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# The State of Health Supplements Consumption in Malaysia

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***Abstract*— The demand for health supplements (HS) has skyrocketed in Malaysia and around the world in recent years. The demand for supplements keeps rising as more people show an interest in maintaining their health. Vitamins, minerals, nutritional supplements, and herbal supplements (botanicals) are popular health items. These medications are available over the counter and often come in pills, powder, or liquid form. The endemic effect of COVID-19 anticipates that people will look outside of vaccines for HSs to support their body's immune system. The study investigates the Malaysian public's awareness, consumption, and perception or belief about HSs, especially the antecedents to the reason for consuming HS. Purposive sampling and snowball methods were used to solicit data from the Malaysian public by employing a self-administered questionnaire in this cross-sectional online survey. Note that 478 responses were received, but 418 were usable (yielding an 87.45% response rate). The key findings demonstrated a statistically significant chi-square where there are positive associations between the antecedents of Malaysians consuming HS, including country of origin, the Internet, liquid form of HS, and loss of body fat, with a strong magnitude of association. The findings in this study provide a valuable indicator for scientists, researchers, producers, sellers, and marketers to identify the marketability of their invented HS products.**

***Keywords*— Awareness, health supplement, perception, consumption.**

## I. INTRODUCTION

Food supplements are defined by the European Food Safety Authority (EFSA) as concentrated sources of nutrients or other substances with a nutritional or physiological effect intended to supplement a normal diet [3, 6, 7, 8, 14]. Any substance intended to supplement a diet to maintain, enhance, or improve the health function of the human body is referred to as a health supplement (HS). It does not contain any sterile preparations (such as injectables or eyedrops) and is supplied in small unit dose forms (to be delivered), such as capsules, pills, powders, and liquids. Vitamins, minerals, amino acids, fatty acids, enzymes, probiotics, and other bioactive compounds may all be present individually or in mixtures. In the form of extracts, isolates, concentrates, and/or metabolites, compounds obtained from natural sources, such as those found in animal, mineral, and plant materials, may also be included in an HS. Some HSs include synthetic sources of components, which are only permitted in products where their safety has been established.

According to Fortune Business Insights, the market for HSs was valued at US$61.2 billion worldwide in 2020. It is anticipated to increase by 8.68% from US$71.81 billion in 2021 to US$128.64 billion in 2028. The "longevity pill," nicotine mononucleotide (NMN), halal-certified supplements,

vitamin D, red ginseng, and probiotics are among the most well-liked and best-selling vitamins and supplements in the Asia-Pacific region, according to Nutra Ingredients, a leading online news source for the nutrition industry [12]. There are several reasons behind the nutritional supplement market's expansion. These include the COVID-19 virus spreading more widely, a rising understanding of the value of a healthy diet, and technological advancements in dietary supplements.

The public is looking for alternatives to treat, prevent, or enhance the immune systems of the body while waiting for effective treatments for contagious diseases. Long before the COVID-19 epidemic, the natural and organic nutrients in food and dietary supplements garnered interest [21] and were the subject of public debate. A highly contagious ailment known as coronavirus disease 2019 (COVID-19), which is thought to be brought on by SARS-CoV-2, has spread throughout the world and presented difficulties for the public health system. It saw ongoing threats to the healthcare and pharmaceutical industries' efficacy as well as to the broad impact of a society's political, economic, and social makeup. Scientists are continually investigating the pathogenesis of this virus and the most effective treatments to stop its activity and spread in society. A hyper-inflammatory immune response in critically ill patients that results in acute respiratory distress syndrome (ARDS) and multi-organ failure is just one example of the overwhelming evidence indicating the virus's harm. In the early stages, SARS-CoV-2 targets the immune system and eludes elimination [22]. Before releasing any medical answer, medical research requires a methodical and time-consuming methodology, especially when it comes to public health. As a result of the COVID-19 pandemic, Malaysians have become more health-conscious towards healthy living, active lifestyles, and achieving inclusive awareness of health. Referring to the Asia-Pacific Priority Survey, 79% of Malaysian respondents showed their health consciousness [11]. Moreover, the survey [11] also shows that Malaysians are willing to increase their spending for health and wellness, including making healthier food choices, purchasing and/or consuming dietary supplements, having regular medical checkups, seeking mental health consultations, and/or engaging experts for health-related advice.

