



Dietary Supplements in the Malaysian Context: Policy Recommendations for Enhancing Freedom of Choice and Healthcare Savings

**Benedict Weerasena, Carmelo Ferlito
and Paolo Bellavite**





Center for
Market
Education



Benedict Weerasena

Economist at Bait Al-Amanah and
Fellow of the Center for Market Education, Malaysia.



Carmelo Ferlito

CEO of the Center for Market Education, Malaysia.



Dr Paolo Bellavite

Medical Doctor, Professor (retired) of
General Pathology at the University of Verona, Italy.

Executive Summary

The demand for dietary supplements in Malaysia is on an upward trajectory similar to global trends, due to increasing awareness regarding personal health and well-being, in addition to evolving eating habits amid time-pressed and hectic urban lifestyles. This is because dietary supplements have been proven to boost immunity, reduce the risk of infections, overcome malnutrition and contribute to significant healthcare savings as a whole. However, the discriminatory regulatory and fiscal framework at present has reduced access to dietary supplements in Malaysia, especially among vulnerable communities. Thus, this paper presents several policy recommendations towards greater accessibility to dietary supplements.

Main findings:

- From extensive global research, dietary supplements have been shown to enhance nutrition, prevent deficiency, reduce the risks of costly disease-related events among high-risk populations, while boosting workplace productivity and improving overall well-being.
- Preventive daily intake of 1g of omega-3 EPA+DHA and 1.7g of phytosterols reduces the relative risk of cardiovascular events by 4.9% and 2.3% respectively, while a daily intake of 1000mg calcium and 15 µg of Vitamin D reduce the incidence of fractures by 15%.
- For every one ringgit spent on omega-3 and B vitamin supplements as preventive daily intake levels, a significant RM4.50 and RM1.72 can be saved respectively in avoided coronary heart disease (CHD) costs. The total estimated potential net savings in avoided hospital utilization cost, productivity loss and burden of disease cost is RM42.44 million and RM16.74 million respectively, on average per year in Malaysia.

- For the prevention of Type 2 Diabetes Mellitus (DM), RM 1.31 can be saved per RM 1 spent on chromium picolinate, amounting to a total potential net cost savings of RM248.27 million per year. Thus, individual expenditure for dietary supplements act as an alternative form of insurance which diminishes the risk of substantial expenses for future medical treatments.
- For protection against Covid-19 and other infectious disease, a nutrition model rich in suitable dietary supplements including omega-3 fatty acids, vitamins C and D, and phytonutrients is highly recommended. This aligns with the rise in demand of immunity-boosting products in Malaysia during the Covid-19 pandemic.
- The market size of the Malaysian dietary supplements industry recorded an estimated CAGR of 3.0% between 2018 and 2020, reaching RM2.1-2.2 billion (USD 519-544 billion) in 2020. The growing trend testifies to the importance of freedom of choice and empowerment of consumers in healthcare solutions.
- Despite the positive growth in demand, Malaysia still lags behind its Asian counterparts, as less than 30% of the population consumes dietary supplements compared to countries like South Korea (60-70%), Taiwan (40-50%) and Australia (40-50%).
- The low consumption of dietary supplements impedes progress in overcoming the triple burden of malnutrition, obesity in adults, and anaemia among women of reproductive age, in which Malaysia is the only Southeast Asian nation with this triple burden.
- The current system of taxes and duties involving dietary supplements have indirectly made products more expensive and limited consumer choices, especially among vulnerable households where affordability is a key barrier. Almost all traditional and non-traditional dietary supplements are charged 5% sales tax.

Policy recommendations:

- The Malaysian government should revise the current import duty policy on the ingredients of dietary supplements, implementing simple and immediate bilateral agreements for truly free trade. Although concerns may arise on the need for protection of domestic industries; yet this would adversely impact consumers and also impede local producers from boosting product quality.
- With regards to SST as duty and SST as tax on manufactured products, we propose that ingredients and final products related with dietary supplements should become SST exempt. This is grounded in the importance of freedom of choice with regard to healthcare decisions and individual courses of treatment.
- We recommend an introduction of lifestyle tax relief for individuals for the purchase of nutrients and dietary supplements, with a limit of RM 1,500 per year; considering how tax reliefs nudge in favour of healthy behaviours.
- Instead of advocating for overarching subsidies which creates a negative dependence mentality, a limited and targeted subsidy strategy towards vulnerable groups can be considered, coupled with end-of-subsidy monitoring plan.
- We believe that local government action in education, together with cooperation from supplement producers and related NGOs will be an effective long-term strategy to increase dietary supplementation.

Introduction

The present paper focuses on the importance of choosing to use health supplements from different perspectives. Extensive space is here devoted to the proven efficacy of dietary supplements in preventing illnesses (section 2), with a specific focus on infectious diseases (section 3).

We wish to emphasize also how important it is to view the use of health supplements from the perspective of freedom of choice. In fact, it has been found (Astin, 1998; Filshie and Rubens, 2006) that complementary and alternative medicine (CAM) users (among whom we should include dietary supplement consumers) resort to these treatments not because of dissatisfaction with conventional medicine, but rather because they find alternative solutions to be more congruent with their own values, beliefs and philosophical orientations. Further research is needed to strengthen the idea that the autonomy of the individual in choosing health solutions is part of a defence of human rights; a rights-based approach can better support informed decisions and policy assessments (Stuttaford et al., 2014). It has been shown that trust in the effectiveness of CAM therapies is not mutually exclusive with a belief in science (Lobera and Rogero-Garcia, 2020).

Freedom of choice and a rights-based approach cannot remain a statement of principle and must be supported by a proper institutional framework. For the case of Malaysia, the current legal background is analysed in section 4, while we present policy recommendations in section 6.

Furthermore, the case for a regulatory framework nudging in favour of dietary supplements is supported by a growing need to incentivize a preventive approach to health, precisely the realm where health supplements play a role. Such a need is made stronger by growing healthcare costs related, among other things, to ageing populations. Better prevention can lead to important healthcare savings.



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As health spending continues to rise, governments are seeking policies that can begin to drive down health costs and improve population wellbeing. [...] With the added health burden of an ageing population, these levels of spending could become unsustainable.

[...] Despite gains in longevity, adults spend the last fifth of their lives with a disability or chronic illness. Clearly, new solutions are needed to manage healthcare costs and improve population wellbeing.

Good nutrition is essential for the maintenance of normal health, and a significant part of this is ensuring that people consume the right amounts of vitamins, minerals, fibre and fatty acids. [...]

Dietary advice remains the central tenet of public health nutrition. [...]

Scientific evidence combined with economic impact studies reveal that topping up diets with supplemented nutrients not only prevents deficiency but could lead to significant health savings as a consequence of the beneficial impact on chronic disease risk. Supplementation is an effective way of bridging the gap between current status and optimal intakes. (FSE, 2019, p. 4)



(FSE, 2019, p. 4)

These opening remarks by Food Supplements Europe help us realize how crucial the health supplements market will be in the near future, in order to tackle rising healthcare costs connected with malnutrition and ageing populations. Shanahan and de Lorimier (2014, p. 2) demonstrated «that significant cost savings can be realized by health care payers, such as insurance companies, and consumers through the use of dietary supplements that have a demonstrable and substantial effect on the risk of costly disease-related events among targeted high-risk populations. Specifically, [...] the usage of key dietary supplements can reduce overall disease treatment-related hospital utilization costs associated with heart disease, age-related eye disease, diabetes, and bone disease in the United States among those at a high risk of experiencing a costly, disease-related event. Thus, targeted dietary supplementation regimens are recommended as a means to help control rising societal health care costs, and as a means for high-risk individuals to minimize the chance of having to deal with potentially costly events and to invest in increased quality of life».

The authors found that, regarding coronary heart disease (CHD), the use of omega-3 and the B vitamins folic acid, B6, and B12 among all U.S. adults over the age of 55 can bring saving for as much as \$2.06 billion on average per year and a cumulative savings of \$16.46 billion from 2013 to 2020. «The potential net savings in avoided CHD-related hospital utilization costs after accounting for the cost of omega-3 dietary supplements at preventive daily intake levels would be an average of \$484.6 million per year, and more than \$3.88 billion in cumulative health care cost savings from 2013 to 2020. The full utilization of folic acid, B6, and B12 among the target population at preventive intake level's effect on potential avoided CHD-related hospital utilization costs would be an average savings of \$1.52 billion per year—a cumulative cost avoidance to health care payers of \$12.12 billion from 2013 to 2020. The potential net savings in avoided CHD-related health care costs after accounting for the cost of folic acid, B6, and B12 utilization at preventive daily intake levels would be an average of \$654.0 million per year and more than \$5.23 billion in cumulative health care cost net savings from 2013 to 2020» (Shanahan and de Lorimier, 2014, p. 2).



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Furthermore, «an average of \$4.23 billion per year and a cumulative savings of \$34.00 billion from 2013 to 2020 in avoidable hospital utilization costs is potentially realizable if all U.S. adults over the age of 55 diagnosed with CHD were to use phytosterol dietary supplements at protective levels. Likewise, potential total cost savings among the same target population given the use of the psyllium dietary fiber at preventive daily intake levels would be an average hospital utilization cost avoidance of \$4.38 billion per year and cumulative savings of \$35.05 billion from 2013 to 2020. The potential net health care cost savings of phytosterols and psyllium dietary fiber supplementation, after accounting for the cost of supplement utilization, would be an average annual savings of \$3.32 billion per year and \$2.48 billion per year, respectively, after accounting for the costs of supplementation utilization from 2013 to 2020» (Shanahan and de Lorimier, 2014, p. 3). The authors also estimated important saving coming from using lutein and zeaxanthin dietary supplements, if every person over the age of 55 with ARED were to take lutein and zeaxanthin supplements at the preventive daily intake levels (\$57.4 million per year from 2013 to 2020).

In this regard, much more research and better information need to be done. In fact, despite the fact that individual countries publish Dietary Reference Values (DRVs), The World Health Organisation highlighted several nutrients which tend to fall below DRVs, including iron, iodine and vitamin D: women, girls and elderly women are most likely to be at risk from low intakes. Similarly, a study conducted on 21 European countries found that none of them met more than 40% of the recommendations for macro or micronutrients (FSE, 2019, p. 5).

According to FSE (2019, p. 6), in example, deficiency of vitamin D in Europe could be already at pandemic levels (with 100% of Belgians falling to achieve nutrient recommendations for vitamin D). FSE (2019, pp. 9-11) has shown that considerable healthcare savings can be achieved by promoting supplements such as folic acid, phytosterols, bone health nutrients, heart health nutrients and Omega-3 fatty acids.

In this regard, recent trends in behavioural economics can become an important tool for policy analysis (Ammerman et al., 2017). In fact, although «the most popular policy-based approach to promote healthier eating has thus far been providing additional nutrition information to consumers» (Liu et al., 2014, p. 15), new approaches are worth exploring. For example, a healthier nutrition program can be supported, via policy, at school cafeterias (Liu et al., 2014, pp. 15-16). Furthermore, a greater role of research to guide policymaking should be encouraged (Liu et al., 2014, p. 18).

The efficacy and innovations of dietary supplements (explained below) have led to their rapid market expansion; however, with regard to the case of Malaysia, they still are still burdened by a discriminatory regulatory and fiscal framework (section 4) when compared to other CAM treatments, like traditional Chinese medicine. Policy reforms for the Malaysian case are presented in section 6.

2. On dietary supplements and their benefits in general

While an exhaustive presentation of the medical benefits produced by a healthy diet and dietary supplements is beyond the scope of the present paper, we present here, in the form of sketches, certain findings that can testify how their consumption can be beneficial in tackling different kinds of diseases.

In section 3 we will extensively discuss this point, but it is worth noting in advance that a well-functioning immune system is important to help reduce the risk of infections (SGE, 2020, p. 4).

Deficiencies or suboptimal status in these micronutrients have the potential to negatively affect immune function and may therefore decrease resistance and the effectiveness of the body's response to infections. Other nutrients such as omega-3 fatty acids also support an immune system to be effective. Optimal status with micronutrients and omega-3 fatty acids is considered to support optimal function of the immune system, with the potential to reduce the risk and consequences of infections, including viral respiratory infections.

Ideally adequate nutritional status should be achieved via a well-balanced diet. However, data indicate that this is not generally the case with the current lifestyle for a number of micronutrients. The nutritional status is even worse in older adults; with a considerable amount being deficient for several vitamins or at risk for vitamin deficiencies. Hence enforcing a well-balanced diet, or if this is not possible, add nutritional supplements or functional foods enhanced with certain vitamin D is one possible cost effective option to fill the nutritional gap. If

supplements are used this should be done within the framework of targeted nutritional strategies among at risk individuals and a well-balanced diet remains the primary goal. For supplements, the amounts need to fall within the recommendations and upper safety limits set by scientific expert bodies, such as in D-A-CH and by EFSA



(SGE, 2020, p. 4).

