritional concepts early, then revisiting them with increasing depth, enables students to move beyond description to causal reasoning. By adolescence, students can connect dietary patterns to metabolic and neurological processes, and critically assess real-world influences on health. This produces scientifically literate individuals capable of evaluating evidence, rather than relying on simplified or behavioural-only explanations. Magnesium and the B group vitamins are included as an example of the possible learning cascade over this ten-year period.

(2) UNDER-GRADUATE HEALTH & BIOMEDICAL STUDIES:

Transition from a curriculum that *describes parts* to one that *explains regulation*. Graduates would still understand pathways and treatments, but would also be equipped to ask, early and routinely, how physiology, nutrient sufficiency, and environmental inputs are shaping the patient's condition, and what can be optimised before, alongside, or instead of intervention.

a) At the level of university leadership: Re-anchor the curriculum around first principles of physiology and system regulation, rather than adding discrete content. The organising foundation would centre on energy regulation, homeostasis, and feedback, with all pathway teaching explicitly framed as instances of these broader processes.

b) Within this structure, position nutrition and nutrient sufficiency as foundational biological inputs, integrated vertically across years and disciplines, so that macronutrients and micronutrient cofactors are consistently recognised as drivers of metabolic, neurological, and endocrine function.

c) Reorganise teaching around systems rather than silos, with co-delivered modules linking biochemistry, physiology, and clinical application in real time. Redesign assessment to reward causal and systems reasoning, requiring students to trace relationships across diet, physiology, and symptoms, thereby aligning incentives with intended learning.

d) Support such an approach with explicit instruction in systems thinking from early stages, and by sustained faculty development to move teaching beyond disciplinary boundaries.

e) Embed clinical translation from the outset, training students to assess physiological state and modifiable inputs before defaulting to intervention.

f) Finally, align institutional signals, examinations, clinical supervision, and teaching materials to reinforce this model, addressing the hidden curriculum and ensuring that integration is not merely stated, but enacted in education and praxis.

BACKGROUND TO THIS POLICY

In effect, New Zealand's primary curriculum reflects a system that is conceptually reasonable but biologically incomplete. It engages with food as culture, behaviour, and identity, but does not sufficiently engage with food as a determinant of physiological function and long-term health. The result is an education system that introduces the topic of nutrition, lacks resourcing in this area to address the biologic and scientific relevance of nutrition, and as a consequence, under-emphasises the role of nutrition during a critical educational and developmental period.

The effect is that, over the years, the curriculum downplays and effectively undermines the critical role of nutrition and diet in the maintenance of metabolic and mental health – or in driving chronic illness and disease.

The New Zealand primary and secondary curriculum is underpinned by a philosophical shift away from prescriptive teaching toward student-led, values-based learning. In health education, this has meant a conscious avoidance of directive statements about what children should eat, in favour of developing attitudes, critical thinking, and personal decision-making. While this approach reflects legitimate concerns about autonomy and cultural sensitivity, it has had a clear consequence: the curriculum does not provide a firm, shared foundation of nutritional knowledge. In practice, this leaves a core domain of human biology, nutrition, without clear guidance or expectation.

Health and physical education and food and nutrition up to the NCEA years, are guided by four underlying concepts: Hauora (holistic wellbeing), the socio-ecological perspective, health promotion, and attitudes and values (See Appendix).[1] [2] [3]

Within this framework, schools design their own programmes. Teachers integrate nutrition into broader wellbeing topics, and delivery is typically project-based, discussion-based, or activity-based. Lessons often take the form of questions such as 'What is a healthy lunch?', alongside cooking sessions, food budgeting exercises, and cultural food studies. These approaches can be engaging and practical. However, they are inherently variable and depend heavily on teacher confidence and knowledge. Without a clear scientific scaffold, nutrition education risks becoming fragmented, rich in activity, but thin in explanatory depth.

Diet and nutrition education is being delivered within a system of constrained resourcing. Home economics is no longer consistently maintained as a standalone subject, instead being distributed across Health Education, Technology, and vocational hospitality pathways, reducing its disciplinary focus. .[4] [5] At the same time, school food provision operates under tight fiscal constraints, with national lunch funding in the order of $3 per student per meal and documented concerns that cost reductions may compromise food quality.

Schools rely on general operational funding to support classroom activities, including food technology, within a broader context where resources are widely acknowledged to be insufficient to meet expectations. In practice, these constraints favour the use of inexpensive, shelf-stable ingredients and limit exposure to fresh, nutrient-dense foods. This creates a disconnect between curriculum intent and delivery, where nutrition education is limited.

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[1] Food and nutrition. https://newzealandcurriculum.tahurangi.education.govt.nz/food-and-nutrition/5637165635.p?

[2] The New Zealand Curriculum - Health and physical education https://newzealandcurriculum.tahurangi.education.govt.nz/the-new-zealand-curriculum---health-and-physical-education/5637209122.p?

[3] NZC – Health and Physical Education Phases 1–4 (Years 0–10). https://newzealandcurriculum.tahurangi.education.govt.nz/nzc---health-and-pe-phases-1-4-years-0-10/5637293829.p?

[4] Ministry of Education and Te Poutahu Curriculum Centre (Sept 12, 2025). Fact Sheet: Home Economics. https://fyi.org.nz/request/32297/response/134062/attach/5/1353163%20Appendix%20A.pdf?

[5] Parkes S, Williams T. (Oct 22, 2025). Home economics is about nourishing a nation. So why is it being scrapped? The Spinoff. https://thespinoff.co.nz/society/22-10-2025/home-economics-is-about-nourishing-a-nation-so-why-is-it-being-scrapped?

[1] PRIMARY EDUCATION: NUTRITION CURRICULUM

No biochemical or metabolic framework: a missed opportunity for simple science

There is no requirement within the primary curriculum to teach even a basic biochemical or metabolic understanding of nutrition. Nutrition education offers a powerful and underused entry point into science by making biological processes immediately relevant to each child's lived experience. Through food, children can explore fundamental scientific ideas in an accessible way: how different colours reflect plant compounds, why foods have distinct smells, how taste receptors signal sweet, bitter, or savoury, and how the digestive system breaks food down to support growth, energy, and brain function. Even simple concepts: what makes a digestive system feel 'happy' or 'grumpy', can introduce cause-and-effect thinking grounded in physiology. This approach not only builds scientific literacy but connects science directly to personal health, making it tangible, memorable, and meaningful from an early age.

Nutrition education could be taught in a simple, age-appropriate way. For example, children could explore three fundamental food types: a protein, a fat, and a carbohydrate. They could learn what each contains, and in simple terms, what happens when the body uses them, how protein supports growth and repair, fats provide energy and structure, and carbohydrates provide quick energy but can be over-consumed. Even at a primary level, this introduces the idea that food interacts with the body through identifiable pathways. Such an approach would not require prescription; it would provide a scientific anchor within a flexible learning model.

[2] MIDDLE SCHOOL EDUCATION (YEARS 7-10)

A review of actual teaching materials across Health and Physical Education (HPE), Technology (Food Technology), and Science shows that scientifically robust nutrition education does exist within the New Zealand system. However, it is not embedded as a core, cumulative component of learning in Years 7–10. Instead, biological understanding appears sporadically, often in optional programmes, external resources[6], or later secondary courses. The system demonstrates awareness of nutrition science, but this is not translated into a guaranteed educational pathway for all students.

Health and Physical Education (HPE): nutrition as behaviour, not biology

Within HPE, nutrition continues to be framed primarily through wellbeing, choice, and social context. [7] [8] Teaching materials emphasise the influences on food choices, family, culture, body image, and environment, and encourage students to reflect on and critique these influences. While this develops important analytical and social awareness, it results in a limited scientific understanding of nutrition. There is no requirement to teach digestion, nutrient function, or

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[6] Vegetable Industry Charity 5+ a Day. Knowing your nutrients with 5+ A Day. https://5adayeducation.org.nz/learning/secondary/year-9-nutrition-resource?