On the other hand, bio-products offer promising economic value as dietary supplements and anticipate their potential for expanded fermentation-derived natural chemical research. Understanding the characteristics of dietary supplement customers, their degrees of awareness, and product consumption rates is critical in deciding the strategy for healthcare providers, manufacturers, and the government [6, 8]. Most surveys of dietary supplement use have not inquired into the motives that cause consumers to seek supplemental intake of key nutrients and other food components, leaving a gap in scientific understanding of the motivations that induce consumers to seek supplemental intake of important nutrients and other food components. Numerous surveys on supplement users' health-related characteristics have found that supplement use is associated with a variety of habits or characteristics considered to be components of a healthy lifestyle, including attempting to make better food choices [7, 19]. In contrast, for some people, consuming supplements can be a risk rather than a benefit. In principle, consuming too many vitamins and minerals from supplements might cause neurologic abnormalities, gastrointestinal problems, liver toxicity, birth deformities, and drug interactions [1]. Therefore, it is important to investigate how Malaysians acknowledge the importance of HS, its consumption, and its perceived benefits. To maximize the return on research expectations, this study focuses on the public's willingness to consume organic or bioproducts as dietary supplements.

## II. METHODS

A cross-sectional survey employing a self-administered Internet questionnaire was conducted among the public in Malaysia. Apparently, there is no database of HS users. Thus, in collecting respondents, this study used a purposive selection technique that targeted Malaysian respondents between the ages of 15 and 64 and of working age [9]. Previously, Malaysians aged 18 and up were urged to get vaccinated to help stop the spread of COVID-19 during the inaugural phase of the National COVID-19 Immunization Programme, which began in May 2021. Currently, vaccination is also suggested for children aged 5 years old and older, as well as children aged 6 months to 5 years old who have health problems or a weak immune system. This study concluded that adolescents aged 16 to 20 may begin to consider and/or take nutritional supplements to preserve their health during the COVID-19 pandemic period. According to a study on dietary supplements among Malaysians [23], dietary supplement use among Malaysians as young as 20 years old is common. In addition, the snowball sampling method was used to perform the survey among the public at random. This non-probability sampling strategy is used since the targeted respondents' identities are unknown.

A 384-sample size is the minimal number of required samples for a population greater than a million to ensure the rationality of the data analysis [13]. Respondents were solicited by coworkers, family, and friends, who asked for their help in forwarding the invitation email and online questionnaire link to their contacts. No personal identification is required in the questionnaire to protect the anonymity of responses. During the COVID-19 pandemic era, the study received 478 responses from October 2021 to January 2022. However, 418 replies were usable (yielding an 87.45% response rate), while the remaining were removed from the dataset due to more than 30% of incomplete responses recorded (suspected respondents closed the browser before submitting the questionnaire).

The survey questionnaire used in this paper contains a demographic section asking for age, ethnicity, gender, employment, academic qualification, monthly income, and HS consumption status (yes or no). This paper descriptively lists 16 statements investigating respondents' awareness, consumption, and perceptions or beliefs towards HS. Each statement is measured against a specific set of responses. For example, in a statement on perceived health status after consuming supplements, the measured scale used ranges from 1 (worsened), 2 (no changes), 3 (improved), 4 (much improved), and 5 (very much improved). The questionnaire was tested for construct validity by 10 close coworkers, family members, and friends. Subsequently, the validity of the content was verified by two academics and a pharmacist. Responses obtained from these construct and content validity tests help tune the questionnaire before its public distribution. The ethics

committee opinionated that the ethical approval is exempted for this study since the survey instrument used is adapted from a published study [6, 14] in surveying the general perception of the public about their HS consumption. The psychometric properties of the questionnaire did not lead to the respondents' afflictive, cognitive, or behavioural damages. However, the research protocols of this study adhered to the World Medical Association's (WMA) Declaration of Helsinki on the ethical principles for medical research involving human subjects. Predominately, informed consent is stated in the confidentiality statement in the questionnaire, where all participants and survey data were anonymized due to this retrospective study design.

Differences in distribution among groups (frequency of a demographic character on awareness, consumption, and perception or belief towards HS) were compared using the chi-squared ($\chi 2$) test (i.e., basically a correlation test for the categorical variables) and reported with the p-value. The relationship between categorical variables was examined with the Pearson chi-square test, which essentially tells whether the results of a cross-tabulation are statistically significant. That is, the 5% significance level was accepted as the 95% confidence level, and the data obtained were analyzed using the statistical software of Statistical Package for the Social Sciences (SPSS), version 24.