We have seen in the previous section that, according to FSE (2019, p. 6), vitamin D deficiency in Europe could be already at pandemic levels. Such a statement is particularly important in light of the evolution and findings related to the Covid-19 pandemic; in fact, vitamin D deficiency on admission to hospital was associated with a 3.7-fold increase in the odds of dying from Covid-19 (McCall, 2020). Similarly, Radjukovic et al. (2020), demonstrated an association between vitamin D deficiency and severity of Covid-19; in particular, vitamin D-deficient patients had a higher hospitalization rate and required more (intensive) oxygen therapy. According to the authors, when adjusted for age, gender, and comorbidities, vitamin D deficiency was associated with a six-fold higher hazard of a severe course of disease and an approximately 15-fold higher risk of death. Similar observations were reported for Indonesia by Pinzon, Angela and Pradana (2020); it may be worth further exploring the idea that Covid-19 found “fertile soil” for infection due to the widespread vitamin D deficiency. Studies referring to Switzerland have also shown that vitamin D reduced the risk for acute respiratory tract infections by 42% (SGE, 2020, p. 2).

The role played by vitamin D is also recognized by Malaysian authorities, although still without specific reference to infectious diseases. Government Clinical Practice Guidelines (CPG) for the management of rheumatoid arthritis suggested that, as long-term use of corticosteroids predisposes one to several complications, in particular osteoporosis and infection, patients on corticosteroids should be treated with calcium and vitamin D (MaHTAS, 2019, pp. 16-17).



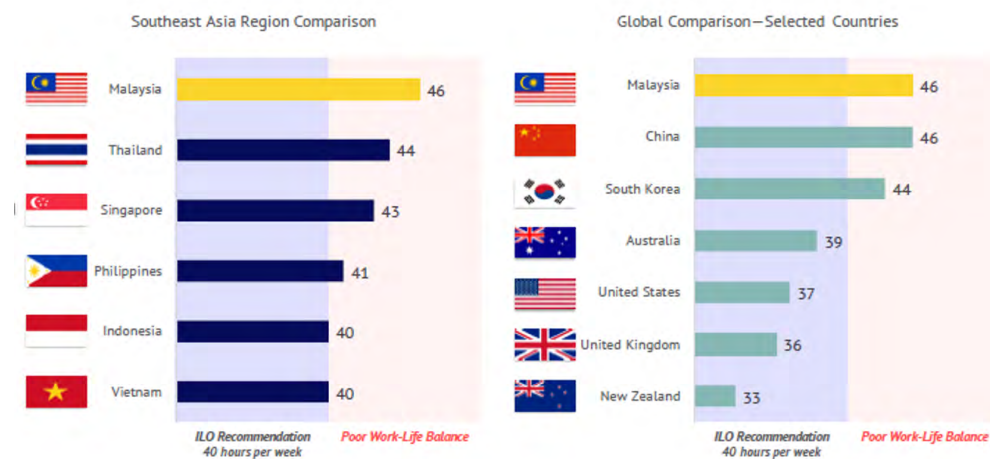
Doctor photo created by jcomp
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Similar recommendations can be found in the Malaysian CPG on management of osteoporosis. In fact, it has been proven that, in preventing osteoporosis, the consumption of calcium and vitamin D supplements improves bone mass density (BMD), decreases the vertebral fracture rate and the hip fracture rate (MOS, 2012, p. 9). The Malaysian CPG for osteoporosis emphasize the importance of nutrition and a balanced diet for bone health (MOS, 2012, p. 28), where is clearly stated that it is important to ensure vitamin D sufficiency among children and adults to prevent osteoporosis (MOS, 2012, p. 30). For adults 50 years old or older, the Malaysian Recommended Nutrient Intake advocates 400 IU of vitamin D per day, but many experts recommend at least 800 to 1000 IU per day. The elderly who are institutionalised, immobile, lack outdoor activities and have a poor diet will benefit from 800 IU vitamin D supplementation daily. Vitamin D supplements are available as ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). With daily dosing, vitamin D2 and D3 appear to be equally potent, but with intermittent (weekly or monthly) dosing, vitamin D3 appears to be about 3 times more potent than vitamin D2. Vitamin D supplementation has also been shown to improve muscle strength, balance, and risk of falling as well as improve survival. (MOS, 2019, pp. 30-31). In conclusion, in the fight to prevent osteoporosis, the Malaysian authorities recommend a daily intake of 1000 mg of calcium (both dietary and supplements) and 800 IU of vitamin D (MOS, 2019, p. 31).

Beyond the role played by vitamin D, vitamin C is also well recognized as a booster for the immune defence, «as it is required by cells from the innate and the adaptive immune system and helps protect the body from damage as a consequence of excessive immune response» (SGE, 2020, pp. 4-5). In particular, vitamin C deficiency increases the risk of contracting infections such as pneumonia; a stressful lifestyle may play a role in reducing vitamin C levels, and this element can be of particular significance in Malaysia, where the mean hours worked per employed person in a week are among the highest in the world. While many studies on the efficacy of vitamin C megadoses in preventing respiratory diseases are inconclusive or negative, meta-analyses suggest a consistent and statistically significant benefit of vitamin C for preventing the common cold and in people exposed to short periods of stress, intense exercise or to a cold environment (Douglas et al., 2007; Hemila and Chalker, 2013). Vitamin C is believed to prevent oxidation of LDL and to protect human vascular smooth muscle cells from apoptosis (Grosso et al., 2013) and to boost immune functions (Carr and Maggini, 2017).

The positive function exercised by supplements is not limited to

Figure I: Mean hours worked per employed person per week.



Source: MADSA (2019, p. 30).

important vitamins such as vitamin C and D. Adverse effects of inflammations can be mitigated also with an adequate intake of docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) (SGE, 2020, p. 5) and polyphenols (see section 3).

Furthermore, some important results have been demonstrated with regard to the usage of health supplements in preventing widespread diseases, such as cardiovascular events. Some of the results from FSE (2019) are summarized in the table below.

Table 1: Supplement consumption and health benefits.

Supplement	Achievement
1g of omega-3 EPA+DHA daily.	4.9% reduction in relative risk of cardiovascular (CVD) events.
1.7g of phytosterols daily.	2.3% reduction in relative risk of CVD events.
1000mg calcium + 15µg vitamin D.	15% reduced incidence of fractures.

Source: FSE (2019).

The consumption of fruits and vegetables has a preventive effect against cancer, and in recent years natural dietary agents have attracted great attention in the scientific community and among the general public (Zanini et al., 2015). Tan et al. (2016) studied the effects of a pre-surgical administration of probiotic microbial cell preparation in colorectal cancer patients. Probiotic microbial cell preparation proved to be a beneficial pre-surgical nutritional supplement to support bowel recovery and promote the return of normal gut function after abdominal surgery; the treatment group demonstrated significantly faster return of normal gut function with a median of 108.5 h, 48 h faster than a group treated with a placebo; also, the duration of hospitalization recorded a 6.5 days median value, versus 13 days for the group treated with a placebo.

Faster return to normality for gut function, thanks to a probiotic microbial cell preparation, has also been demonstrated in the case of adding such a treatment to enteral feeding in critically ill patients. The probiotic supplement reduced the required duration of mechanical ventilation and the length of ICU stay (Malik et al., 2016).

Ibrahim et al (2020) demonstrated that consumption of a multi-strain probiotic over 8 weeks improved bowel opening frequency and whole gut transit time in Parkinson's disease patients with constipation; in particular a 50% improvement in bowel movement and a 38% reduction in gastric transit time have been observed.



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Similarly, research results suggest that probiotic microbial cell preparation is effective in improving stool frequency (+50%) and stool consistency; furthermore, it could reduce the symptoms of straining and sensation of incomplete evacuation (about a 37% reduction) in adults with chronic functional constipation (Jayasimhan et al., 2013). With regard to the same issue, Ghafar et al. (2020) conducted controlled trials and found an improvement in stool frequency and consistency in elderly patients with chronic medical conditions following the administration of MCP[®] and BCMC[®] strains; in particular, stool frequency improved by 50% and overall constipation symptoms were reduced by 70%.

With reference to dengue fever, unfortunately still a common disease in tropical countries like Malaysia, Lorraine (2012) demonstrated that patients given probiotics had a shorter length of hospital stay (3 instead of 4 days), earlier normalization of haematocrit levels (0.64 instead of 1.1 days), fewer complications (9% instead of 18% of patients) and earlier resolution of abdominal pain (0.5 instead of 1 day), while the fever took 1-2 days to resolve instead of 3-4 days without the probiotics.

Furthermore, it has been found that glucosamine is statistically more efficacious than a placebo in terms of pain reduction related to osteoarthritis (MaHTAS, 2013, p. 23). In particular, 1500 mg per

day of glucosamine sulfate may be used as pain relief for knee osteoarthritis (MaHTAS, 2013, p. 23). Similarly, although further studies may be needed, there are indications that chondroitin sulfate (800 mg as a single dose) may be efficacious in pain reduction, improving hand function and morning stiffness in patients with hand osteoarthritis (MaHTAS, 2013, p. 23).

Another important finding is that, contrary to expectations, vitamin supplement consumption positively impacts energy consumption, probably because of a substitution effect on the mix of consumed food generated by the supplement intake (Schroeter et al., 2010, p. 15).

All these important results need to be understood within the introductory framework explained in section 1: Even in developed countries, and despite the growing varieties of food to which we have access, in contemporary diets several micronutrients tend to fall below DRVs. Such a deficiency is not only a cause for concern because it increases the exposure to several diseases, but it seems to have important negative effects even on productivity.

Referring to a study published by Dr Adam Drewnowski in 2019, IADSA (2020) explained that both in low and middle-income countries (LMICs) and in high-income countries (HICs), it is believed that malnutrition among workers makes them less productive, which is a threat to economic growth and development; therefore, investing in better nutrition is seen as a factor that may positively affect national economics and public health. Obviously, in LMICs malnutrition is usually caused by undernutrition (a diet low in calories and micronutrients), while in HICs malnutrition generally results from the consumption of too many high-energy, low nutrient foods, leading to diet-related diseases such as obesity, diabetes and coronary heart disease.

In this regard, it is important to observe that in HICs, low-nutrition foods tend to be cheaper than more nutrient-dense food, and therefore nutrient deficiencies are more likely to affect the low-income segments of the population. Despite a lack of data on

the role of dietary supplements in improving productivity in the workplace, promising results have been obtained in the US National School Lunch Program, where pupils were given low-cost nutrient-rich meals; the initiative produced improved school performances, raising the question whether similar effects may be obtained in the workplace (IADSA, 2020).

3. Nutrition and infectious diseases

Public health practices including handwashing and vaccinations help reduce the spread and impact of infections. Nevertheless, the global burden of infection is high, and additional measures are necessary. Acute respiratory tract infections, for example, were responsible for approximately 2.38 million deaths worldwide in 2016. The role nutrition plays in supporting the immune system is well-established (Calder et al., 2020; Iddir et al., 2020; Donzelli and Giudicatti, 2020). The groups of foods that follow have evidence to show their influence on total mortality and on mortality from infectious diseases.

A systematic review of cohort studies (Aune et al., 2016) showed convincing reductions of up to 30% of total mortality associated with the consumption of up to 225 g / day of integral cereals. Mortality for infectious diseases was reduced by 20% with the consumption of 50 g / day of integral cereals, and the curve continues with a slight slope up to ~ 110 g / day (RR 0.74; 0.56-0.96) (Aune et al., 2016). A series of systematic and meta-planning reviews (Reynolds et al., 2019) confirmed reductions of total mortality by 15-19% with fiber consumption at least 25-30 g / day.



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A systematic review of 20 cohort studies (Aune et al., 2016) showed reductions of up to 22% total mortality associated with consumption of a 28 g portion/day of nuts/nuts (the benefits were even greater around 20 g/day). The total number of deaths per year for Italy attributable to consumption of less than 20 g/day was almost 70,000. The reduction in mortality from infectious diseases was very high (RR 0.25; 0.07-0.85), although only two studies were available for this meta-analysis.

A systematic review of 24 cohort studies (Aune et al., 2017) showed reductions of up to 31% total mortality associated with consumption of up to 800 g/day of fruit and vegetables, with non-linear reductions, higher at lower levels of consumption. The total number of deaths per year for Italy attributable to consumption of less than 800 g/day was 55,000 (Donzelli and Giudicatti, 2020). A retrospective study of the lower risk of respiratory diseases in 1,034 pregnant women is reported, comparing the highest quartile of fruit and vegetable consumption with the lower quartile (Li and Werler, 2010).