[7] NZC – Health and Physical Education Phase 3 (Years 7–8). https://newzealandcurriculum.tahurangi.education.govt.nz/nzc---health-and-pe-phase-3-years-7-8/5637293090.p?

[8] NZC – Health and Physical Education Phase 4 (Years 9–10). https://newzealandcurriculum.tahurangi.education.govt.nz/new-zealand-curriculum-online/nzc---health-and-pe-phase-4-years-9-10/5637293085.p

metabolic processes. Even by Year 10, nutrition remains positioned as a behavioural and lifestyle issue rather than a biological system. As a result, students may become adept at discussing food in social terms, but are not systematically taught what food does in the body.

Technology (Food Technology): food as product, not physiology

In *Technology*, particularly *Food Technology*, students engage extensively with food through preparation, cooking, and design.[9] Programmes focus on practical skills, food safety, sensory evaluation, and the development of recipes or food products. Some units introduce basic ideas such as 'healthy meals' or the general functions of nutrients (e.g. energy, growth), but these are typically simplified and not developed into an educative framework that helps students appreciate how and why food groups benefit their biological health.

Even where science appears, such as chemical changes during cooking, it relates to the properties of food rather than its effects within the human body. In the context of food science, food is something to be made, modified, and evaluated. How a food may determine physiological function is not addressed. The result is strong capability in food handling, but limited understanding of nutrition as a scientific domain.

Home economics and food technology education impacted by resource constraints that are rarely acknowledged in curriculum design and this may why external providers are providing curriculum content – however it is unclear whether for example, meat dishes are funded in the Food Technology budget. [10] [11]

Teachers report operating within extremely limited budgets, which favour inexpensive, shelf-stable ingredients such as flour and sugar, and constrain the ability to work with fresh, nutrient-dense foods. This aligns with broader evidence of funding pressure within school food provision, where cost reductions have already been shown to compromise meal quality. In this context, cooking lessons often default to simple, carbohydrate-based recipes that are affordable and scalable, but do not reflect the diversity or nutritional composition of a balanced diet. While not formally documented in those terms, available evidence shows that constrained school food funding and operational budgets strongly incentivise the use of low-cost, shelf-stable ingredients, which aligns with teacher reports of limited ingredient diversity in practice.

Science: Biology curriculum does not focus on nutrition and biological systems

In Years 7–10, the science curriculum includes general references to life processes and organismal needs, but does not require a structured or progressive teaching of human nutrition, digestion, or metabolism. Biological study at this level tends to emphasise ecosystems, adaptation, and genetics, with comparatively little focus on internal physiological processes such as nutrient utilisation or metabolic regulation by flora, fauna or humans.

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[9] Food technology – Cross-curricular learning. https://newzealandcurriculum.tahurangi.education.govt.nz/food-technology-cross-curricular-learning/5637208329.p?

[10] Heart Foundation. Food Technology: Year 8 unit plan. https://www.heartfoundation.org.nz/educators/edu-resources/food-tech-unit-plan-yr8?

[11] Heart Foundation and Vegetables New Zealand. Food Technology process unit plan (Suggest year 7). https://www.vegetables.co.nz/assets/Education/food-technology-unit-plan-year-7-1.pdf?

Content reviewing nutrition and metabolism is typically introduced at senior secondary level and is not a required component of learning in Years 7–10. In the middle years, there is no systematic integration between *Science* and nutrition education. As a result, students are not progressively introduced to foundational concepts such as how mammals processes food, regulate energy, or maintain metabolic balance.

External and supplementary resources: evidence of what is possible

Some external programmes and supplementary teaching resources do introduce students to the biological role of nutrients, including how different nutrients function in the body and support health.[12] These materials demonstrate that age-appropriate, nutrition education is both feasible and effective at the Year 9–10 level. However, their use is discretionary and reflects the focus of the providers. Access depends on individual schools, teachers, or external providers, reinforcing variability rather than ensuring consistency across the system.

Leaving our young people uninformed

Adolescents are growing up in food environments characterised by the widespread availability of ultraprocessed foods and sugar-sweetened beverages that are engineered to be highly palatable and easy to overconsume. While the curriculum makes reference to 'junk food' and encourages students to reflect on influences such as advertising and peer behaviour, it does not explicitly address the defining features of these products, their formulation, their ubiquity, or their capacity to drive repeated consumption. Nor does it equip students to understand the distinction between hunger, transient cravings, or the energy instability that can follow high intakes of refined carbohydrates.

This omission is particularly significant in the middle years, when young people gain increasing independence and purchasing power, and are more exposed to food environments dominated by inexpensive, energy-dense products. At the same time, there is growing evidence linking high consumption of these foods with patterns of fatigue, disrupted sleep, reduced concentration, and increased risk of dental decay. Yet these relationships are not integrated into the curriculum. The result is a curriculum that acknowledges choice, but does not adequately prepare students to understand the biological and environmental forces that shape that choice, leaving them without a clear framework to interpret their own experiences of energy, mood, and health.

A missed opportunity for foundational science education

The middle years represent a critical window in which children could develop a clear, scientifically robust understanding of nutrition as it relates to their own health, energy, and development.

Instead, the curriculum deepens students' ability to analyse food in society and work with food in practice, without ensuring that they understand its biological role. The result is an education that is active and engaging, but not fully informative. Nutrition science is available within the system, but it remains peripheral, rather than foundational.

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[12] https://5adayeducation.org.nz/learning/secondary/year-9-nutrition-resource?

[3] SENIOR SECONDARY (YEARS 11-13).

Nutrition science is present in senior secondary education, but it is optional, fragmented across subjects, and not systematically connected to daily diet, mental health, or physiological function. The NCEA system, which governs Years 11–13 in New Zealand, does not prescribe compulsory subjects at a national level. While students must achieve a set number of credits and meet literacy and numeracy requirements, the choice of subjects is flexible and largely determined by schools and students. There is no requirement for students to study biology, health education, or food and nutrition during their senior secondary years. This has significant implications for nutrition literacy. Where elements of nutrition science exist within biology, or food knowledge exists within technology subjects, students are not guaranteed exposure to these domains, either individually or in combination. Students can complete secondary education without developing an integrative understanding of nutrition, physiology, or their relationship to health.

Health Education / Health Studies

At senior secondary level, where home economics has largely been absorbed into Health Education and related pathways, nutrition education remains uneven and fragmented. Students may encounter basic descriptions of macronutrients and micronutrients, and in some courses study elements of digestion and physiology. However, this content is optional and not systematically integrated with health learning.

An example of the under-resourced potential of this subject is a health education page that was last updated in 2011.[13]

At senior secondary level, Health Education and Health Studies are positioned as the principal subjects through which students engage with wellbeing, including mental health, lifestyle, and nutrition. The NCEA standards at Levels 1–3 are conceptually sophisticated and emphasise higher-order skills. Students are assessed on their ability to analyse health issues, evaluate the determinants of wellbeing, critique social and environmental influences, and design health

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[13] Health and physical education https://seniorsecondary.tki.org.nz/Health-and-physical-education?

promotion strategies. This represents a clear progression in analytical capability and reflects a strong commitment to socio-ecological and public health perspectives.

> *Description: Students are taught about the complex factors that influence personal and community health and wellbeing. Students are taught how to examine health-related issues, such as nutrition, mental health, global health challenges, online safety, and relationships, considering how these intersect across diverse communities and contexts. They are taught how to apply critical and ethical decision-making to explore health practices, policies, and systems, developing capabilities to respond to health needs at personal, community, and societal levels. Health Education leads to pathways in health and related areas such as, science, health promotion, education, sport or community development, and health.*[14]

This is reflected in the nature of assessment tasks. Students may be required to:

- analyse influences on food choices (e.g. peers, culture, media)
- evaluate the impact of a health issue (e.g. obesity, body image, mental health)
- develop a health promotion initiative

These tasks are valuable, but they are introduced without foregrounding in biological nutrition. They do not require students to engage with the practical realities of dietary patterns in a sustained or systematic way. Concepts such as satiety, energy stability, or the difference between transient cravings and sustained nourishment are not explicitly developed as part of the learning progression.