Supposedly, Hair et al. [10] advised the estimated internal consistency (pairwise correlations between survey items) measured with Cronbach's alpha reliability coefficient with a significant value ($\alpha$) greater than 0.70 with a combination of the observed items combined as a scale [5, 17]. Apparently, the reliability test was unable to establish reliability since each construct established in this study is for individual description to investigate respondents' awareness, consumption, and perception or belief about HSs.

## III. RESULTS

As shown in Table 1, most of the respondents, i.e., 49%, were between 21 and 30 years old, 50.2% were male, 60.3% were Malay, 41.1% had a bachelor's degree, 51.0% had no monthly income, 38.8% were employed, 70.1% were currently located in the state of Sarawak, and 61.5% claimed not consuming HS.

Additionally, Table 2 descriptively shows that the majority (49.7%) of the respondents claimed they consumed HS to perform better in their daily activities. Most (29.2%) of the respondents claimed that they are consuming HS due to hypertension (blood pressure) issues; 45.3% get information about HS mostly from the Internet; 51.6% claimed a country of origin of the HS as the important factor to buy HS; and 48.4% are concerned about the manufacturer's production certificate (originality) as the most important factor in buying HS. 43.5% of the respondents claimed that they bought HS every two months. Moreover, 50.9% of respondents preferred a liquid form of HS, 38.5% preferred multivitamins (a combined nutrient of HS), 32.3% preferred vitamin D of HS (a single nutrient of HS), 28.6% preferred potato starch (non-conventional of HS), 28.6% preferred ginseng (herbal of HS), and 36.0% mostly preferred other than fish oil, virgin coconut oil, or olive oil.

**TABLE 1.** SOCIO-DEMOGRAPHIC PROFILES OF THE RESPONDENTS

| | *Profiles* | *n* | % |
|---|---|---|---|
| **Age** | ≤ 20 | 118 | 28.2 |
| | 21-30 | **205** | **49.0** |
| | 31-40 | 34 | 8.1 |
| | ≥ 41 | 61 | 14.6 |
| | *Total* | *418* | *100.0* |
| **Gender** | Male | **210** | **50.2** |
| | Female | 208 | 49.8 |
| | *Total* | *418* | *100.0* |
| **Ethnicity** | Malay | **252** | **60.3** |
| | Chinese | 21 | 5.0 |
| | Indian | 5 | 1.2 |
| | Others (S&S native) | 140 | 33.5 |
| | *Total* | *418* | *100.0* |
| **Highest Qualification** | Primary school | 4 | 1.0 |
| | Secondary school | 55 | 13.2 |
| | Certificate | 27 | 6.5 |
| | Diploma | 143 | 34.2 |
| | Bachelor's degree | **172** | **41.1** |
| | Master's degree | 11 | 2.6 |
| | Doctorate | 4 | 1.0 |
| | Professional certificate | 2 | 0.5 |
| | *Total* | *418* | *100.0* |
| **Monthly Income** | No income | **213** | **51.0** |
| | RM1000 and below | 125 | 29.9 |
| | RM1001-RM3999 | 35 | 8.4 |
| | RM4000-RM8500 | 42 | 10.0 |
| | Above RM8500 | 3 | 0.7 |
| | *Total* | *418* | *100.0* |
| **Employment** | Unemployed | 30 | 7.2 |
| | Employed | **162** | **38.8** |
| | Employed & Part time student | 4 | 1.0 |
| | Full time student | 210 | 50.2 |
| | Retired | 12 | 2.9 |
| | *Total* | *418* | *100.0* |
| **Current Location** | Sarawak | **293** | **70.1** |
| | Sabah | 34 | 8.1 |
| | Peninsular Malaysia | 86 | 20.6 |
| | Federal territory | 5 | 1.2 |
| | *Total* | *418* | *100.0* |
| **Consuming HS?** | Yes | 161 | 38.5 |
| | No | 257 | 61.5 |
| | *Total* | *418* | *100.0* |

Furthermore, 40.4% of respondents mostly perceived that their health status had improved after consuming HS, while 56.5% believed they were consuming HS to lose body fat. On the contrary, out of 61.5% of respondents who claimed not to consume HS, 44.0% of them mostly perceived that the price of HS was too expensive to make it a reason not to consume it.