An umbrella review of meta-analyses of observational studies (Yi et al., 2019) on tea and health shows, in the three meta-analysis with total mortality data, a dose-effect association (RR 0.76; 0.63-0.91)

that is maximum with three cups per day (which becomes nothing or positive with >5 cups/day), confirmed for both green and black tea. The laboratory effect of tea catechins shows inhibition of flu virus absorption, suppression of replication and neuraminidase activity, as well as being effective against cold viruses (Furushima, Ide and Yamada, 2018).

Various computer research to simulate the effect on COVID-19 of drugs or natural substances with antiviral activity has shown that hesperidin, present in citrus fruits, especially in the peel and white part (albedo), has a link to the central part of the Spike and the main protease of the virus that is much stronger than conventional antivirals (Bellavite and Donzelli, 2020). Micromolar doses of hesperidin and quercetin can inhibit the enzymatic activity of the main protease of SARS-CoV-2, with an effect in theory also on the plasma of those who take medium-high amounts of citrus (hesperidin) and vegetables such as onions (quercetin) (Bellavite, 2021). In fresh orange juice the hesperidin content represents about 30 mg per 100 mg (Gattuso et al., 2007), but it is found in greater quantities in the white part of the peel (Meneguzzo et al., 2020). Quercetin is widely present in the plant kingdom (Kawai et al., 2007; Boots et al., 2008) with an average daily consumption of 25-50 milligrams (Formica and Regelson, 1995), up to about 250 mg per day in high consumers of fruit and vegetables (Andres et al. 2018).

In addition to the direct benefits of fighting viral infections, flavonoids have positive effects on co-morbidity factors that make infectious diseases more serious. It is known that the severity of COVID-19 as well as other viral respiratory infections is related to many different parameters (age, gender, nutritional status, comorbidities, etc.) and that people with pre-existing conditions such as diabetes, hypertension, and lung, heart and kidney diseases (all diseases in which ROS play a pathogenetic role) are at increased risk of developing severe effects. In serious cases, endothelial dysfunction, coagulopathy and pulmonary thrombosis cause hypoxia, mitochondrial chain abnormalities, mitochondrial dysfunction, oxidative stress, and DNA damage (Erlich et al., 2020;



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Potus et al., 2020). These mechanisms are involved in the extensive systemic lesions observed during severe complications associated with influenza. It has therefore been suggested that agents with antioxidant properties could be drugs of choice for the treatment of patients with such severe complications (Uchida and Toyoda, 2011).

The antioxidant effect of quercetin was studied in a two-week, randomised, crossover-controlled intervention trial (Duranti et al. 2018). Quercetin supplementation improved redox status as assessed by the reduced glutathione / oxidised ratio analysis and reduced thiobarbituric acid reactive substances levels in both erythrocytes and plasma. Soy isoflavones, citrus products, hesperidin and quercetin improved lipid metabolism (Amiot, Riva and Minet, 2016), endothelial function (Rizza et al., 2011), and arterial pressure (Cassidy et al., 2016; Homayouni et al., 2018; Valls et al., 2020). Such vasculoprotective actions may explain the beneficial cardiovascular effects of citrus fruit consumption.

A systematic review has highlighted the potential antidiabetic action of citrus flavonoids and their molecular mechanisms based on in vitro and in vivo studies (Gandhi et al., 2020). Quercetin supplementation also may have positive effects among patients with metabolic syndrome (MetS) and related disorders (Ostadmohammadi et al., 2019). Regarding lipid levels, a meta-analysis of 9 clinical studies (Guo, Gong and Li, 2019) found a significant reduction in LDL

in overweight and obese human subjects. The supplementation of nutrition with quercetin on blood pressure and endothelial function among patients with MetS was investigated with a meta-analysis (Tamataji et al., 2019). The authors found a significant reduction in systolic blood pressure but not diastolic pressure.

Finally, the health of the intestine cannot be neglected, which is an organ where viral infections tend to be found, and it is also fundamental because the release of endotoxins (LPS) due to an increased mucosa permeability or intestinal dysmicrobism could enhance systemic inflammatory reactions. It has been argued that the interaction between the lung and gut could lead to a vicious cycle of lung and intestinal inflammation which may be a potential factor leading to the death of patients with COVID-19 (Zhang et al, 2020). Citrus flavanones may have an impact on the intestinal microbiome, exerting beneficial effects on the intestinal barrier function and gastrointestinal inflammation (Stevens et al., 2019). In intervention studies on volunteers, orange juice positively modulated the composition and metabolic activity of the microbiota, increasing the population of *Bifidobacterium* spp. and *Lactobacillus* spp. (Lima et al, 2019) or of *Lactobacillus* spp., *Akkermansia* spp and *Ruminococcus* spp according to other authors (Fidelix et al., 2020), suggesting that orange juice showed a prebiotic effect, modulating the intestinal microbiota by improving blood sugar and the lipid profile. A recent review by (Mas-Capdevila et al., 2020) highlighted how the beneficial effects of hesperidin on cardiovascular risk factors can be partly attributed to the modulation of the intestinal microbiota. Quercetin also has a profound influence on the intestinal microbiome, which in turn modulates its bioavailability (Murota, Nakamura and Uehara, 2018).

In conclusion, a nutrition model rich in omega-3 fatty acids from marine (or vegetable) sources, in whole grains, vegetables and fresh and dried oily fruits, vitamins D and C, and phytonutrients (e.g. anthocyanins, flavonoids), properly integrated with suitable food supplements, is recommended to protect against infectious diseases and COVID-19.

4. Dietary supplements in Malaysia: market and institutional framework

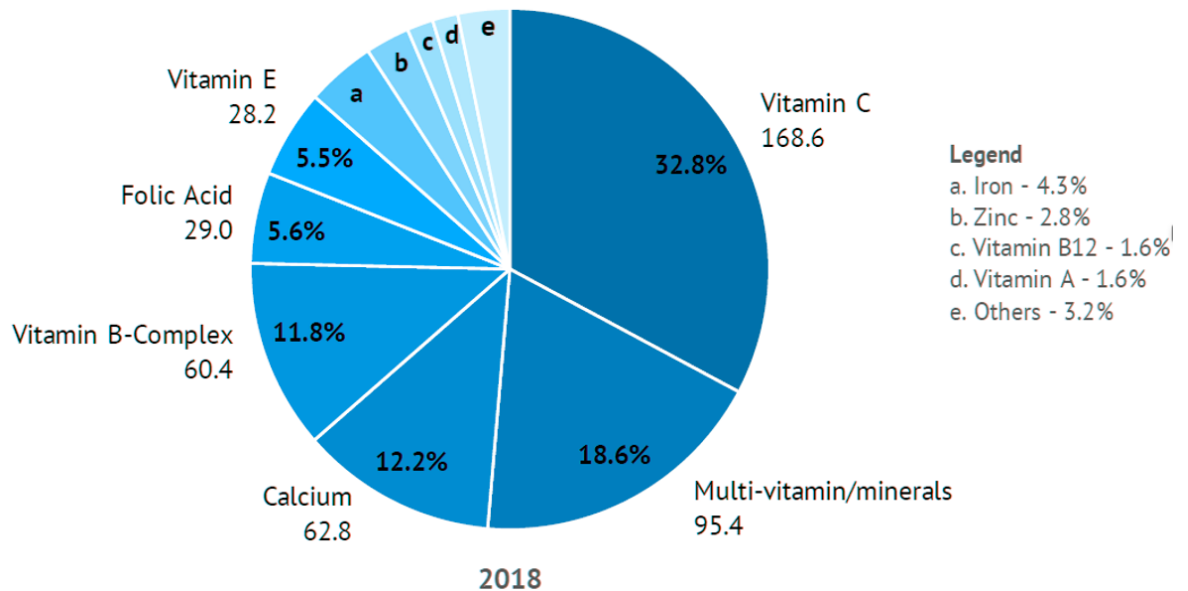
Across the world, the demand for dietary supplements is growing rapidly due to increasing awareness regarding personal health and well-being, in addition to evolving eating habits amid stressful and time-pressed lifestyles. The global dietary supplements market size is expected to expand at a compound annual growth rate (CAGR) of 9.0% from 2020 to 2026, reaching USD 306.8 billion (RM 1,270 billion) by 2026 (Facts and Factors, 2020).

Similarly in Malaysia, increasing health awareness among Malaysians, especially in the younger to mid-adult segments, will drive positive demand for dietary supplements in the years to come. More Malaysian consumers are engaging in self-medication and self-care amid their hectic and modern lifestyles coupled with irregular eating patterns and prolonged use of digital screens. With economic growth and an expanding middle class with more disposable income, the demand for dietary supplements is growing in our consumer- and trend-driven country.

In 2020, the market size of the Malaysian dietary supplements industry was between RM2.1 billion (USD 519 million) to RM2.2 billion (USD 544 million) (Koe, 2021), with the industry's CAGR estimated at 3.0% between 2018 and 2020 (MADSA, 2019). In fact, there was a rise in demand for immune system-boosting products during the Covid-19 pandemic as consumers took an increasingly preventative approach to healthcare. Rakuten Insight reported that majority of respondents between 16 and 44 years old increased their frequency of taking dietary supplements after the outbreak, with those aged 25 to 34 years recording the largest share of 59% of respondents with an increased frequency (Hirschmann, 2020). As a result, most dietary supplements categories saw higher growth in 2020 than in 2019.

Looking at the Malaysian supplements market in more detail, it emerges that vitamin C counts for almost a third, followed by multi-vitamin/minerals, calcium and vitamin B.

Figure 2: Market breakdown of vitamin and mineral supplements in Malaysia (RM million).

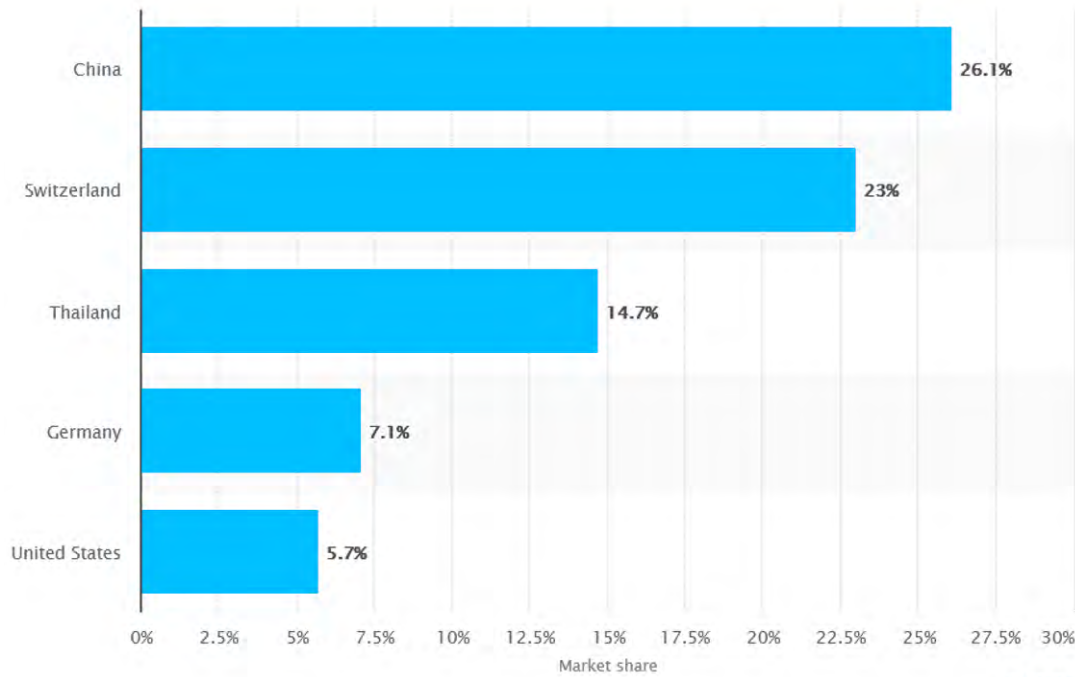


Source: MADSA (2019, p. 58).

Among the non-vitamin and mineral supplements, instead, the market is dominated by traditional dietary supplements (33.8%), fish oil (17.9%) and royal jelly (12.4%) (MADSA, 2019, p. 60). Most consumers are taking supplements to boost their immune system (18.8%), followed by those who look for a healthier ageing process (16.7%), meal replacement (16%), and support for bones and joints (14.6%) (MADSA, 2019, p. 62).