The approach also reflects a deliberate effort to avoid judgement, particularly in relation to food. Guidance materials caution against labelling foods as 'good' or 'bad', recognising the risk of stigma, inequity, and eating-disorder vulnerability. This is an important safeguard. However, the removal of evaluative language has not been matched by the introduction of a clear, neutral vocabulary that would allow students to understand differences between foods in terms of their effects on hunger, energy, and wellbeing. As a result, students are encouraged to reflect on food in social and ethical terms, but are not consistently equipped to interpret their own lived experience of eating.

In parallel, Health Education places strong emphasis on mental health, resilience, identity, and coping strategies. Students develop skills in recognising stress, supporting peers, and engaging with mental health issues at both personal and societal levels. However, the relationship between diet and mental wellbeing is not systematically integrated into this learning. There is no consistent requirement to explore how dietary patterns may influence concentration, fatigue, mood, or sleep, despite the increasing relevance of these issues for young people.

The result is an approach that is analytically advanced but practically limited. Students can critically evaluate health issues and design interventions, however, students are not

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[14] Health and Physical Education Learning Area. https://newzealandcurriculum.tahurangi.education.govt.nz/5637308828.p?

consistently taught how daily dietary patterns influence energy, concentration, sleep, or mental resilience. The scientific knowledge exists within the system, but it is dispersed across topics rather than combined into a coherent framework.

Biology

The current NCEA biology structure shows that the New Zealand secondary biology curriculum contains real biology, cells, enzymes, respiration, genetics, adaptation, evolution, and homeostasis, but it does not build a cumulative pathway linking food, digestion, nutrient handling, cofactors, metabolism, immune competence, and brain function. The result is a curriculum that can teach biological mechanisms in abstraction while leaving students only weakly equipped to understand how those mechanisms relate to daily diet, chronic disease risk, or core principles of mammalian physiology, including their own.

There is no evident core to integrated learning that establishes coherent pathways for teaching macronutrients, micronutrients, digestive physiology, or enzyme synthesis. The standards teach cellular mechanisms; they do not systematically teach nutrition as applied mammalian biology.

The curriculum is organised around disciplinary orthodoxies: cells, genes, species, evolution, ecology, and abstract biochemical processes. Fragments of enzyme function and cellular processing are included, yet there is no strong curricular foundation that links ingestion, digestion, absorption, transport, utilisation, waste handling, satiety, microbiome interaction, and the biological consequences of dietary patterns. This leaves a gap in understanding how these processes underpin mammalian survival, reproduction, disease resistance, and behaviour across both human and wider ecological contexts.

Level 1: broad conceptual science

At NCEA Level 1, science has been recently reorganised into distinct Level 1 subjects, including Science and Chemistry and Biology, and the Level 1 learning matrices are intended as flexible tools rather than prescribed sequences. Teachers use the learning matrix to construct programmes. There is no prescribed order within a level. The curriculum is decentralised and variable and there is no guaranteed, universal sequence by which all students encounter nutrition-related biology.[15]

Following restructuring in 2024, Level 1 Chemistry and Biology were amalgamated into one subject. This integrated subject contains broad ‘Big Ideas’ and ‘Significant Learning’ elements. The explanatory material explicitly notes connections with Food and Nutrition, saying both subjects look at ‘the relationship between molecules and life’, and with Psychology, saying chemistry, biology, and biochemistry are applied to understanding the human brain. The material outlines state that students should be able to use their understanding in everyday life and ‘recommend strategies for healthy living that are grounded in chemistry and biology’.

However, the actual standards demonstrate a much narrower emphasis. One verified Level 1 standard, 92021 Demonstrate understanding of chemical reactions in context, is about

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[15] NCEA Education. Chemistry and Biology. https://ncea.education.govt.nz/science/chemistry-and-biology?view=learning

reactants, products, equations, conservation of mass, and common reaction types such as neutralisation, combustion, precipitation, combination, and decomposition. Its stated purpose is to understand chemical reactions in contexts beyond the laboratory; students are assessed on the chemistry, not on any nutritional or physiological context. Another verified standard, 92022 Demonstrate understanding of genetic variation in relation to an identified characteristic, is about mutation, sexual reproduction, migration, survival, non-random mating, and gene tracking methodologies.

Effectively, identifiable standards that could be identified do educate students on important scientific areas including chemical reactions and genetic variation, but do not extend to other equally relevant biological concepts including digestion, nutrient assimilation, or metabolism in the lived human sense. Level 1 therefore establishes chemical literacy, conservation of mass, scientific language, genetics, and general biological reasoning.

Level 2: real cellular biology, but excludes nutrient intake, digestion & metabolism

At Level 2, the standards are much clearer and more traditional. NZQA lists the main biology standards as: 91153 practical investigation, 91154 biological validity of information presented to the public, 91155 adaptation of plants or animals to their way of life, 91156 life processes at the cellular level, 91157 genetic variation and change, 91158 ecological community pattern, 91159 gene expression, and 91160 biological material at the microscopic level. This is a substantial biology suite. But only one of these standards sits anywhere near the territory of nutrition physiology: 91156 life processes at the cellular level. The rest focus largely on genetics, adaptation, ecology, microscopy, scientific critique, and laboratory investigation.

The 2025 external paper for 91156 is especially revealing. Its questions were on photosynthesis in different environments, cell respiration in a cheetah, and enzyme function and temperature. Students were asked to discuss chlorophyll, photosynthetic stages, limiting factors, aerobic versus anaerobic respiration, mitochondria, and enzyme structure and activity. This is proper biology. But it is not a nutrition curriculum. The questions are framed around plants, athletic animals, and general enzyme mechanics, but does not extend to how food is digested, how nutrients are absorbed, how macro- and micronutrients interact, or how diet patterns in impact mammalian function.

This matters because 91156 demonstrates the central pattern of the curriculum. Students may learn the vocabulary of cellular energetics, ATP, aerobic respiration, anaerobic respiration, enzymes, membranes, but they are not required to connect this to diet and nutrition.

The rest of Level 2 strengthens that conclusion. The 2025 paper for 91157 genetic variation and change covered snake genetics, Punnett squares, linked versus unlinked genes, crossing over, segregation, and sexual selection in the New Zealand giraffe weevil. That is recognisably genetics-heavy and ecology-adjacent. Standards 91155, 91158, and 91159 continue the emphasis on adaptation, ecological pattern, and gene expression. As a package, Level 2 biology is academically respectable, but the focus remains on cellular biology, heredity, adaptation, and ecology, not nutrition, digestion, metabolism, immunity, or mental health.

Level 3: opportunity for physiology, but still no integrated nutrition curriculum

At Level 3, NZQA lists the main standards as: 91601 practical investigation, 91602 informed response to a socio-scientific issue, 91603 responses of plants and animals to their external environment, 91604 how an animal maintains a stable internal environment, 91605 evolutionary processes leading to speciation, 91606 trends in human evolution, and 91607 human manipulations of genetic transfer and its biological implications. Here again, only one standard, 91604, clearly points toward core physiology and homeostasis. The rest are centred on environmental responses, evolution, human evolution, genetic transfer, and socio-scientific analysis.

The external papers make the pattern even clearer. The 2025 paper for 91603 included questions on photoperiodism in plants and honey bee behaviour during a solar eclipse. The 2025 paper for 91605 dealt with speciation, including apple maggot flies, lampreys and eels, and polyploid treefrogs. The 2025 paper for 91606 dealt with hominin hands, brain expansion, cultural evolution, and dispersal of Homo sapiens. These are all legitimate biology topics, but they show where the formal assessment weight lies: environmental response, speciation, and human evolution. None of these standards embeds a required, systematic treatment of nutrient pathways, micronutrient sufficiency, digestive function, or diet-related physiology.