Conjointly in the statistical analysis, the dispersion of responses shown in Table 3 of the cross-tabulation investigates an association between the reason for consuming HS and the consumption and perception or belief about HS. In general, the majority (49.7%) of the respondents claimed they were aware that they were consuming HS to perform better. Besides, the statistical analyses of the Pearson Chi-Square showed a statistically insignificant association ($p \geq 0.05$) was found between the reason for consuming HS and the consumption and perception or belief about HS based on the demographic

characteristics, i.e., age ($\chi^2$ = 13.928, $p$ = 0.305), gender ($\chi^2$ = 3.232, $p$ = 0.520), employment ($\chi^2$ = 13.207, $p$ = 0.658), and monthly income ($\chi^2$ = 4.595, $p$ = 0.997). However, although the Pearson Chi-Square test showed a statistically significant association ($p \leq 0.05$) between academic background and the reason for consuming the HS ($\chi^2$ = 43.846, $p$ = 0.029), the Pearson's correlation indicated an effect size (strength) or magnitude of association was statistically insignificant ($r$ = -0.066, $p$ = 0.408).

**TABLE 2.** FREQUENCIES OF AWARENESS, CONSUMPTION, AND PERCEPTION OR BELIEF ABOUT HSs.

| | | *n* | *%* |
|---|---|---|---|
| ***(Awareness)*** | | | |
| **Reason for consuming HS** | Stay Healthy | 1 | 0.6 |
| | Medical - doctor recommendation | 6 | 3.7 |
| | To improve diet | 54 | 33.5 |
| | To perform better | **80** | **49.7** |
| | Increase energy | 20 | 12.5 |
| | *Total* | *161* | *100.0* |
| ***(Consumption)*** | | | |
| **HS consumption by illness** | Hypertension - Blood pressure | **47** | **29.2** |
| | Heart disease | 34 | 21.1 |
| | Diabetes | 30 | 18.6 |
| | Ulcer/hyperacidity | 33 | 20.5 |
| | Gout | 17 | 10.6 |
| | *Total* | *161* | *100.0* |
| **Important factor to buy HS** | Ingredients | 4 | 2.5 |
| | Nutrition facts | 18 | 11.2 |
| | Country of origin | **83** | **51.6** |
| | Actual effectiveness | 56 | 34.7 |
| | *Total* | *161* | *100.0* |
| **Getting Information about HS** | Newspaper and/or articles | 1 | 0.6 |
| | Recommendation by family, friends, and other people | 11 | 6.8 |
| | Advertisement | 56 | 34.8 |
| | Internet | **73** | **45.3** |
| | Social media | 20 | 12.5 |
| | *Total* | *161* | *100.0* |
| **Choosing Criteria to buy HS** | Nutrient information | 64 | 39.8 |
| | Quality | 3 | 1.9 |
| | Manufacturer's production certificate | **78** | **48.4** |
| | Brand awareness | 16 | 9.9 |
| | *Total* | *161* | *100.0* |
| **Preferred form of HS** | Powder | 1 | 0.6 |
| | Pill/capsule | 13 | 8.1 |
| | Jelly | 29 | 18.0 |
| | Liquid | **82** | **50.9** |
| | Food | 36 | 22.4 |
| | *Total* | *161* | *100.0* |
| **Frequency buying HS** | Every week | 1 | 0.6 |
| | A few times a month | 50 | 31.1 |
| | Every other month | **70** | **43.5** |
| | Rarely | 40 | 24.8 |
| | *Total* | *161* | *100.0* |
| **Preferred Combined Nutrient HS** | Multivitamins | **62** | **38.5** |
| | Multivitamins & minerals | 57 | 35.4 |
| | B-complex vitamins | 42 | 26.1 |
| | *Total* | *161* | *100.0* |
| **Preferred Single Nutrient HS** | Vitamin A | 9 | 5.6 |
| | Vitamin C | 37 | 23.0 |
| | Vitamin D | **52** | **32.3** |
| | Vitamin E | 45 | 28.0 |
| | Folic Acid | 18 | 11.1 |
| | *Total* | *161* | *100.0* |
| **Preferred Herbal HS** | Garlic | 27 | 16.8 |
| | Feverfew | 35 | 21.7 |
| | Ginger | 32 | 19.9 |
| | Ginseng | **46** | **28.6** |
| | Blackseed | 21 | 13.0 |
| | *Total* | *161* | *100.0* |