The food supplements imported to Malaysia are mainly coming from China (26.1% in 2017), followed by Switzerland (23%), while health supplements are mostly imported from the United States and Europe.

Figure 3: Market share of nutritional supplements import to Malaysia in 2017, by country.

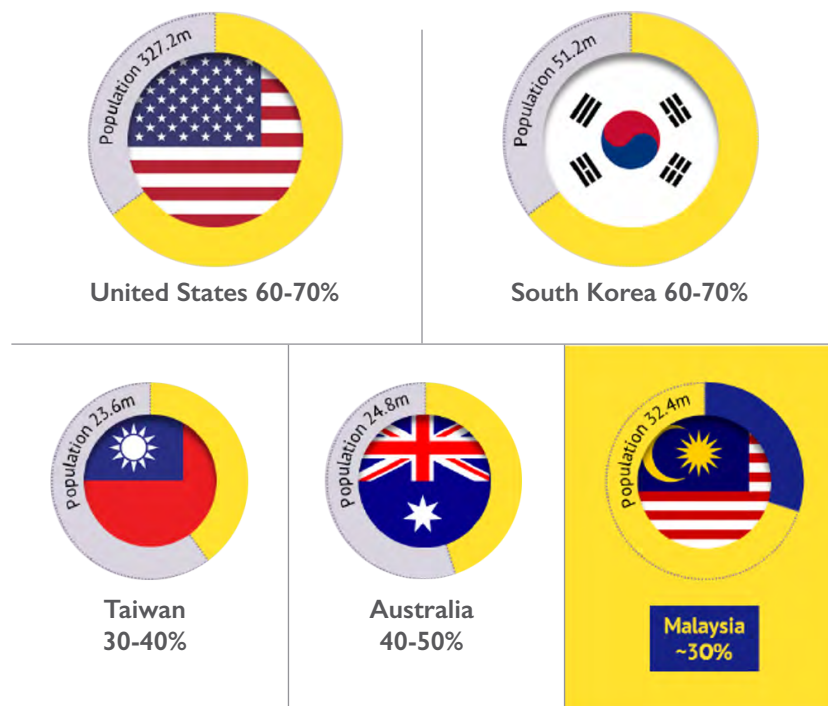


Source: <https://www.statista.com/statistics/890137/nutrition-supplement-import-countries-malaysia-2017/>.

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Despite this growth in demand, Malaysia still lags behind its Asian counterparts in terms of demand for dietary supplements, as less than 30% of the population consumes dietary supplements compared to countries like South Korea (60-70%), Taiwan (40-50%) and Australia (40-50%), as of 2019 (Haziqah, 2019).

Figure 4: Prevalence of dietary supplement usage – Benchmark comparisons.



Source: MADSA (2019, p. 19).

This is worrying because Malaysians are not consuming enough sources of key nutrients, which impedes progress in overcoming the triple burden of malnutrition (stunting or wasting in children under 5 years of age), obesity in adults, and anaemia among women of reproductive age (Global Nutrition Report, 2020). In fact, Malaysia is the only Southeast Asian nation with a triple malnutrition burden. As reported in UNICEF (2020) and Global Nutrition Report (2020), these are the main facts that characterize malnutrition in Malaysia:

- 1.** Malaysia still has a considerable number of malnourished young children. The prevalence of stunting (low height-for-age), among children under 5 years was three times higher than the average rate found in other upper-middle-income countries. In fact, the rate was increasing even before the COVID-19 crisis, from 17.7% in 2015 to 21.8% in 2019. As such, there has been no progress made towards achieving the '40% reduction by 2025' global target for childhood stunting.
- 2.** Meanwhile, Malaysia has also made no advancement towards achieving the target for wasting (low weight-for-height), with 9.7% of children under 5 years of age impacted in 2019, which is higher than the average for developing countries (8.9%) and the Asia region (9.1%).
- 3.** With 11.3% of infants having a low weight at birth, there has also been no breakthrough towards achieving the low birth weight target. Furthermore, there is insufficient data to assess the progress that Malaysia has made towards achieving the exclusive breastfeeding target; however, the latest prevalent data shows that 40.3% of infants aged 0 to 5 months are exclusively breastfed.
- 4.** With 24.9% of women aged 15 to 49 years now affected by anaemia, no progress has been made towards achieving the target of reducing anaemia among women of reproductive age.
- 5.** Next, Malaysia has shown minimal improvement towards achieving the diet-related non-communicable disease (NCD) targets. Diabetes is estimated to affect 10.7% of adult women and 11.4% of adult men.
- 6.** With an estimated 13.0% of adult men and 17.9% of adult women living with obesity (higher than the regional average of 8.7% for women and 6.0% for men), there is no advancement shown towards accomplishing the target for obesity.



Photo by Nicolas Solerieu on Unsplash

4.1 Limited access to dietary supplements

With such dismal progress in overcoming stunting and wasting among younger children and minimal improvement in achieving diet-related non-communicable disease (NCD) targets, there needs to be an overhaul in Malaysia's approach towards dietary supplements. As dietary supplements have been scientifically proven to overcome malnutrition, boost general health and reduce the risks of diseases, they need to be made more accessible to the general public, especially the most vulnerable communities.

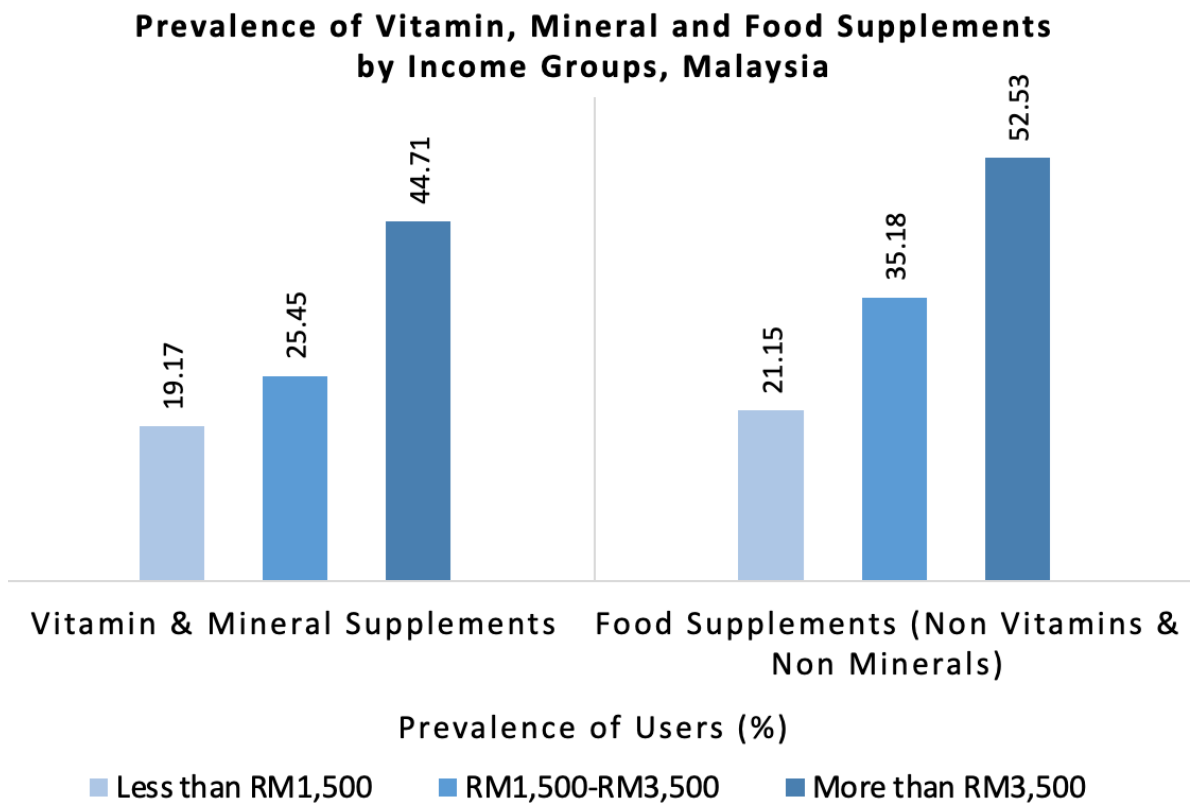
This is important, as nutrition insecurity has been linked to long-term economic impacts, including lower educational achievement, diminished earnings in adulthood, reduced productivity, heightened risk of poverty later in life, and higher future health care expenditures (UNICEF, 2020). Hence, strengthening nutrition-focused social protection through an increase in access to dietary supplements is essential to reducing vulnerability and building long term resilience, and it is one of the key factors in breaking the intergenerational cycle of poverty.

Among the socio-demographic factors which affect dietary supplement consumption behaviour among Malaysian consumers were region, strata, gender, age group, ethnicity, education level, work status and income group. According to the Malaysian Adult Nutrition Survey 2014, Peninsular Malaysians, urban citizens, women,

young adults (ages 30-39), Malaysians with higher educational levels, Chinese and Indian communities are more likely to consume vitamin and mineral supplements (Institute for Public Health, 2014).

More importantly, the prevalence of vitamin and mineral supplement¹ users was significantly high among those earning more than RM3,500 at 44.7%, followed by those earning between RM1,500 and RM3,500 (25.5%) and finally a low 19.2% for those earning below RM1,500. A greater divide is evident for the consumption behaviour of food supplements (non-vitamins and non-minerals⁵), at 52.5% for those of the highest income group, followed by 35.2% (RM1,500-RM3,000) and finally a significantly lower 21.2% for the lowest income group, as shown in Diagram 2. This significant finding highlights the widening inequality in access to better overall health and additional nutrients to combat malnutrition.

Figure 5: Malaysians from higher income groups are more likely to consume vitamin, mineral and food supplements.



Source: Institute for Public Health (2014).

¹ Vitamin and mineral supplements are defined here as mineral, synthetic nutrients and vitamins sold singly or in mixtures in controlled dosages form such as sachets, capsules, liquids, lozenges, powders or tablet; which includes multivitamin and multimineral, Vitamin A/Carotenoids, Vitamin B complex, Vitamin B12, Vitamin C, Folic Acid (B6), Iron, Calcium, Vitamin E and Zinc.

² Food supplements are defined as non-vitamin and non-mineral supplement products with health claims that are made from natural food or food derivatives, for examples fish oil, essence of chicken, sea cucumber products and traditional herbs.

In fact, affordability is a key barrier to a healthier diet in Malaysia. The “Healthier Product Reformulation in Malaysia” survey in 2019 conducted by Food Industry Asia (FIA) and research firm IGD reveals that 71% of respondents agreed it is a lot more expensive to eat healthily, although 99% are actively trying to improve their consumption habits healthy (IGD, 2019). In addition, 66% opine that there aren’t enough special offers on healthy food.

The current system of taxes and duties involving dietary supplements have indirectly made products more expensive, limited consumer choices, and prevented Malaysian households from enjoying the benefits deriving from a wider consumption of dietary supplements. All in all, the arguments above highlight the need to re-examine, re-evaluate and reform government policies on dietary supplements, with the ultimate goal of increasing access to promote better overall health of Malaysians.

4.2 Institutional framework

a) Import Tax

- Import duties are levied on goods that are subject to import duties and imported into the country.
- Import duties are generally levied on an ad valorem basis but may also be imposed on a specific basis.
- The ad valorem rates of import duties are defined in terms of a fixed percentage of value, ranging from 0% to 60%.
- Raw materials, machinery, essential foodstuffs and pharmaceutical products are generally non-dutiable or subject to duties at lower rates (PwC, 2021).

b) Sales Tax Rate for Dietary Supplements

Table 2: SST and dietary supplements.

Type of Dietary Supplement/Product	Taxation Rate (SST)
Food supplement	5%
Vitamin (for Food Supplement)	5%
Fish Oil (e.g. Scott's Emulsion)	5%
Isolated Soy Protein Powder	5%
Hydrolysed Protein	5%
Complete Nutritional Beverage	5%
Spirulina	5%
Birds' Nest	5%
Bird's Nest Ginseng W/Fungus	5%
Ginseng Plus Kapsul Ekstrak	5%

Type of Dietary Supplement/Product	Taxation Rate (SST)
Essence of Chicken & Sea Cucumber	5%
Essence of Haruan Fish	5%
Essence of Haruan Fish & Sea Cucumber	5%
Tongkat Ali 100% Powder	Tax Exempted
All Pharmaceutical products including Ascorbic Acid (Vitamin C), elemental iron, Esomeprazole Magnesium, Atorvastatin Calcium vitamins and minerals, medications containing multivitamins & minerals	Tax Exempted

Source: Royal Malaysian Custom Department (2018).