The important exception is 91604 how an animal maintains a stable internal environment, which in principle is where genuine physiology could be taught: homeostasis, glucose regulation, osmoregulation, thermoregulation, and hormonal control. But 91604 is internally assessed, which means delivery depends much more on local course design and teacher emphasis. NZQA's listings confirm the standard exists, but public exam papers do not provide the same transparent window into what students everywhere are being asked to learn, because there is no common external paper for it. This standard creates an opportunity for richer physiology, but does not step into deeper exploration of nutrition, metabolism, or diet-health relationships.

In conclusion, the NCEA biology curriculum gives students substantial exposure to cellular mechanisms, enzyme action, respiration, genetics, evolution, adaptation, ecology, and scientific reasoning. It cultivates biological literacy and gives students tools for understanding molecular and organismal processes. At Level 3 especially, it supports genuine academic biology.

[4] FOOD LITERACY UNDERMINED

Across Years 1–13, the curriculum and associated guidance do not provide a sustained, age-appropriate integrative approach to education and the relationship between diet, nutrition, and metabolic and mental health.

The Ministry of Education appear broadly unfamiliar with the urgency in the scientific and economic literature relating to metabolic health and the communicable disease crisis, and the exciting role of education in supporting the growth of productive, happy young people.

The absence of educational resourcing effectively limits the ability of young people to interpret their own biological experience and to make informed judgements about their health.

Teachers are therefore left to construct content within the existing conceptual framework, often drawing on generalised public health messaging which downplays the scientific evidence for metabolic and brain-related challenges experienced by children and adolescents.

The result is that the curriculum reflects its philosophical base rather than any robust, integrated scientific understanding of nutrition and health. As Ludwig Wittgenstein observed, 'the limits of my language mean the limits of my world'. Aristotle similarly argued that education should cultivate the conditions for human flourishing and practical wisdom. In the present context, this includes the capacity to navigate a markedly changed food environment.

New Zealand's curriculum, including the 2024 redesign, lacks any framework to integrate the current scientific understanding of nutrition, including mechanistic biology, the role of food processing in appetite regulation, or the emerging literature on compulsive and addictive-like eating behaviours. It does not equip students with a language to distinguish between hunger, craving, and transient energy decline and act protectively to support the prevention of eating disorders. Where students are not given the concepts to describe hunger, satiety, energy stability, or the physiological effects of different foods, their capacity for understanding is constrained.

The urgency of integrating a sophisticated, scientifically relevant language, particularly in secondary education, cannot be over-estimated. Young people are expected to live with more years lost to disease. They are expected to be diagnosed with a spectrum of preventable chronic health conditions, many years earlier (known as early onset) than previous generations.

The absence of a foundational curriculum and an integrated approach, leaves adolescents lacking a language to support their *healthspan*, the number of years lived in good health.

The Prevalence of Hyper-palatable, Industrially Formulated Substances

The contemporary food environment extends well beyond the availability of ultraprocessed, highly palatable foods. It includes a pervasive digital and media ecosystem, advertising, retail design, social platforms, and algorithmically curated content, that actively promotes engineered foods and reinforces patterns of frequent consumption, particularly among adolescents. These environments are highly sophisticated: foods are formulated for hyperpalatability, while marketing strategies are designed to drive impulse purchasing and sustain habitual intake by directly engaging human biology and psychology.

Children are therefore growing up in a markedly altered health landscape. They are increasingly exposed to dietary patterns associated with energy instability, persistent hunger, and early markers of metabolic dysfunction, alongside rising rates of mental health challenges. Yet the curriculum does not provide a clear, developmentally appropriate framework to understand these experiences. Students are not systematically taught to distinguish between hunger, craving, and fluctuating energy, nor to understand concepts such as satiety, metabolic response, nutrient density, or the effects of food processing on appetite and behaviour.

Instead, the curriculum emphasises individual choice, non-judgement, and respect for diverse practices. While these are important principles, they sit uneasily alongside an environment that is not neutral, but actively shaped in ways that can undermine health. By focusing on choice without equipping students to understand the biological and environmental forces influencing that choice, the curriculum risks implying that all choices are equally informed. In practice, this leaves students interpreting fatigue, cravings, and energy fluctuations as matters of preference or personal discipline, rather than as responses to identifiable physiological processes.

This challenge is compounded by structural inequality. Many children experience food environments shaped by cost and availability, with greater exposure to refined, energy-dense foods. Educational caution around stigma is understandable in this context, but it creates a blind spot: the system avoids explicit biological explanation without replacing it with a neutral, scientific framework. As a result, those most exposed to nutritional disadvantage are often the least equipped to interpret its effects.

A more effective approach would retain non-judgement while introducing clear, biologically grounded concepts, such as satiety, energy regulation, and nutrient function, that enable students to interpret their own experience. When supported by practical measures such as well-designed school food provision, this creates an equitable foundation for learning. Without such integration, students remain highly exposed to powerful environmental drivers of behaviour, yet lack the language and scientific understanding needed to navigate them.

Cultural food systems: an underused strength

Cultural dimensions of food are included in the curriculum and represent a genuine strength. However, they are often approached descriptively rather than analytically. There is an opportunity to deepen this: to explore how traditional dietary patterns across cultures present in New Zealand: Māori, Pasifika, Indian, historically supported strength, growth, and health. This would allow students to connect cultural knowledge with biological function, recognising that traditional food systems often evolved in alignment with human nutritional needs. Such an approach would strengthen both cultural understanding and scientific literacy.

A Public Health Market Failure

Living Longer, But Sicker: The Rise of Years Lived with Illness

Improvements in life expectancy have not been matched by equivalent gains in health. While people are, on average, living longer, a growing body of epidemiological evidence shows that a greater proportion of these additional years are lived with chronic illness, disability, and reduced quality of life. This phenomenon is captured in the concept of Years Lived with Disability (YLDs) within the Global Burden of Disease Study framework.

Global analyses consistently demonstrate that although mortality rates for many conditions have declined, the overall burden of disease has shifted toward long-term, non-communicable conditions. The contemporary burden of illness is now predominantly driven by non-communicable, environmentally mediated conditions, rather than infectious or acute disease.

These include diabetes, cardiovascular disease, mental illness, and musculoskeletal disorders, conditions that often co-occur and progress over time, but for which diet and nutrition are major modifiable determinants. The result is an increase in multimorbidity, where individuals live with multiple chronic conditions simultaneously, often for decades.

While infectious diseases remain important, their impact is increasingly shaped by underlying metabolic health; individuals with chronic conditions such as obesity, diabetes, and cardiovascular disease experience higher susceptibility and worse outcomes. In this context, nutrition is not a peripheral, but a central driver of population health, influencing both the development of chronic disease and resilience to infectious threats.

From a population health perspective, this represents a shift from premature mortality to prolonged morbidity. In practical terms, individuals may survive conditions that were once fatal, but live for extended periods with fatigue, impaired metabolic function, reduced mobility, and mental health challenges. These are not marginal effects, they shape educational attainment, workforce participation, and long-term wellbeing.

Lower-income populations experience earlier onset of chronic disease and higher rates of multimorbidity, reflecting cumulative exposure to adverse environmental, dietary, and social conditions. This includes earlier diagnosis of metabolic conditions such as type 2 diabetes, with more severe progression and longer duration of disease across the life course.[16] [17]

Market Failure

In regulatory terms, this creates a foreseeable risk environment. Young people are exposed to products and signals designed to capture attention, encourage repeated consumption, and shape preference, at a stage of development characterised by heightened sensitivity to reward and novelty.

The current food environment exhibits the defining characteristics of a market failure. In economic terms, a market failure occurs where the allocation of goods and services by the market does not achieve socially optimal outcomes, often due to information asymmetry, externalities, and behavioural distortions. From a policy perspective, this reflects a broader market failure. The food environment is characterised by:

- information asymmetry (limited understanding of biological effects),
- externalities (health costs borne by individuals and the system), and
- behavioural influences (product design and marketing shaping consumption).

Under such countervailing circumstances, individual choice does not reliably lead to health-promoting outcomes, and there is a recognised role for public policy to correct these distortions.