| | | *n* | *%* |
|---|---|---|---|
| **Preferred Non-conventional HS** | Yeast | 39 | 24.2 |
| | Lecithin | 36 | 22.4 |
| | Potato starch | **50** | **31.1** |
| | Almond flour | 36 | 22.3 |
| | *Total* | *161* | *100.0* |
| **Preferred another type of HS** | Fish oil | 52 | 32.3 |
| | Virgin coconut oil | 22 | 13.7 |
| | Olive Oil | 29 | 18.0 |
| | other than listed | **58** | **36.0** |
| | *Total* | *161* | *100.0* |
| ***(Perception)*** | | | |
| **Health Status after HS** | No change | 3 | 1.9 |
| | Improved | 32 | 19.9 |
| | Much improved | **65** | **40.4** |
| | Very much improved | 61 | 37.8 |
| | *Total* | *161* | *100.0* |
| **Health beliefs after HS** | To Improve appearance | 26 | 16.1 |
| | To lose body fat | **91** | **56.5** |
| | To skip meal | 44 | 27.4 |
| | *Total* | *161* | *100.0* |
| **Reason does not consume HS** | Not available in the area | 6 | 2.3 |
| | Not needed | 25 | 9.7 |
| | Very Expensive | **113** | **44.0** |
| | Not believe it works | 89 | 34.6 |
| | Different HSs beliefs | 24 | 9.4 |
| | *Total* | *257* | *100.0* |

**TABLE 3.** CROSS-TABULATION ANALYSES THE REASON FOR CONSUMING SUPPLEMENTS, CONSUMPTION, AND PERCEPTION OR BELIEF ABOUT HSs.

| | | ***Reason for consuming supplement**** | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Stay Healthy (n) %* | *Medical (n) %* | *To improve diet (n) %* | *To perform better (n) %* | *Increase energy (n) %* | *Total (n) %* |
| **Consuming HS?** | Yes | (1) 0.6 | (6) 3.7 | (54) 33.5 | **(80) 49.7** | (20) 12.4 | *(161) 100.0* |
| | No | - | - | - | - | - | - |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | - | | | | | |
| | *Pearson Correlation* | - | | | | | |
| ***Age** | 20 and below | (1) 0.6 | (2) 1.2 | (13) 8.1 | (23) 14.3 | (4) 2.5 | *(43) 26.7* |
| | 21-30 | (0) 0.0 | (3) 1.9 | (24) 14.9 | **(41) 25.5** | (5) 3.1 | *(73) 45.3* |
| | 31-40 | (0) 0.0 | (0) 0.0 | (4) 2.5 | (4) 2.5 | (2) 1.2 | *(10) 6.2* |
| | 41 and above | (0) 0.0 | (1) 0.6 | (13) 8.1 | (12) 7.5 | (9) 5.6 | *(35) 21.7* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2 = 13.928$, $p = 0.305$ | | | | | |
| | *Pearson Correlation* | $r = 0.102$, $p = 0.199$ | | | | | |
| ***Gender** | Male | (1) 0.6 | (1) 0.6 | (23) 14.3 | (36) 22.4 | (8) 5.0 | *(69) 42.9* |
| | Female | (0) 0.0 | (5) 3.1 | (31) 19.3 | **(44) 27.3** | (12) 7.5 | *(92) 57.1* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2 = 3.232$, $p = 0.520$ | | | | | |
| | *Pearson Correlation* | $r = -0.017$, $p = 0.834$ | | | | | |
| ***Employment** | Employed | (0) 0.0 | (3) 1.9 | (27) 16.8 | (27) 16.8 | (12) 7.5 | *(69) 42.9* |
| | Unemployed | (0) 0.0 | (0) 0.0 | (6) 3.7 | (7) 4.3 | (2) 1.2 | *(15) 9.3* |
| | Full time student | (1) 0.6 | (3) 1.9 | (18) 11.2 | **(40) 24.8** | (6) 3.7 | *(68) 42.2* |
| | Part time student | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | (0) 0.0 | *(1) 0.6* |
| | Retired | (0) 0.0 | (0) 0.0 | (2) 1.2 | (6) 3.7 | (0) 0.0 | *(8) 5.0* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2 = 13.207$, $p = 0.658$ | | | | | |
| | *Pearson Correlation* | $r = -0.003$, $p = 0.972$ | | | | | |