- Almost all traditional and non-traditional dietary supplements are charged 5% sales tax.
- On the contrary, all pharmaceutical products including Ascorbic Acid (Vitamin C), elemental iron, Esomeprazole Magnesium, Atorvastatin Calcium vitamins and minerals, medications containing multivitamins and minerals are tax exempted³.

c) Tax Relief for Resident Individual

- As of year of assessment 2020, there is currently no tax relief/rebate for the purchase of dietary supplements in Malaysia.
- On the other hand, there are individual tax reliefs for medical treatment, medical treatment of parents, medical expenses for serious diseases and fertility treatment, complete medical examination and medical insurance, which in general are more geared towards treating rather than preventing diseases, as shown below in the Table.
- Also, the lifestyle category specifies tax relief for the purchase of sports equipment for sports activity and gym membership, to encourage more Malaysians pursue a healthier lifestyle.
- Similarly, dietary supplements which enhance general health, promote nutrition, support healthy growth and development, besides reducing the risk of diseases, should be given tax relief for a healthier Malaysia.

³ This means that, when buying vitamins or products with vitamins at a pharmacy, the seller does not apply SST to the final customer. However, SST may have been imposed at the different stages of production, according to the different ingredients used along the process. Specifically, pharmaceutical products (subject to an import/export license from the relevant authorities) are SST free, based on page 53 in here (https://mysst.customs.gov.my/assets/document/General%20Guides/V4.0%20Guide%20On%20Sales%20Tax%20Rates%20for%20Various%20Goods_07.09.pdf) and pages 103-107 (<https://mysst.customs.gov.my/assets/document/PROPOSED%20GOODS%20EXEMPTED%20FROM%20SALES%20TAX%2016072018%20btm.pdf>). But this is not the case for the ingredients, as shown in the table.

Table 3: Tax relief and medical treatments.

Individual Relief Types (Year of Assessment 2020)	Amount (RM)
Medical treatment, special needs and caregiver expenses for parents (for medical conditions certified by a medical practitioner)	5,000 (Restricted)
OR	OR
Parent Restricted to 1,500 for only one mother Restricted to 1,500 for only one father	3000 (Restricted)
Medical expenses for serious diseases for self, spouse or child	6,000 (Restricted)
Medical expenses for fertility treatment for self or spouse	
Complete medical examination for self, spouse, or child (Restricted to 500)	
e Lifestyle – Expenses for the use / benefit of self, spouse or child in respect of: <ul style="list-style-type: none"> i. purchase of books / journals / magazines / printed newspapers / other similar publications (not banned reading materials) ii. purchase of personal computer, smartphone or tablet (not for business use) iii. purchase of sports equipment for sports activity defined under the Sports Development Act of 1997 and payment of gym membership iv. payment of monthly bill for internet subscription (Under own name) 	2,500 (Restricted)
Education and medical insurance (including not through salary deduction)	3,000 (Restricted)

Source: Inland Revenue Board of Malaysia (2021).

5. Supplement consumption and healthcare savings

5.1 Bad health and financial burdens

Malaysia's healthcare costs show a growing trend over the years. For instance, Aon's 2021 Global Medical Trend Reports showed that Malaysia's healthcare cost is one of the highest in the region, as shown in Figure 6 (Aon, 2021). Besides the rise in hospital costs for reasons such as the use of surgery, inpatient rooms and the rental of inpatient equipment, underlying reasons include the increasing prevalence of non-communicable diseases (NCDs), leading to more complex treatments and, consequently, higher hospital bills. In addition, non-communicable diseases continue to be one of the leading reasons for insurance claims, leading to increasing medical insurance premiums. Thus, the rise in NCDs among Malaysians incurs significant healthcare costs, besides other economic and social costs.

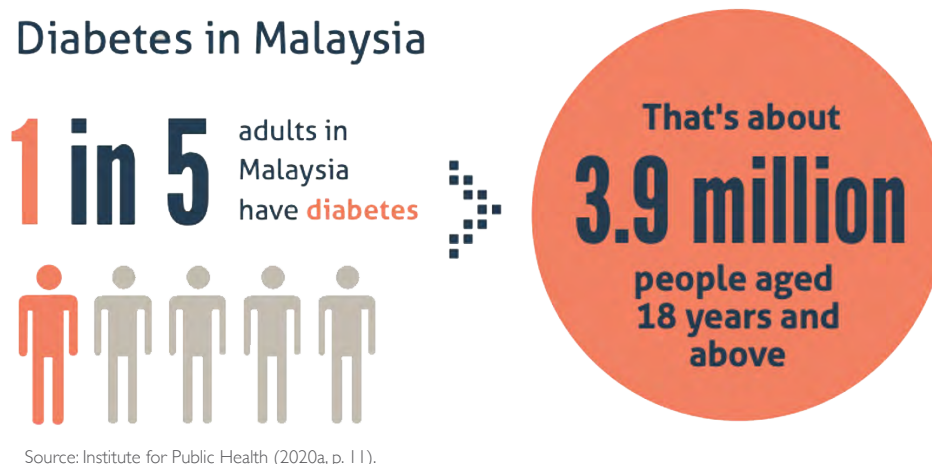
Figure 6: Malaysia's medical inflation rates is one of the highest in the Asia-Pacific region.

Regional & Country Averages	2020			2021		
	Annual General Inflation Rate	Annual Medical Trend Rates		Annual General Inflation Rate	Annual Medical Trend Rates	
		Gross	Net		Gross	Net
North America	2.6	6.4	3.8	2.1	7.0	4.9
Canada	1.9	6.0	4.1	1.3	7.0	5.7
United States	2.7	6.5	3.8	2.2	7.0	4.8
Asia-Pacific	2.8	8.7	5.9	2.5	8.0	5.5
Australia	2.3	3.5	1.2	1.8	2.5	0.7
Bangladesh	5.4	7.0	1.6	5.6	7.7	2.1
China	2.5	7.5	5.0	2.6	7.0	4.4
Hong Kong	2.5	8.1	5.6	2.5	5.3	2.8
India	4.2	8.5	4.3	3.6	9.0	5.4
Indonesia	3.6	13.0	9.4	2.9	13.0	10.1
Japan	1.5	1.5	0.0	0.4	0.0	(0.4)
Kazakhstan	5.0	11.2	6.2	6.8	15.0	8.2
Malaysia	2.6	14.0	11.4	2.8	14.0	11.2

Source: Aon (2021, p. 16).

Alarming, as of 2019 two thirds of the Malaysian population are at risk for one of three non-communicable diseases (NCDs), namely diabetes, hypertension or high cholesterol levels (Institute for Public Health, 2020a). Also, NCDs contribute to 71% of premature deaths (Institute for Public Health, 2020b). In addition, in 2019 1 in 5 Malaysian adults had diabetes, with almost half of them not knowing that they had diabetes, as shown in Figure 7.

Figure 7: High Prevalence of Diabetes in Malaysia.



Meanwhile, a higher 3 in 10, or 6.4 million people, in Malaysia suffer from hypertension (Institute for Public Health, 2020a). Even more troubling, 4 in 10, or 8 million Malaysians, have raised total cholesterol levels. Shockingly, 1 in 4 of those were unaware that they have hypercholesterolaemia (raised total cholesterol level), as shown in Figure 8.

Figure 8: High Prevalence of hypercholesterolaemia in Malaysia.



In view of the increasing and high burden of NCD risk factors across Malaysia, it is expected that the healthcare costs of treating patients with NCDs and their related complications will continue to increase. In addition, NCDs will continue to dominate health services provision at all levels of care, particularly at secondary and tertiary levels, further increasing the financial burden on the community and government at large.

Beside the main healthcare costs – such as inpatient admissions, outpatient visits, allied health, medications, laboratory tests and preventive care – the prevalence of NCDs also incur additional economic costs, including lost productivity and the socioeconomic burden of the disease. For example, Malaysia’s economy lost an estimated RM 8.91-12.88 billion as a result of cardiovascular disease, diabetes and cancer in the year 2017. The financial costs arising from lost productivity entail tangible costs to the economy, including costs to individuals, industry and government as a result of absenteeism, presenteeism or premature death in persons of working age in the year 2017, shown in Table 4 (MOH, 2020).

Table 4: Productivity Losses due to Cardiovascular Disease, Diabetes and Cancer in 2017.

NCD Risk Factor	Productivity Losses (RM million)				
	Deaths	Absenteeism	Presenteeism	Total	Total (in %)
<i>High Estimate (Using Human Capital Approach for Productivity Losses due to Deaths)</i>					
Cardiovascular Disease	2,536.8	1,152.7	1,634.9	5,324.5	41.3
Diabetes	89.4	1,346.5	4,308.1	5,744.0	44.6
Cancer	1,484.3	114.6	211.4	1,810.4	14.1
Total for Selected NCDs	4,110.5	2,613.8	6,154.4	12,878.9	100.0
<i>Low Estimate (Using Human Capital Approach for Productivity Losses due to Deaths)</i>					
Cardiovascular Disease	87.8	1,152.7	1,634.9	2,875.5	32.3
Diabetes	3.1	1,346.5	4,308.0	5,657.7	63.5
Cancer	48.6	114.6	211.4	374.7	4.2
Total for Selected NCDs	139.5	2,613.8	6,154.3	8,907.9	100.0

Source: MOH (2020, p. 11).

More worryingly, the estimated burden of disease cost for cardiovascular disease, diabetes and cancer is considerably higher at RM 100.79 billion (low estimate) or RM 302.37 billion (high estimate). These intangible costs which relate to the value placed by individuals on the loss of life or loss of healthy life associated with specific diseases is calculated using the cost of disability-adjusted life years (DALY⁴).

⁴ Disability-adjusted life years (DALY) provides a measure of overall disease burden and are expressed as the sum of years of potential life lost due to premature mortality (years of life lost [YLL]) and the years of life lost due to disability (years lived with disability [YLD]). The WHO Commission on Macro-economics and Health recommended valuing DALYs at between one and three times a country’s GDP per capita.

If other noncommunicable diseases⁵ and all other diseases⁶ are taken into account, the estimated burden of disease grows to a massive RM 305.18-915.55 billion, as shown in Table 6. Altogether, this cost accounts for 7.12 million years of potential life lost due to premature mortality and years of life lost due to disability associated with disease.

Table 5: Burden of Disease cost for all Diseases in 2017.

Disease Category	DALYs (million years)	Cost of DALYs (RM billion)		Total DALY Burden (in %)
		Low estimate (valued at GDP per capita)	High estimate (valued at 3 times GDP per capita)	
Cardiovascular disease, diabetes and cancer	2.35	100.79	302.37	33.03
Other NCDs ²	2.80	120.18	360.56	39.38
Other Diseases ³	1.97	84.21	252.62	27.59
Total for all Diseases	7.12	305.18	6,154.4	12,878.9

Source: MOH (2020, p. 13).

Yet again, all these financial costs do not factor in other aspects including caregiver costs, welfare payments or taxes foregone, among others. Factoring all these additional costs reaffirms the core significance and necessity of further strengthening the prevention and control of NCDs in Malaysia from an economic viewpoint. In short, better prevention will result in significant healthcare saving.

5.2 Better prevention for individual and systemic savings

Earlier in this report, it was stated that dietary supplements are proven successful as preventive measures to decrease the risk of NCDs and other diseases. Investment in adequate and regular dietary supplements will eventually enhance population health and prevent diet-related diseases, leading to significant healthcare cost savings. We will follow here what was done by Shanahan and de Lorimier (2014) for the American case, in order to explain how a higher consumption of nutrients and supplements could lead to important financial savings not only for individuals, but also for the medical system in general. This is especially important in view of the increasing and high burden of NCD risk factors across Malaysia, which will lead to an exponential rise in healthcare costs of treating patients with NCDs and their related complications.

⁵ Other noncommunicable diseases, beside cardiovascular disease, cancer and diabetes include cirrhosis, chronic respiratory disease, digestive diseases, neurological disorders, mental and substance use disorders, urogenital, blood and endocrine diseases, musculoskeletal disorders, congenital anomalies, skin and subcutaneous diseases, sense order diseases and oral disorders.

⁶ All other diseases here include all communicable, maternal, neonatal and nutritional diseases, plus injuries.



Photo by Robina Weermeijer on Unsplash

Regarding Coronary Heart Disease (CHD), which is the number one cause of death in Malaysia (15% of medically certified deaths) (DOSM, 2020), regular dietary supplements have been proven to reduce the risk factors and also confer significant cost savings. Specifically, the estimated potential net savings in avoided hospital utilization cost, productivity loss and burden of disease cost related to CHD after accounting for the cost of omega-3 dietary supplements can be as much as **RM 42.44 million** on average per year in Malaysia (table 6).