A proportionate response requires coordinated action across multiple domains, including fiscal policy, research investment, clinical support, and education. Within this, the education sector

[16] Head A, Fleming K, Kypridemos C, et al. (2021). Multimorbidity: the case for prevention. J Epidemiol Community
Health 2021;75:242–244. DOI:10.1136/jech-2020-214301

[17] Skou ST, Mair FS, Fortin M. et al. (2022). Multimorbidity. Nat Rev Dis Primers 8,48.

has a critical role in developing nutritional and food-environment literacy. At present, teachers and educators are not adequately supported by curriculum and guidance materials to deliver this.

[5] KEY OMISSION: MENTAL HEALTH, DEVELOPMENT & NUTRITION

The draft refreshed Health and Physical Education materials include isolated statements linking nutrition to mood, cognition, and resilience, however the summary material statements are not developed into a coherent, assessable learning pathway.

The primary mental health guidance is framed as a whole-school and implementation resource, and does not systematically integrate the biological role of nutrition in mental health or brain function. Primary school children are in a period of rapid physical, neurological, and emotional development. At the same time, rates of mental health challenges, including anxiety, attention difficulties, and mood disorders, are rising. Yet the curriculum does not direct meaningful attention to the role of nutrition in supporting brain function, sleep, concentration, or emotional regulation. Children are taught about feelings and relationships, but not about how biological inputs, food, nutrients, and energy stability, may influence those states. This represents a missed opportunity for early resilience-building based that is underpinned by basic physiology.

Secondary mental health education in New Zealand is comprehensive in its treatment of social, emotional, and cultural determinants of wellbeing. However, it does not systematically incorporate the biological role of nutrition in brain function, including its effects on sleep, concentration, energy regulation, and resilience. While some supplementary resources acknowledge these relationships, they are not embedded within the core curriculum. As a result, students are taught to understand mental health in relational and behavioural terms, but are not consistently equipped to recognise the physiological factors, particularly diet, that may influence their mental and emotional state.

The Ministry's general mental health guidance appropriately cautions against labelling foods as 'good' or 'bad', recognising that such language can stigmatise children and place pressure on families, particularly where financial constraints or sensory needs shape what children eat. However, in removing evaluative language, the curriculum does not replace it with a biologically robust framework that helps students understand how different foods affect their bodies. [18]

Nutrition: Fundamental to Good Mental Health

Students are not systematically taught core physiological concepts such as satiety, energy stability, nutrient density, or level of processing, nor are they given tools to distinguish between hunger, cravings, and short-lived energy fluctuations following high intakes of refined carbohydrates. The curriculum addresses the risk of judgement, but does not equip students to interpret their own biological experience.

Dietary patterns are associated with metabolic and mental health outcomes in children and adolescents. Systematic reviews report that healthier dietary patterns are associated with fewer

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[18] Ministry of Education. Mental Health Education. Years 1-13. A Guide for Teachers, Leaders, and School Boards. https://newzealandcurriculum.tahurangi.education.govt.nz/mental-health-education-guide/5637165639.p

depressive symptoms and better overall mental wellbeing, while poorer diet quality is associated with increased psychological distress.[19] [20]

Nutritional adequacy is therefore central to maintaining cognitive performance, emotional regulation, and resilience, including improved coping when exposed to stress and traumatic events.[21]

At the same time, micronutrients play a foundational biological role: vitamins, minerals, and trace elements act as cofactors in enzymatic processes, including neurotransmitter synthesis and regulation of mood and cognition.[22] Nutrients are essential for brain function, but the extent to which the brain requires nutrients may be largely unrecognised:

> *In adults, every minute their hearts are beating, a quart of blood passes through their brains. That quart represents 15–20% of the entire blood supply, but the brain is only about 2% of adult bodyweight. The brain "punches above its weight," needing to be fed as much as 10 times the amount of blood you would expect for an organ so small. Similar numbers apply to children, depending on their age and weight. In general, the brain consumes 20–40% of the nutrients and energy we ingest, which is disproportionately higher than its weight.*[23]

The modern food environment compounds this issue. A substantial and rapidly expanding literature identifies associations between high consumption of ultraprocessed foods and adverse health outcomes. Umbrella reviews and meta-analyses report links between ultraprocessed food consumption and cardiometabolic disease, as well as highly suggestive associations with depression and common mental disorders.

Emerging research also links ultraprocessed food consumption with poorer mental health outcomes in children and adolescents.

In parallel, sugar-sweetened beverages and high free sugar intake are associated with dental caries, obesity, and broader non-communicable disease risk, and are a major source of sugar intake among young people in New Zealand.

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[19] Tucker JE, Brennan AM, Benton D, Young HA. (2025). A Recipe for Resilience: A Systematic Review of Diet and Adolescent Mental Health. Nutrients. 2025; 17(23):3677. https://doi.org/10.3390/nu17233677

[20] da Silva LEM, Costa PRF, Brito Beck da Silva Magalhães K, et al (2025). Dietary Pattern and Depressive Outcomes in Children and Adolescents: Systematic Review and Meta-analysis of Observational Studies. Nutr Rev. 2025 Sep 1;83(9):1725-1742. doi: 10.1093/nutrit/nuae182.

[21] Rucklidge JJ, Usman Azfali M, Kaplan BJ et al (2021). Massacre, Earthquake, Flood: Translational science evidence
that the use of micronutrients post-disaster reduces the risk of post-traumatic stress in survivors of disasters.
International Perspectives in Psychology 10(1):39–54. DOI: 10.1027/2157-3891/a000003.

[22] Rucklidge JJ, Bruton A, Welsh A et al. (2024). Annual Research Review: Micronutrients and their role in the treatment
of paediatric mental illness. J Child Psychology and Psychiatry. 66(4):477-497. DOI: 10.1111/jcpp.14091

[23] Rucklidge, J. J., Johnstone, J. M., & Kaplan, B. J. (2021). Nutrition Provides the Essential Foundation for Optimizing Mental Health. Evidence-Based Practice in Child and Adolescent Mental Health, 6(1), 131-154. https://doi.org/10.1080/23794925.2021.1875342

Systematic reviews further indicate associations between sugar-sweetened beverage consumption, disrupted sleep, and anxiety symptoms in adolescents. Adolescents are particularly exposed to these risks. Evidence suggests that young people are increasingly embedded in environments characterised by high exposure to ultraprocessed foods and energy-dense, nutrient-poor dietary patterns.

At the same time, type 2 diabetes and related metabolic conditions are now being diagnosed with increasing frequency in younger populations, with earlier onset associated with more severe disease trajectories.

Increasing Rates of Depression, Anxiety & Antidepressant Prescribing

The Ministry of Health has reported that young adults aged 15–24 years (22.9%), commonly experience high or very high levels of psychological distress with rates of distress increasing in the past five years.[24] Depressive symptoms are common, with the:

> *overall prevalence of depressive symptoms rising from 13% to 23% in this 7-year period. Declines were unevenly spread and were generally greater among Māori and Pacific students and those in lower socioeconomic neighbourhoods*[25]

Prescribing of stimulants to treat ADHD, antidepressants including SSRIs (Selective Serotonin Reuptake Inhibitors), a group of antidepressants and antipsychotic medication has increased in Australia and in New Zealand.[26] Between the years 2007/8 to 2015/2016 the rate of dispensing of antidepressants to young people increased by 44%.[27] [28] [29]