In other words, for every one ringgit spent on omega-3 dietary supplements as preventive daily intake levels, a significant **RM 4.50 can be saved** in avoided coronary heart disease (CHD) costs. The total costs here include potential avoided annual hospitalization costs (RM 14,203 per person), annual productivity loss cost⁷ (RM 9,272 per person), and annual burden of disease cost⁸ (RM 135,359 per person) (see table 6).

Besides that, the full utilization of B vitamins such as folic acid, B6, and B12 among the target population will result in potential net savings of **RM 16.74 million**. For every RM 1 spent on preventive intake of B vitamin supplements, RM 1.72 can be saved through CHD-related costs. Yet again, due to unavailable data all these financial costs listed in table 6 do not factor in other costs incurred, including care-giver costs, welfare payments or taxes foregone, among others. Factoring in all these additional costs reaffirms the core significance and necessity of further strengthening the prevention and control of CHD in Malaysia from an economic viewpoint. In short, better prevention through dietary supplements will result in significant healthcare saving.

⁷ Defined as financial costs arising from lost productivity entail tangible costs to the economy including costs to individuals, industry and government as a result of absenteeism, presenteeism or premature death in persons of working age. Total productivity loss (RM4,099.9 million) divided by population with CHD, divided by average number of years lost due to CHD (9.679 years) (MOH, 2020).

⁸ Defined as intangible costs which relate to the value placed by individuals on the loss of life or loss of healthy life associated with specific diseases is calculated using the cost of disability-adjusted life years (DALY). Total burden of disease cost (RM59,852.4 million) divided by population with CHD divided by average number of years lost due to CHD (9.679 years) (MOH, 2020).

Table 6: Summary of Cost Calculations for Omega-3 & B Vitamins Supplementation and Coronary Heart Disease (CHD) Cost Hypothetical Case.

Ref. Column	Metric	Measure (Omega-3)	Measure (B Vitamins)	Note/ Data Source	
A	Target population with CHD, 2018	45,684		Ministry of Health	
B	Expected number of people within the target population who will experience a CHD hospitalization event ⁹ , 2018	12,972		Frost & Sullivan; Author's estimates	
C	Number needed to treat (NNT) ¹⁰	133	181	Frost & Sullivan	
D	Total Annual Expected Cost per person		RM158,834	Clinical Research Centre (CRC); Ministry of Health; Author's estimates	
	Sub-Metric				Cost (RM)
	Expected cost of hospital utilization ¹¹				14,203
	Expected productivity loss cost				9,272
	Expected burden of disease cost ¹²				135,359
Total Expected Cost of CHD per person		158,834			
E	Annual cost of dietary supplementation per person ¹³	RM265 (Omega-3)	RM511 (B Vitamins)	Blackmores; Solgar; Author's estimates	
F	Number of events avoided if everyone in the target population took a supplement ¹⁴	343	252	A/C=F	
G	Avoided total costs of CHD (using supplements)	RM 54,557,786	RM 40,089,423	D*F=G	
H	Total costs of supplementation	RM 12,116,920	RM 23,344,524	A*E=H	
I	Net savings	RM 42,440,866	RM 16,744,899	G - H= I	
J	Net benefit cost ratio (per RM 1 spent on dietary supplement)	RM 4.50	RM 1.72	G/H=J	

It must be stressed that the net saving here reported is calculated on the basis that the government would entirely subsidize the use of supplements for the whole population considered at risk; if, instead, a combined intervention of information and financial support were to be chosen, whereby monetary aids are extended only to the poorer segments of the population, while the others are oriented toward supplements with proper information campaigns, the saving would even be higher.

Alarming, 1 in 5 Malaysian adults had diabetes in 2019, with almost half of them not knowing that they had diabetes (Institute for Public Health, 2020b). Also, data from the previous National Health and Morbidity Survey (NHMS) showed an increasing trend for diabetes in which the prevalence of diabetes

⁹ Percentage of expected hospitalization (28.39%) sourced from Shanahan and de Lorimier (2014), and multiplied by target population with CHD to obtain number of hospitalization events.

¹⁰ NNT is the total number of people who would have to undergo a preventive or treatment intervention to realize one avoided undesired event, and is calculated by Shanahan and de Lorimier (2014) using the deduced relative risk reduction (RRR) metrics from the literature review. For example, if it was found that a given dietary supplement had an NNT of 100, this would mean that 100 people would need to be supplemented to avoid one major disease event in the target population.

¹¹ Average of mean hospitalization cost (RM 12,117) at the General Hospital and at the Teaching Hospital (RM 16,289) (Lee et al., 2017).

¹² Defined as intangible costs which relate to the value placed by individuals on the loss of life or loss of healthy life associated with specific diseases, which is calculated using the cost of disability-adjusted life years (DALY). Total burden of disease cost (RM 59,852.4 million) divided by population with CHD divided by average number of years lost due to CHD (9.679 years) (MOH, 2020).

¹³ Cost of Blackmores 150 capsules (RM 109) divided by 150 (1 capsule per day) multiplied by 365 days (Blackmores, 2021). Cost of Solgar 60 capsules (RM 84) divided by 60 (1 capsule per day) multiplied by 365 days (Solgar, 2021).

¹⁴ The number of possible avoided events that could be realized if everybody in a given population were to use the supplement at an adequate or protective daily intake level can be calculated, based on the NNT (Shanahan and de Lorimier, 2014)

rose to 13.4% (2015) from 11.2% (2011). As such, preventive efforts are highly important to ensure that this NCD does not continue to incur both tangible and intangible costs on individuals, communities and the nation as a whole.

From an individual perspective, instead, expenses for nutrients and supplements can be seen as a sort of “insurance investment.” For the case we just examined, a cost of around RM 750 per year and per person could lead each individual to potentially save at least the direct cost of hospitalization, which is estimated to be on average RM 14,203; and this is the amount in the Malaysian public hospital, while in private facilities the price for CHD related operations is estimated to be between RM 30,000 and RM 70,000 (RinggitPlus, 2019).

The exercise we did for CHD can be extended to diabetes. As shown in table 7, the potential net cost savings from avoided Type 2 Diabetes Mellitus (DM) through preventive intake of the dietary supplement chromium picolinate is **RM 248.27 million**. For the prevention of this disease, **RM 1.31 can be saved per RM 1 spent on chromium picolinate**. Specifically, the estimated total annual cost avoided is RM 25,450 per person, factoring in direct healthcare costs (outpatient ambulatory care and hospitalization), non-healthcare costs, and the cost of absenteeism as a result of seeking treatment and hospitalization activities (table 7).

Once again, the impact of regular preventive intake of chromium picolinate, leading to reduced risk of Diabetes Mellitus, demonstrates effective cost savings of dietary supplements. Although there has been minimal research in the Malaysian context on specific healthcare savings on other diseases, we can still infer from the three examples above that the amount of healthcare, economic and social costs saved far outweighs the investment in dietary supplements.

This is especially important in the near future as Malaysia's healthcare costs continue to increase. In fact, Malaysia's medical inflation rates is one of the highest in the Asia-Pacific region, according to the 2021 Global Medical Trend Reports (Aon, 2021). Besides the rise in hospital costs, such as the use of surgery, inpatient rooms and the rental of inpatient equipment, underlying reasons include the increasing prevalence of non-communicable diseases (NCDs), leading to higher complexity treatments, and, consequently, higher hospital bills.

All in all, NCDs will continue to dominate health services provision at all levels of care, particularly at secondary and tertiary levels, further increasing the financial burden on the community and government at large. Thus, a dietary supplement regimen is a relatively low-technology, yet smart and cost-efficient approach that can be used by consumers, physicians, and policymakers as a means to reduce personal and societal health care costs.

Table 7: Summary of Cost Calculations for Chromium Picolinate Supplementation and Type 2 Diabetes Mellitus (DM) Cost Hypothetical Case.

Ref. Column	Metric	Measure	Note/ Data Source																							
A	Target population with DM, 2019	3,900,000	Institute for Public Health																							
B	Expected number of people within the target population who will experience a DM hospitalization event ¹⁵ , 2019	47,243	Malaysian Healthcare Performance Unit																							
C	Number needed to treat (NNT) ¹⁶ ,	95	Frost & Sullivan																							
D	Total Annual Cost per person, 2019		Pharmaceutical Services Division Ministry of Health; Author's estimates																							
	<table border="1"> <thead> <tr> <th>Sub-Metric</th> <th>Cost (RM)</th> </tr> </thead> <tbody> <tr> <td>Direct Healthcare costs (Ambulatory Care)¹⁷,</td> <td>1,476</td> </tr> <tr> <td>Direct Healthcare costs (Hospitalization)</td> <td>6,079</td> </tr> <tr> <td>Direct Non-Healthcare costs (Ambulatory Care & Hospitalization)¹⁸</td> <td>8,067</td> </tr> <tr> <td>Direct Non-Healthcare costs (Miscellaneous Expenses)¹⁹</td> <td>882</td> </tr> <tr> <td>Direct Non-Healthcare costs (Consumables)²⁰</td> <td>3,477</td> </tr> <tr> <td>Cost of Absenteeism from Work (Seeking Treatment)</td> <td>560</td> </tr> <tr> <td>Cost of Absenteeism from Work (Accompanying person)</td> <td>593</td> </tr> <tr> <td>Cost of Absenteeism in hospitalization activities</td> <td>3,780</td> </tr> <tr> <td>Cost of Absenteeism in hospitalization activities (Accompanying person)</td> <td>536</td> </tr> <tr> <td>Total Annual Costs</td> <td>25,450</td> </tr> </tbody> </table>			Sub-Metric	Cost (RM)	Direct Healthcare costs (Ambulatory Care) ¹⁷ ,	1,476	Direct Healthcare costs (Hospitalization)	6,079	Direct Non-Healthcare costs (Ambulatory Care & Hospitalization) ¹⁸	8,067	Direct Non-Healthcare costs (Miscellaneous Expenses) ¹⁹	882	Direct Non-Healthcare costs (Consumables) ²⁰	3,477	Cost of Absenteeism from Work (Seeking Treatment)	560	Cost of Absenteeism from Work (Accompanying person)	593	Cost of Absenteeism in hospitalization activities	3,780	Cost of Absenteeism in hospitalization activities (Accompanying person)	536	Total Annual Costs	25,450	RM 25,450
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E	Annual cost of Chromium Picolinate dietary supplementation per person ²¹	RM 204	GNC Livewell; Author's estimates																							
F	Number of events avoided if everyone in the target population took a supplement ²²	41,053	A/C=F																							
G	Avoided total costs of DM (using Chromium Picolinate)	RM 1,044.80 million	D*F=G																							
H	Total Costs of Chromium Picolinate supplementation	RM 796.53 million	A*E=H																							
I	Net savings	RM 248.27 million	G - H= I																							
J	Net benefit cost ratio (per RM1 spent on dietary supplement)	RM 1.31	G/H=J																							

¹⁵ Calculated based on Total DM hospital admission rate (Malaysian Healthcare Performance Unit, 2017).

¹⁶ NNT is the total number of people who would have to undergo a preventive or treatment intervention to realize one avoided undesired event, and is calculated by Shanahan and de Lorimier (2014) using the deduced relative risk reduction (RRR) metrics from the literature review. For example, if it was found that a given dietary supplement had an NNT of 100, this would mean that 100 people would need to be supplemented to avoid one major disease event in the target population.

¹⁷ Direct healthcare cost for ambulatory care (outpatient) includes costs of drugs, laboratory and investigations, consultation fees and other procedures (e.g. wound dressing) (Pharmaceutical Services Division, 2014). The cost value is compounded based on the average medical inflation rates, to better reflect the current cost.

¹⁸ Defined as expenses incurred by patients to purchase products and services related to DM.

¹⁹ Defined as cost of DM patients paying for clinic visit charges, seeking private laboratory testing and drugs.

²⁰ Defined as cost of insulin needles, lancets, strips, alcohol swabs, medical devices, bandages and cottons, exercise equipment, diabetic shoes.

²¹ Cost of GNC Livewell Chromium Picolinate 200mcg (180 caplets) (RM 100.72) divided by 180 (1 capsule per day) multiplied by 365 days (GNC, 2021).

²² The number of possible avoided events that could be realized if everybody in a given population were to use the supplement at an adequate or protective daily intake level can be calculated, based on the NNT (Shanahan and de Lorimier, 2014).

In this case, with regard to the individual savings, an investment slightly higher than RM 200 per year per person can bring each subject to save around RM 20,000 in medical treatments. From a subjective perspective, it is confirmed that we should look at expenses for nutrients as a sort of alternative – and cheap – medical insurance.