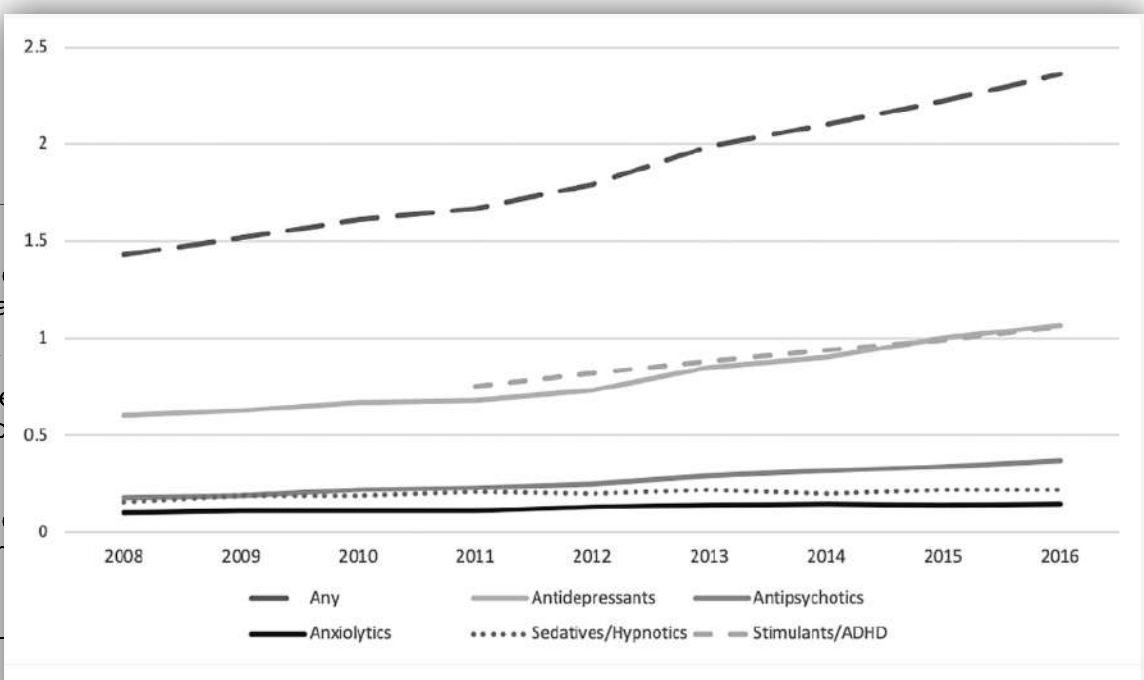

FIG. 1. Percentage of New Zealand children and adolescents prescribed psychotropic medications during 2008–2016, by medication class.

Figure 1. Barczyk ZA, Rucklidge JJ, Eggleston M, Mulder RT. (2020). Psychotropic Medication Prescription Rates and Trends for New Zealand Children and Adolescents 2008–2016. Journal of Child and Adolescent Psychopharmacology.

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Rates and Trends for New Zealand Children and Adolescents 2008–2016. Journal of Child and Adoles

29 BPAC (March 2016). The role of medicines for the treatment of depression and anxiety in patients aged under 18 years. https://bpac.org.nz/BPJ/2016/March/docs/BPJ74-depression-anxiety-under18.pdf?

The biological pathways underlying these patterns are interconnected. Diets high in refined carbohydrates and ultraprocessed foods (UPFs) are associated with dysregulated glucose and insulin signalling, inflammation, and nutrient insufficiency, alongside emerging evidence of microbiome disruption. These mechanisms intersect with neurological and psychological processes, affecting mood, cognition, and behaviour.

This omission is increasingly difficult to justify in the current food environment. A growing body of evidence indicates that diets high in UPFs, typically formulated to be highly palatable and easy to overconsume, are associated with a wide range of adverse health outcomes. A recent umbrella review reported strong evidence linking UPF consumption with cardiometabolic disease, and highly suggestive evidence for associations with depression and common mental disorders.

Adolescents, who have greater autonomy and exposure to food environments outside the home, consume higher proportions of these products, including sugar-sweetened beverages, which are also linked to dental decay, disrupted sleep, and poorer mental health outcomes. UPF exposure and adverse health outcomes

At the same time, the scientific literature continues to support the importance of overall dietary quality and nutrient sufficiency for brain health. Systematic reviews in children and adolescents report associations between healthier dietary patterns and improved mental health outcomes, while poorer diet quality is associated with increased psychological distress. The brain, while a small proportion of body mass, has disproportionately high metabolic demands, and relies on a continuous supply of energy and micronutrient cofactors to support neurotransmitter synthesis, mitochondrial function, and cognitive performance. Diet quality and mental health in children and adolescents

Despite this, curriculum guidance does not explicitly address the distinctive features of UPFs, their role in shaping appetite and consumption patterns, or their potential contribution to fatigue, reduced concentration, and mood instability. Nor does it provide a clear, non-stigmatising language through which students can understand these relationships. In practice, this leaves teachers without a framework to explain why some foods are more likely to promote sustained energy and satiety, while others are associated with fluctuating energy and increased consumption.

The Ministry of Education's limited subject-matter capability reflects a broader absence of coordinated, public-good science infrastructure in nutrition, metabolism, and environmental health. There is no authoritative, evolving evidence base systematically informing the education sector. MNZH's Policy 9, *Science for Healthy People and Healthy Systems,* addresses this gap by establishing an integrated, independent science and research system, operating at arm's length from political ministries. Its purpose is to support health, education, agriculture, and infrastructure stewardship; strengthen capacity to investigate the drivers of environmental decline and chronic mental and metabolic illness; investigate regulatory, social, technical and innovative solutions to these challenges, and ensure effective feedback loops between science, government, and the public.

[7] EXAMPLE HEALTH EDUCATION FORMAT TO BUILD NUTRITIONAL KNOWLEDGE (AGES 8-18)

A DEVELOPMENTAL CASCADE: HEALTH EDUCATION (AGES 8–18)

STAGE 1: FOUNDATIONS (Ages 8–10)

Core principle: The body needs energy and building blocks to function.

Physiology (simplified)

i. Body as a system of parts: muscles, brain, stomach, heart.

ii. Energy concept: food → energy for movement, thinking, growth.

iii. Early concept of "tiny engines" (proto-mitochondrial idea without terminology).

Nutrition: *Macronutrients* introduced simply:

a.Carbohydrates = quick energy.

b.Proteins = growth/repair.

c.Fats = long-lasting energy.

d.Whole vs highly processed foods (observational, not moral framing).

Micronutrients (introductory): 'Helper nutrients' that support the body. Examples:

- Magnesium → muscles, relaxation & sleep → Sourced from: Nuts, seeds, leafy greens .
- B vitamins → energy and brain function → Eggs, meat, whole foods.

Learning outcome: Students can describe: *Food helps different parts of my body work*.

STAGE 2: SYSTEMS & FUNCTION (Ages 11–13)

Core principle: The body is an interconnected system regulating energy.

Physiology. Introduction to:

i. Digestive system → breakdown and absorption.

ii. Blood glucose as circulating energy.

iii. Organs: liver, pancreas, brain (basic roles).

iv. Early regulatory concept: Body keeps things "in balance" (homeostasis).

Metabolic concepts (introductory):

- Food → glucose → energy or storage.
- Introduction to insulin as a 'storage signal' (non-technical).

Nutrition: *Macronutrients* revisited with function:

a.Carbohydrates → raise blood glucose.

b.Protein → satiety, repair.

c.Fat → slower energy release.

d.Distinction: Whole foods vs refined starches/sugars.

Micronutrients (Expanded role):

- Magnesium → nerve signalling, muscle relaxation.
- B vitamins → energy release from food.
- Begin linking deficiency → symptoms (fatigue, irritability).

Learning outcome: Students can explain: *Food affects how my body regulates energy and how I feel*.

STAGE 3: METABOLISM & REGULATION (Ages 13–15)

Core principle: Energy regulation affects long-term health.

Physiology. Clear introduction to:

i. Metabolism (energy use and storage).

ii. Mitochondria (cellular energy production).

iii. Blood glucose regulation:

- Insulin and energy storage.
- Repeated high glucose exposure (conceptual, not clinical).

Brain health

- Brain energy demand (calorific energy and nutrient demand).
- Link between blood glucose variability and concentration & mood stability.