With regard to the total net saving, instead, as mentioned earlier, the amount is calculated on the basis that the government would entirely subsidize the usage of supplements for the whole population considered at risk; if, instead, a combined intervention of information and financial support were to be chosen, whereby monetary aids are extended only to the poorer segments of the population, while the others are oriented toward supplements with proper information campaigns, the saving would even be higher.

6. Policy recommendations

The main facts that we have described in the previous sections can be summarized as it follows:

- There is a growing market demand for food and dietary supplements, also in Malaysia;
- Such a trend testifies to the importance of freedom of choice and consumers' empowerment in the realm of healthcare solutions;
- Despite the growing consumption of food and dietary supplements, vitamin deficiencies and malnutrition are still a problem both in the developed world and in emerging and developing nations;
- A regular consumption of food and dietary supplements is key both in reducing the risk of critical illness and, as a consequence, in reducing the financial burden on public finances;
- At the same time, individual expenses for food supplements can be seen as an alternative form of insurance and help the population in diminishing the risk of finding themselves needing to make substantial financial disbursements for medical treatments;

- Indirectly, higher consumption of food and dietary supplements can improve GDP performances by reducing the loss in productivity due to stress and lack of vitamins;
- In Malaysia, the institutional framework surrounding food and dietary supplements can be improved in order to boost consumption and to produce the savings we described in section 5.

The policy strategy we recommend is centred on the following pillars:

- Trade liberalization and SST revision;
- Individual tax relief;
- Educational and support initiatives for fragile groups.

6.1 Trade liberalization and SST revision

In 2018, Malaysia imported USD 37,920,000 in nutrient supplements, while the export amounted to USD 15,974,000; two years earlier, in 2016, Malaysia exported USD 16,203,000 of nutrient supplements, while importing USD 22,312,000²³. So, while in two years the Malaysian export of nutrient supplements declined by 1.4%, the import grew by almost 70%. These figures tell us how important international trade is for Malaysia to have access to supplements.

While the imported supplements are usually non-dutiable, different circumstances may be encountered according to the different ingredients which are necessary for production of nutrients within the Malaysian territory (an extensive analysis of this goes beyond the scope of the present paper).

Furthermore, as shown in section 4, most ingredients are charged with a 5% sales and service tax (SST). It should be clarified here the SST is not only applicable to the price of goods produced by manufacturers with a turnover beyond a certain threshold, becoming part of the cost for consumers (not claimable). Sales tax is also charged, levied and payable on any importation of goods into Malaysia and is treated as if it were liable for customs or excise duty and as if such importation is dutiable and liable to customs or excise duty (Kastam Diraja Malaysia, 2018, p. 8).

²³ Source: <https://www.export.gov/apex/article2?id=Malaysia-Nutritional-and-Food-Supplements>.

From this perspective, our policy proposal is twofold. First of all, the government should revise the current duty policy on ingredients that would eventually be subject to import duties, implementing simple and immediate bilateral agreements for truly free trade. Concerns may arise on the need for protecting local ingredient producers; but protection would only be detrimental for consumers, while impeding local producers from stepping up in terms of quality. As with regard to food policies, it must be clear that security does not mean self-sufficiency.

Secondly, ingredients and final products related with food supplements should become SST exempt both with regard to SST as duty and to SST as tax on manufactured products.

As can be seen, we do not advocate for government support of subsidies. We believe primarily in the importance of freedom of choice with regard to healthcare decisions and individual courses of treatment. However, such freedom of choice is somewhat diminished if certain products are burdened with a tax regime that makes them potentially more expensive.

The measures herewith suggested go in the direction of allowing more room for free and informed decisions, by potentially reducing the cost of one of the alternatives offered in the curative field.

6.2 Individual tax relief

As seen in section 4, Malaysia can enjoy a variety of individual tax reliefs²⁴. One special section, as has been seen, is devoted to the adoption of a “healthy” or “virtuous” lifestyle, and it includes the purchasing of books, an internet subscription or enrolment in a gym.

If these tax reliefs are indeed introduced to nudge in favour of virtuous behaviours, it makes much sense to introduce the consumption of dietary supplements within this category. Furthermore, we have seen in section 5 how simply spending less than RM 500 on vitamin B could bring very positive results in preventive CHD cases.

Our proposal is to introduce a lifestyle tax relief for individuals for the purchase of nutrients and food supplements, with a limit of RM 1,500 per year.

²⁴ A complete list for 2021 can be found here: <https://ringgitplus.com/en/blog/income-tax/everything-you-should-claim-for-income-tax-relief-malaysia-2021-ya-2020.html>.

6.3 Educational and support initiatives

We believe that government action in education, involving also supplement producers and their associations, could be a more effective long-term strategy than simply taking recourse to subsidies, which have the negative effective of creating a dependence mentality.

While the middle and upper-income segments of the population are already developing significant awareness about the importance of dietary supplementation, the lower-income groups could perceive such products as “fancy consumption for the rich,” without realizing that they may be more at risk of developing disease that can be prevented with a more balanced diet and life-style.

Because of a higher degree of territorial knowledge, we believe that such educational initiatives should be developed by local governments. As mentioned, public institutions should not exclusively take on the burden of producing these plans, but rather they should build a partnership with supplements producers, healthcare providers and NGOs.

This virtuous mix of players could be better placed to create trust among households. These initiatives, furthermore, should go beyond the traditional informational campaign and be designed to be user-friendly, thanks to the usage of social media platforms and, in particular, of short explanatory videos for immediate and effective communication.

This does not mean that institutions should completely renounce the subsidy tool to incentivize the use of supplements. However, such subsidies should be conceived as restricted to very specific and limited health and income groups, together with a constant monitoring strategy to promptly identify the situations in which financial support could be removed.

7. Conclusions

The present paper focused on analysing the importance of consuming food supplements and nutrients. Extensive space has been devoted to the proven efficacy of food and dietary supplements in preventing illness, with a specific focus on infectious diseases.

The role of food supplements has been analysed from different perspectives, including the importance of freedom of choice in the realm of healthcare solutions. However, freedom of choice and a rights-based approach cannot remain merely a statement of principle and must be supported by a proper institutional framework.

In Malaysia, despite a growing market, the regulatory framework still presents elements that can be improved. This is necessary not only in order to improve freedom of choice, but also because we have demonstrated that a more widespread consumption of supplements could bring important savings to the healthcare system, not only in terms of reduced costs related to a lower number of patients (prevention), but also in terms of reducing the loss in productivity (and therefore in GDP) produced by stress and lifestyle linked to lack of vitamins.

In light of these considerations, we propose a few clear and easy-to-implement policy suggestions, aiming to improve freedom of choice and to incentivize supplement consumption. First of all, the government should revise the current duty policy on ingredients that would eventually be subject to import duties, implementing simple and immediate bilateral agreements for truly free trade. Secondly, ingredients and final products related to food supplements should become SST exempt both with regard to SST as duty and to SST as tax on manufactured products.



Photo by Lucas van Oort on Unsplash

We also propose introducing a lifestyle tax relief for individuals for the purchase of nutrients and food supplements, with a limit of RM 1,500 per year.

Finally, we believe that local governments, supplement producers and NGOs should team up in order to develop informative and user-friendly communication and education campaigns, devoted in particular to creating awareness among the most fragile groups of the population. These campaigns could be accompanied by a limited and targeted subsidy strategy, accompanied by an end-of-subsidy monitoring plan.

Disclaimer:

Possible competing interests.

Benedict Weerasena and Carmelo Ferlito have no competing interests. Paolo Bellavite is a consultant for Vanda srl, an Italian company producing dietary supplements.

References

- Amiot, M.J., Riva, C. and Vinet, A. (2016), *Effects of dietary polyphenols on metabolic syndrome features in humans: a systematic review*, «Obes Rev», 17, 7, pp. 573-586.
- Ammerman, A.S. et al. (2017), *Behavioral Economics and the Supplemental Nutrition Assistance Program: Making the Healthy Choice the Easy Choice*, «American Journal of Preventive Medicine», 52, 2S2, pp. S145-S150.
- Andres, S. et al. (2018), *Safety Aspects of the Use of Quercetin as a Dietary Supplement*, «Mol Nutr Food Res», 62, 1.
- Aon (2021), *2021 Global Medical Trend Rates Report*, London, Aon UK Limited.
- Astin, A.J. (1998), *Why Patients Use Alternative Medicine. Results of a National Study*, «Jama», May 20, 279, 19, pp. 1548-1553.
- Aune, D. et al. (2016), *Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose-response meta-analysis of prospective studies*, «BMJ», 353, i2716.
- Aune, D. et al. (2017), *Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality—a systematic review and dose-response meta-analysis of prospective studies*, «International Journal of Epidemiology», 46, 3, pp. 1029-1056.
- Bellavite, P. (2021), *Reappraisal of Dietary Phytochemicals for Coronavirus Infection: Focus on Hesperidin and Quercetin*, in V.Y. Waisundara (ed.), *Antioxidants*, London, Intechopen, forthcoming.
- Bellavite, P. and Donzelli, A. (2020), *Hesperidin and SARS-CoV-2: New Light on the Healthy Function of Citrus Fruits*, «Antioxidants (Basel)», 9, 8.
- Blackmores (2021), *Blackmores Omega Triple Concentrated Fish Oil 150 Capsules*, Lazada.com.
- Boots, A.W. et al. (2008), *In vitro and ex vivo anti-inflammatory activity of quercetin in healthy volunteers*, «Nutrition», 24, 7-8, pp. 703-710.
- Calder, P.C. et al. (2020), *Optimal Nutritional Status for a Well-Functioning Immune System Is an Important Factor to Protect against Viral Infections*, «Nutrients», 12, 4.
- Carr, A.C. and Maggini, S. (2017), *Vitamin C and Immune Function*, «Nutrients», 9, 11.
- Cassidy, A. et al. (2016), *Habitual intake of anthocyanins and flavanones and risk of cardiovascular disease in men*, «Am J Clin Nutr», 104, 3, pp. 587-594.
- Donzelli, A. and Giudicatti, G. (2020), *More specific implications of the Immunological Model of COVID-19 for Prevention, Therapy, and Public Health Measures*, «Il Cesalpino», 51, pp. 3-10.
- DOSM (2020), *Statistics on Causes of Death Malaysia 2020*, Department of Statistics Malaysia Official Portal.
- Douglas, R.M. et al. (2007), *Vitamin C for preventing and treating the common cold*, «Cochrane Database Syst Rev», 3, p. CD000980.

Duranti, G. et al. (2018), *Chronic consumption of quercetin reduces erythrocytes oxidative damage: Evaluation at resting and after eccentric exercise in humans*, «Nutr Res», 50, pp. 73-81.

Erlich, J.R. et al. (2020), *Targeting Evolutionary Conserved Oxidative Stress and Immunometabolic Pathways for the Treatment of Respiratory Infectious Diseases*, «Antioxid Redox Signal», 32, 13, pp. 993-1013.

Facts & Factors (2020), *Global Dietary Supplements Market Projected to Reach USD 306.8 Billion by 2026*, «FnFRResearch», July 2, <https://www.fnfresearch.com/news/global-dietary-supplements-market-projected-to-reach-usd>.

Fidelix, M. et al. (2020), *Microbiota modulation and effects on metabolic biomarkers by orange juice: a controlled clinical trial*, «Food Funct», 11, 2, pp. 1599-1610.

Filshie, J. and Rubens, C.N. (2006), *Complementary and alternative medicine*, «Anesthesiol Clin», 24, 1, pp. 81-111, VIII.

Formica, J.V. and Regelson, W. (1995), *Review of the biology of Quercetin and related bioflavonoids*, «Food Chem Toxicol», 33, 12, pp. 1061-1080.

FSE (2019), *How food supplements can help contribute to public health in Europe*, Brussels, Food Supplements Europe.

Furushima, D., Ide, K. and Yamada, H. (2018), *Effect of Tea Catechins on Influenza Infection and the Common Cold with a Focus on Epidemiological/Clinical Studies*, «Molecules», 23, 7.

Gandhi, G.R. et al. (2020), *Citrus Flavonoids as Promising Phytochemicals Targeting Diabetes and Related Complications: A Systematic Review of In Vitro and In Vivo Studies*, «Nutrients», 12, 10.

Gattuso, G. et al. (2007), *Flavonoid composition of Citrus juices*, «Molecules», 12, 8, pp. 1641-1673.

Ghafar, M.Y.A. et al. (2020), *Evaluation of the Efficacy of Probiotics (MCP® BCMC® Strains) Treating Constipation in Elderly Patients with Multiple Chronic Co-Morbidities: A Randomized Control Trial*, «J Nutr Health Aging», 24, 10, pp. 1066-1072.