Nutrition

a.Glycaemic impact:

- Refined vs whole carbohydrates

b.Satiety and energy stability:

- Protein and fats in meals

c. Energy density vs nutrient density

Micronutrients (mechanistic link)

- Magnesium: Involved in ATP (energy) processes and nervous system regulation.
- B vitamins: Cofactors in mitochondrial energy production.

- Food sources recognised for their biologic necessity: Why nutrient-dense foods support cellular processes.

Learning outcome: Students can reason: *Different foods change how my body produces and uses energy*.

STAGE 4: SYSTEM STRESS & ADAPTATION (Ages 15–16)

Core principle: Chronic patterns influence biological systems.

Physiology. Introduction to:

i. Insulin resistance (conceptual).

ii. Chronic inflammation (low-grade).

iii. Organ-level effects:

   - Liver fat storage.
   - Hormonal signalling disruption.

Brain and behaviour

- Reward pathways: Definition of an addictive substance, food palatability and repeated intake. - Early concept of: Habit formation and neuroadaptation

Nutrition: Macronutrients:

a. Recognising the effect of satiety, feeling well and frequent high glycaemic intake, the students daily experience of diet + sleep + activity

b. An assignment researching their personal experience and the scientific evidence for their experience.

Micronutrients

- Deficiency and suboptimal intake:
   - Links to fatigue, mood, cognitive performance, skin, immune and/or digestive health.
- Diet quality vs energy intake
- An assignment researching the metabolic or brain-related impact of a selected micronutrient and how it interacts with other micronutrients.

Learning outcome: Students can evaluate: Long-term dietary patterns can alter body systems.

STAGE 5: INTEGRATION & PUBLIC HEALTH (Ages 16–18)

Core principle: Health emerges from biological systems interacting with environments.

Physiology (integrated):

i. Systems model: Metabolic + neurological + endocrine interactions

ii. Multimorbidity concept: Conditions share underlying pathways (e.g. metabolic dysregulation).

Nutrition

a. Dietary patterns at population level: Ultraprocessed vs minimally processed.

b. Nutrient sufficiency: Macro + micro together.

Micronutrients (applied). Magnesium and B vitamins revisited. Role in:

- Stress response.
- Brain function.
- Energy metabolism.

Real-world dietary assessment: Identifying nutrient gaps.

Learning outcome: Students can synthesise: *Health outcomes arise from biological mechanisms interacting with real-world environments.*

SENIOR SECONDARY APPLICATION (Ages 15–18)

At this stage, students are expected to apply mechanistic understanding + social analysis.

1. Analyse influences on food choices (expected at high level):

Integrate:

- Biological drivers (reward pathways, energy regulation).
- Environmental drivers (availability, pricing, marketing).

Evaluate: How hyperpalatable ultraprocessed foods interact with neurobiology.

Recognise: Cultural and social influences without reducing to preference alone.

Students can:

✓ Link behaviour to physiology.

✓ Distinguish short-term preference vs biological reinforcement.

✓ Use examples (e.g. refined carbohydrates and satiety signalling).

2. Evaluate the impact of a health issue (e.g. diabetes, mental health)

Recognise the issue as systems issue, not single-cause:

- Metabolic regulation.
- Brain function.
- Environmental exposure.

Example of a case study:

- Mechanism: Energy dysregulation → insulin signalling → storage.
- Brain: Mood, cognition, reward.
- Outcomes: Physical *and* psychological.

Students can:

- ✓ Avoids single-factor explanations
- ✓ Uses biological pathways to explain observed patterns
- ✓ Distinguishes correlation vs plausible mechanism

3. Develop a health promotion initiative

Grounded in:

- Biological plausibility.
- Environmental feasibility.

Example features/policy or promotion instruments:

- Targets: Food environment (availability, pricing, access);
- Incorporates: Nutrient-dense foods, the reduction in high glycaemic load foods; or
- Increases access to whole foods.

Design expectations

Identifies: Target population and why it is important.

Evaluates: Barriers (cost, access, habits)

Measures: Outcomes (energy stability, wellbeing, behaviour change)

Students Can:

- ✓ Links intervention → biological mechanism → expected outcome
- ✓ Avoids purely informational strategies
- ✓ Recognises system constraints

By the senior years, this progression enables students to engage in applied reasoning, demonstrating causal analysis, systems-level thinking, and the ability to evaluate evidence in a structured and scientifically literate manner.

[8] UNDERGRADUATE STUDIES: PRE-MEDICAL & BIOMED OVERVIEW

Reviews of University of Otago and Auckland curriculum suggest that while students develop a strong analytical understanding of biochemical and physiological processes, the curriculum places less explicit emphasis on synthesising these into a unified, nutrient-centred systems model.

Cofactors and micronutrients are recognised within specific reactions, yet are not consistently framed as cross-system regulators influencing multiple pathways simultaneously. Consequently, while graduates are well equipped to understand and analyse individual biological processes, the integration of diet, nutrient sufficiency, digestive function, and whole-body feedback loops remains an area that depends on later-stage learning or independent synthesis.

University of Otago

The University of Otago's pre-medical and biomedical teaching is characterised by a strongly pathway-centred approach, in which biological understanding is built through detailed examination of discrete biochemical and physiological processes. Core teaching in chemistry and biochemistry establishes reaction energetics, molecular interactions, and enzyme function, which then feed directly into canonical pathways such as glycolysis, the citric acid cycle, lipid metabolism, and amino acid turnover. Within this structure, nutrients, particularly vitamins and mineral cofactors, are introduced primarily as functional components embedded within these pathways, for example as coenzymes or catalytic elements required for specific reactions. This produces a high level of technical competence in understanding how individual pathways operate and are regulated.

A similar pattern is evident in physiology and neuroscience. Hormonal signalling and neurotransmitter systems are taught through defined regulatory circuits, such as insulin-glucagon balance or amino acid-derived neurotransmitter synthesis, again with emphasis on the internal logic of each pathway. The digestive tract is likewise presented with clarity in terms of structure, enzymatic breakdown, and absorption mechanisms, linking nutrient intake to systemic circulation and organ-level metabolism. However, these components are typically taught as functionally complete units, rather than as parts of a continuously interacting, nutrient-dependent system.

The consequence of this pathway orientation is that integration across domains, dietary intake, micronutrient status, metabolic regulation, and brain function, remains comparatively implicit rather than explicit. Cofactors such as magnesium and B vitamins are recognised within specific reactions, but are not consistently foregrounded as cross-cutting regulators operating simultaneously across multiple systems. As a result, while students develop a rigorous understanding of biochemical and physiological mechanisms, the curriculum places less emphasis on synthesising these into a unified model in which nutrient availability, digestive function, and systemic feedback loops are understood as dynamically interdependent. This reflects a traditional biomedical pedagogy that privileges analytical decomposition into pathways, with systems-level nutritional integration emerging later, or requiring additional synthesis by the learner.

University of Auckland

A similar, though not identical, pattern is evident in the University of Auckland's pre-medical and biomedical teaching, which is likewise grounded in a pathway-centred scientific framework, but with some variation in emphasis and integration across courses. Foundational teaching in chemistry and biochemistry (e.g. CHEM 110, BIOSCI 107/106) establishes molecular structure, reaction energetics, and enzyme function, which then underpin detailed study of canonical metabolic pathways. As at Otago, students are taught glycolysis, oxidative phosphorylation, lipid and amino acid metabolism as discrete, internally coherent systems, with strong attention to regulation, energetics, and biochemical logic.

Within this structure, nutrients, particularly micronutrients, are again primarily introduced as embedded components within biochemical pathways, rather than as organising principles in their own right. Vitamins, especially B-group cofactors, appear in the context of cellular respiration and enzymatic reactions, while minerals such as magnesium are typically implicit within discussions of enzyme activity and ATP function. This produces a technically strong understanding of metabolism, but one that is framed through pathway mechanics rather than nutrient sufficiency or system-wide dependency.

In physiology (e.g. MEDSCI 142) and related biomedical sciences, the same pathway orientation persists. Hormonal regulation, particularly insulin, glucagon, and broader endocrine signalling, is taught through clearly defined control systems, while neurotransmitter synthesis and neural signalling are presented through specific biochemical routes and receptor interactions.

The digestive system is covered in terms of anatomy, enzymatic digestion, and absorption, linking nutrient intake to circulation and organ-level metabolism. These components are well articulated, but are generally taught as functionally bounded modules, each with its own internal coherence.

Where Auckland differs slightly is in its incorporation of population health and behavioural science earlier in the curriculum, which introduces broader determinants of health alongside biological teaching. However, this does not fundamentally alter the underlying scientific structure, which remains predominantly pathway-driven. Real-life integration of dietary patterns, micronutrient status, metabolic regulation, and brain function is implied rather than explicitly integrated across the curriculum.

[9] UNDERGRADUATE STUDIES: SYSTEMS PHYSIOLOGY & CLINICAL

Medical education has long been maintained a technical focus on discrete organs, discrete pathways, and technical or mechanistic intervention. Students are commonly trained by breaking the body into bounded modules: cardiovascular, endocrine, gastrointestinal, neurochemical, and by mastering canonical mechanisms within each, such as glycolysis, receptor signalling, hormone cascades, and disease-specific treatment algorithms. [30] [31] [32]

That approach is scientifically valuable, but a critical literature argues that this narrows clinical reasoning when the technical approach becomes the predominant governing frame rather than one tool among others. Critiques of the biomedical model note that the traditional approach tends to approach and treat disease as malfunction within isolated parts, rather than as the outcome of interacting systems over time. The 'hidden curriculum' literature further shows that this reductionist orientation is reproduced culturally through teaching norms and clinical apprenticeship, even when formal curricula claim to be more holistic.[33] [34]

Critics argue that the mechanistic approach can be improved through a different lens. One that starts from first principles of physiology, regulation, adaptation, and whole-body function, and then situates pathways within that wider frame. In this model, the clinician asks first how energy regulation, nutrient sufficiency, endocrine signalling, immune activity, organ cross-talk, and feedback loops are functioning, before moving to narrower disease labels and treatments. Major reform work has argued for education that is more explicitly systems-based, integrative, and responsive to complexity, rather than simply additive or modular. More recent work in systems biology and physiology education pushes in the same direction: teaching medicine as the study of interacting living systems, not merely a catalogue of pathways and protocols.

The core challenge is not 'curriculum overcrowding', but rather, institutional inertia: faculties are themselves trained within established biomedical categories, licensing and assessment systems still reward compartmentalised recall, and clinical culture remains strongly treatment-oriented. That is why reforms so often become organisationally visible but epistemically shallow. Described as 'reform without change', schools may adopt integrated blocks, new competencies, or problem-based learning, while the underlying logic of teaching still returns students to organs, pathways, and downstream treatment paradigms. Student knowledge and learning is shaped as much by institutional culture and role modelling as by official course documents.[35]

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[30] Lempp H, Seale C. The hidden curriculum in undergraduate medical education: qualitative study of medical students' perceptions of teaching. BMJ. 2004 Oct 2;329(7469):770-3. doi: 10.1136/bmj.329.7469.770.

[31] Ricotta DN, Hale AJ, Freed JA, Scribner TE, Zeidel ML, Herzig SJ. Generalists as Clinical Physiologists: Bringing Science Back to the Bedside. J Gen Intern Med. 2021 Dec;36(12):3847-3851. doi: 10.1007/s11606-021-06978-0.

[32] Choudhury D, Nortjé N. The Hidden Curriculum and Integrating Cure- and Care-Based Approaches to Medicine. HEC Forum. 2022 Mar;34(1):41-53. doi: 10.1007/s10730-020-09424-6.

[33] David, L., Gourraud, PA., Lamirault, G. et al. Rethinking medical education through systems biology to address complexity. npj Syst Biol Appl 12, 12 (2026). https://doi.org/10.1038/s41540-025-00636-5

[34] Sturmberg JP, Martin CM, Katerndahl DA. Systems and complexity thinking in the general practice literature: an integrative, historical narrative review. Ann Fam Med. 2014 Jan-Feb;12(1):66-74. doi: 10.1370/afm.1593.

[35] Iedema, R., Degeling, P., Braithwaite, J., & Kam Yin Chan, D. (2004). Medical Education and Curriculum Reform: Putting Reform Proposals in Context. Medical Education Online, 9(1). https://doi.org/10.3402/meo.v9i.4368

This translates into the clinical experience. A doctor may graduate highly capable at diagnosing diabetes, matching symptoms to psychiatric categories, and prescribing within guideline-based frameworks, yet be less well prepared to understand type 2 diabetes as a largely preventable disorder of long-term metabolic dysregulation or to treat nutritional status as a central explanatory variable rather than an adjunct. Likewise, such a doctor may know that deficiency states can contribute to low mood, cognitive symptoms, or neuropathy, but may not emerge with a strong routine language for thinking through nutrient cofactors, digestive function, dietary pattern, metabolic stress, and symptom expression as part of first-line clinical reasoning. The evidence on nutrition teaching is particularly clear here: a major systematic review found nutrition to be insufficiently incorporated across medical education, with consequences for students' knowledge, confidence, and ability to deliver nutrition care; subsequent competency work has therefore argued that nutrition assessment, diagnosis, and treatment skills should be explicitly embedded in training and even in licensing examinations.[36] [37]

Government officials, patients and their family members and other health care professionals are entitled to question whether doctors are systematically trained to see preventability, physiological causation, and nutritional optimisation early enough in the reasoning process. They may only partly have such a capacity. Many doctors can certainly acquire that language, and some do, particularly if they engage in nutrition-based ongoing professional development training, but the prevailing educational architecture does not reliably produce it. A physiology-led, first-principles model would be more likely to produce clinicians who can ask, before prescribing, whether the patient's metabolic state, nutrient sufficiency, gastrointestinal function, sleep, and broader regulatory biology have first been properly assessed and optimised.

APPENDIX

Food and nutrition

What is food and nutrition education?

It is expected that all ākonga will have had practical cooking experiences by the end of year 8. Through learning opportunities in food and nutrition education, ākonga will develop knowledge and understanding of:

- the nutrition people across all age groups require for growth and development
- how nutrition, exercise, and wellbeing are related
- the cultural significance of food and of rituals associated with food and nutrition
- selecting and preparing food and eating patterns that reflect health-enhancing attitudes towards nutrition

[36] Crowley J, Ball L, Hiddink G (2019). Nutrition in medical education: a systematic review The Lancet Planetary Health, 3, e379-e389

[37] Eisenberg DM, Cole A, Maile EJ, et al. Proposed Nutrition Competencies for Medical Students and Physician Trainees: A Consensus Statement. JAMA Netw Open. 2024;7(9):e2435425. doi:10.1001/jamanetworkopen.2024.35425

- the costs associated with buying and preparing food and the skills necessary to meet nutritional needs on a limited budget
- the skills needed to prepare food successfully and safely at a personal level and as a shared responsibility.

The underlying concepts in food and nutrition

The underlying concepts are woven through learning in this area in the following ways:

Hauora

In this key area of learning, ākonga have opportunities to examine the influence of food and nutrition in relation to the physical, social, mental, emotional, and spiritual dimensions of hauora.

Attitudes and values

Ākonga will have practical experiences enabling them to develop healthy attitudes towards food and nutrition. Teachers will recognise and take into account the diverse cultural, social, and economic backgrounds of ākonga in New Zealand schools. Programmes should encourage a healthy and realistic attitude to body size and shape, and promote the enjoyment and appreciation of food.

The socio-ecologicalperspective

Ākonga examine the influences of culture, technology, and society on food choices, food preparation, and eating patterns. They will develop strategies for addressing nutrition related health issues.

Health promotion

Effective food and nutrition education is reinforced by a school environment that encourages healthy eating, promotes safe food handling practices, and makes use of community support.

Reference: https://newzealandcurriculum.tahurangi.education.govt.nz/food-and-nutrition/5637165635.p?