Global Nutrition Report (2020), *Malaysia: The burden of malnutrition at a glance, in 2020 Global Nutrition Report*, <https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/malaysia/>.

GNC (2021), *Chromium Picolinate 200mcg (180 caplets)*, LAC Worldwide.com.

Grosso, G. et al. (2013), *Red orange: experimental models and epidemiological evidence of its benefits on human health*, «Oxid Med Cell Longev», 2013, p. 157240.

Guo, W., Gong, X. and Li, M. (2019), *Quercetin Actions on Lipid Profiles in Overweight and Obese Individuals: A Systematic Review and Meta-Analysis*, «Curr Pharm Des», 25, 28, pp. 3087-3095.

Haziqah, A.M. (2019), *Dietary supplements address NCDs better than food, says association*, «The Malaysian Reserve», September 13, <https://themalaysianreserve.com/2019/09/13/dietary-supplements-address-ncds-better-than-food-says-association/>.

Hemila, H. and Chalker, E. (2013), *Vitamin C for preventing and treating the common cold*, «Cochrane Database Syst Rev», 1, p. CD000980.

Hirschmann, R. (2020), *Impact of COVID-19 on dietary supplement intake in Malaysia 2020, by age group*, «Rakuten Insight», <https://www.statista.com/statistics/1183158/malaysia-covid-19-impact-on-dietary-supplement-intake-by-age-group/>.

Homayouni, F. et al. (2018), *Blood pressure lowering and anti-inflammatory effects of hesperidin in type 2 diabetes; a randomized double-blind controlled clinical trial*, «Phytother Res», 32, 6, pp. 1073-1079.

IADSA (2020), *Impact of Nutrition Interventions and Dietary Nutrient Density on Productivity in the Workplace*, London, International Alliance of Dietary/Food Supplement Associations.

Ibrahim, A. et al. (2020), *Multi-strain probiotics (Hexbio) containing MCP BCMC strains improved constipation and gut motility in Parkinson's disease: A randomised controlled trial*, «PLoS One», 15, 12, e0244680.

Iddir, M. et al. (2020), *Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis*, «Nutrients», 12, 6.

IGD Services Limited (2019), *Healthier Product Reformulation in Malaysia: Detailed Consumer Findings*, Singapore, Food Industry Asia.

Inland Revenue Board of Malaysia (2021), *Tax Relief for Resident Individual. Year of Assessment 2020*, Kuala Lumpur, Inland Revenue Board of Malaysia.

Institute for Public Health (2014), *The National Health and Morbidity Survey 2014: Malaysian Adult Nutrition Survey Volume II: Survey Findings*, Putrajaya, Ministry of Health of Malaysia.

Institute for Public Health (IPH) (2020a), *National Health and Morbidity Survey (NHMS) 2019: Non-communicable diseases, healthcare demand, and health literacy - Key Findings*, Putrajaya, Ministry of Health of Malaysia.

Institute for Public Health (IPH) (2020b), *National Health and Morbidity Survey (NHMS) 2019: Vol. I: NCDs – Non-Communicable Diseases: Risk Factors and other Health Problems*, Putrajaya, Ministry of Health of Malaysia.

Jay, B.N. (2019), *Cardiovascular diseases have almost doubled in 13 years: Deputy Health Minister*, Kuala Lumpur, New Straits Times.

Jayasimhan, S. et al. (2013), *Efficacy of microbial cell preparation in improving chronic constipation: a randomized, double-blind, placebo-controlled trial*, «Clin Nutr», 32, 6, pp. 928-934.

Kastam Diraja Malaysia (2018), *Sales Tax 2018 General Guide*, Putrajaya, Royal Malaysian Customs Department – Internal Tax Division.

Kawai, M. et al. (2007), *Flavonoids and related compounds as anti-allergic substances*, «Allergol Int.», 56, 2, pp. 113-123.

Koe, T. (2021), *E-commerce complaints: Malaysian industry calls for clampdown on 'unauthorized' online sales*, «NutraIngredients-Asia», Feb 2, <https://www.nutraingredients-asia.com/Article/2021/02/02/E-commerce-complaints-Malaysian-industry-calls-for-clampdown-on-unauthorised-online-sales>.

Lee, K.Y. et al. (2017), *Comparison of the treatment practice and hospitalization cost of percutaneous coronary intervention between a teaching hospital and a general hospital in Malaysia: A cross sectional study*, Clinical Research Centre.

Li, L. and Werler, M.M. (2010), *Fruit and vegetable intake and risk of upper respiratory tract infection in pregnant women*, «Public Health Nutrition», 13, 2, pp. 276-282.

Lima, A.C.D. et al. (2019), *Effect of Daily Consumption of Orange Juice on the Levels of Blood Glucose, Lipids, and Gut Microbiota Metabolites: Controlled Clinical Trials*, «J Med Food», 22, 2, pp. 202-210.

Liu, P.J. et al. (2014), *Using Behavioral Economics to Design More Effective Food Policies to Address Obesity*, «Applied Economic Perspectives and Policy», 36, 1, pp. 6-24.

Lobera, J. and Rogero-Garcia, J. (2020), *Scientific Appearance and Homeopathy. Determinants of Trust in Complementary and Alternative Medicine*, «Health Commun», pp. 1-8.

Lorraine, M.I. (2012), *Use of Multi-strain Probiotics as Adjunct in the Treatment of Dengue Haemorrhagic Fever*, Master thesis, Manila, Ospital ng Maynila Medical Center.

Malik, A.A. et al. (2016), *Microbial cell preparation in enteral feeding in critically ill patients: A randomized, double-blind, placebo-controlled clinical trial*, «Journal of Critical Care», 32, pp. 182-188.

MADSA (2019), *The Malaysian Dietary Supplements Industry Status and Outlook Report 2019-2020 Edition*, Petaling Jaya, Malaysian Dietary Supplement Association.

MaHTAS (2013), *Clinical Practice Guidelines: Management of Osteoarthritis*, Putrajaya, Malaysia Health Technology Assessment Section.

MaHTAS (2019), *Clinical Practice Guidelines: Management of Rheumatoid Arthritis*, Putrajaya, Malaysia Health Technology Assessment Section.

Malaysian Healthcare Performance Unit (2017), *Diabetes Care Performance Report 2016*, Putrajaya, Ministry of Health Malaysia.

Mas-Capdevila, A. et al. (2020), *Effect of Hesperidin on Cardiovascular Disease Risk Factors: The Role of Intestinal Microbiota on Hesperidin Bioavailability*, «Nutrients», 12, 5.

McCall, B. (2020), *Vitamin D Deficiency in COVID-19 Quadrupled Death Rate*, «Medscape», 11 December, <https://www.medscape.com/viewarticle/942497>.

Meneguzzo, F. et al., (2020), *Review of Evidence Available on Hesperidin-Rich Products as Potential Tools against COVID-19 and Hydrodynamic Cavitation-Based Extraction as a Method of Increasing Their Production*, 8 ed., p. 549.

MOH (2020), *The Impact of Noncommunicable Diseases and Their Risk Factors on Malaysia's Gross Domestic Product*, Putrajaya, Ministry of Health of Malaysia.

MOS (2012), *Clinical Guidance on Management of Osteoporosis 2012*, Petaling Jaya, Malaysian Osteoporosis Society, 2015.

Murota, K., Nakamura, Y. and Uehara, M. (2018), *Flavonoid metabolism: the interaction of metabolites and gut microbiota*, «Biosci Biotechnol Biochem», 82, 4, pp. 600-610.

Ostadmohammadi, V. et al. (2019), *Effects of quercetin supplementation on glycemic control among patients with metabolic syndrome and related disorders: A systematic review and meta-analysis of randomized controlled trials*, «Phytother Res», 33, 5, pp. 1330-1340.

Pharmaceutical Services Division (2014), *The Cost of Diabetes Care for Ambulatory Patients in Malaysian Ministry of Health Facilities*, Selangor; Ministry of Health Malaysia.

Pinzon, R.T., Angela and Pradana, A.W. (2020), *Vitamin D deficiency among patients with COVID-19: case series and recent literature review*, «Tropical Medicine and Health», 48, 102.

Potus, F. et al. (2020), *Novel insights on the pulmonary vascular consequences of COVID-19*, «Am J Physiol Lung Cell Mol Physiol», 319, 2, pp. L277-L288.

PwC (2021), *2020/2021 Malaysian Tax Booklet: Import Duties*, Kuala Lumpur, PwC Malaysia.

Radujkovic, A. et al. (2020), *Vitamin D Deficiency and Outcome of COVID-19 Patients*, «Nutrients», 12, 2757.

Reynolds, A. (2019), *Carbohydrate quality and human health: a series of systematic reviews and meta-analyses*, «Lancet», 393, 10170, pp. 434-445.

RinggitPlus (2019), *How Much Do The Most Common Critical Illnesses In Malaysia Cost?*, «RinggitPlus», 11 January, <https://ringgitplus.com/en/blog/sponsored/how-much-do-the-most-common-critical-illnesses-in-malaysia-cost.html>.

Rizza, S. et al. (2011), *Citrus polyphenol hesperidin stimulates production of nitric oxide in endothelial cells while improving endothelial function and reducing inflammatory markers in patients with metabolic syndrome*, «J Clin Endocrinol Metab», 96, 5, pp. E782-E792.

Royal Malaysian Custom Department (2018), *Guide on Sales Tax Rates for Various Goods*, Kuala Lumpur, Royal Malaysian Custom Department.

Schroeter, C. et al. (2010), *The Economics of Health Behavior and Vitamin Consumption*, paper prepared for the 1st joint EAAE/AEA seminar, The Economics of Food, Food Choice and Health, Freising, Germany, September 15-17, 2010.

SGE (2020), *White paper on Nutritional status in supporting a well-functioning immune system for optimal health with a recommendation for Switzerland*, Bern, Schweizerische Gesellschaft für Ernährung.

Shanahan, C. and de Lorimier, R. (2013), *Smart Prevention – Health Care Cost Savings Resulting from the Targeted Use of Dietary Supplements*, Mountain View, CA, Frost & Sullivan.

Solgar (2021), *Gold Specifics Homocysteine Modulators®* Vegetable Capsules.*, Solgar.com.

Stevens, Y. et al. (2019), *The Intestinal Fate of Citrus Flavanones and Their Effects on Gastrointestinal Health*, «Nutrients», 11, 7.

Stuttaford, M. et al. (2014), *The right to traditional, complementary, and alternative health care*, «Global Health Action», 7, 24121.

Tamtaji, O.R. et al. (2019), *The Effects of Quercetin Supplementation on Blood Pressures and Endothelial Function Among Patients with Metabolic Syndrome and Related Disorders: A Systematic Review and Meta-analysis of Randomized Controlled Trials*, «Curr Pharm Des», 25, 12, pp. 1372-1384.

Tan, C.K. et al. (2016), *Pre-surgical Administration of Microbial Cell Preparation in Colorectal Cancer Patients: A Randomized Controlled Trial*, «World Journal of Surgery», DOI 10.1007/s00268-016-3499-9.

Uchide, N. and Toyoda, H. (2011), *Antioxidant therapy as a potential approach to severe influenza-associated complications*. *Molecules*, 16, 3, 2032-2052.

UNICEF (2020), *Addressing Malaysia's nutrition crisis post COVID-19: Time for nutrition-focused social protection*, Kuala Lumpur, UNICEF Malaysia.

Valls, R.M. et al. (2020), *Effects of hesperidin in orange juice on blood and pulse pressures in mildly hypertensive individuals: a randomized controlled trial (Citrus study)*, «Eur J Nutr», Jul 13.

Yi, M. et al. (2019), *Tea Consumption and Health Outcomes: Umbrella Review of Meta-Analyses of Observational Studies in Humans*, «Mol Nutr Food Res», 63, 16, e1900389.

Zanini, S. et al. (2015), *Effects of dietary components on cancer of the digestive system*, «Crit Rev Food Sci Nutr», 55, 13, pp. 1870-1885.

Zhang, M. et al. (2020), *COVID-19: gastrointestinal symptoms from the view of gut-lung axis*, «Eur J Gastroenterol Hepatol», Oct 29.



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In order to do so, CME is not only involved in academic initiatives, but it organizes seminars, webinars and tailor-made economics classes for students, journalists, business people and professionals who wish to better understand the relevance of economics for their daily lives and activities.

Economics matters and needs to be presented in a fashion in which the link with reality is clearly visible. In this sense, we look not only at theoretical economics but also at policy making, with an emphasis on the unintended consequences generated by political actions.



centerformarketeducation@gmail.com



No. 53, Jalan SS15/4, 47500 Subang Jaya, Selangor, Malaysia



www.marketedu.org



shorturl.at/iwl00



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