| | | *Reason for consuming supplement** | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Stay Healthy* *(n)* % | *Medical* *(n)* % | *To improve diet* *(n)* % | *To perform better* *(n)* % | *Increase energy* *(n)* % | *Total* *(n)* % |
| ***Education** | Primary school | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | (1) 0.6 | *(2) 1.2* |
| | Secondary school | (0) 0.0 | (2) 1.2 | (6) 3.7 | (13) 8.1 | (4) 2.5 | *(25) 15.5* |
| | Certificate | (1) 0.6 | (0) 0.0 | (2) 1.2 | (3) 1.9 | (4) 2.5 | *(10) 6.2* |
| | Diploma | (0) 0.0 | (2) 1.2 | (18) 11.2 | **(32) 19.9** | (4) 2.5 | *(56) 34.8* |
| | Bachelor's degree | (0) 0.0 | (2) 1.2 | (22) 13.7 | (29) 18.0 | (6) 3.7 | *(59) 36.6* |
| | Master's degree | (0) 0.0 | (0) 0.0 | (5) 3.1 | (2) 1.2 | (0) 0.0 | *(7) 4.3* |
| | Doctorate | (0) 0.0 | (0) 0.0 | (0) 0.0 | (0) 0.0 | (1) 0.6 | *(1) 0.6* |
| | Professional certificate | (0) 0.0 | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | *(1) 0.6* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 43.846, *p* = 0.029** | | | | | |
| | *Pearson Correlation* | *r* = -0.066, *p* = 0.408 | | | | | |
| ***Income** | No income | (1) 0.6 | (3) 1.9 | (22) 13.7 | **(42) 26.1** | (8) 5.0 | *(76) 47.2* |
| | RM1000 and below | (0) 0.0 | (2) 1.2 | (19) 11.8 | (23) 14.3 | (7) 4.3 | *(51) 31.7* |
| | RM1001-RM3999 | (0) 0.0 | (1) 0.6 | (7) 4.3 | (9) 5.6 | (3) 1.9 | *(20) 12.4* |
| | RM4000-RM8500 | (0) 0.0 | (0) 0.0 | (5) 3.1 | (5) 3.1 | (2) 1.2 | *(12) 7.5* |
| | Above RM8500 | (0) 0.0 | (0) 0.0 | (1) 0.6 | (1) 0.6 | (0) 0.0 | *(2) 1.2* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ = 4.595, *p* = 0.997 | | | | | |
| | *Pearson Correlation* | *r* = 0.001, *p* = 0.993 | | | | | |
| ***(Consumption)*** | | | | | | | |
| **HS consumption by illness** | Hypertension - Blood pressure | (1) 0.6 | (5) 3.1 | (18) 11.2 | (20) 12.4 | (3) 1.9 | *(47) 29.2* |
| | Heart disease | (0) 0.0 | (0) 0.0 | (11) 6.8 | (18) 11.2 | (5) 3.1 | *(34) 21.1* |
| | Diabetes | (0) 0.0 | (1) 0.6 | (11) 6.8 | (13) 8.1 | (5) 3.1 | *(30) 18.6* |
| | Ulcer/hyperacidity | (0) 0.0 | (0) 0.0 | (9) 5.6 | **(21) 13.0** | (3) 1.9 | *(33) 20.5* |
| | Gout | (0) 0.0 | (0) 0.0 | (5) 3.1 | (8) 5.0 | (4) 2.5 | *(17) 10.6* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 18.539, *p* = 0.293** | | | | | |
| | *Pearson Correlation* | ***r* = 0.213, *p* = 0.007** | | | | | |
| **Important factor to buy HS** | Ingredients | (1) 0.6 | (1) 0.6 | (1) 0.6 | (0) 0.0 | (1) 0.6 | *(4) 2.5* |
| | Nutrition facts | (0) 0.0 | (1) 0.6 | (11) 6.8 | (5) 3.1 | (1) 0.6 | *(18) 11.2* |
| | Country of origin | (0) 0.0 | (4) 2.5 | (31) 19.3 | **(46) 28.6** | (2) 1.2 | *(83) 51.6* |
| | Actual effectiveness | (0) 0.0 | (0) 0.0 | (11) 6.8 | (29) 18.0 | (16) 9.9 | *(56) 34.8* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 78.345, *p* = *0.001*** | | | | | |
| | *Pearson Correlation* | ***r* = 0.410, *p* = *0.001*** | | | | | |
| **Getting Information about HS** | Newspaper and/or articles | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | (0) 0.0 | *(1) 0.6* |
| | Recommendation by family, friends, and other people | (1) 0.6 | (3) 1.9 | (2) 1.2 | (4) 2.5 | (1) 0.6 | *(11) 6.8* |
| | Advertisement | (0) 0.0 | (2) 1.2 | (30) 18.6 | (22) 13.7 | (2) 1.2 | *(56) 34.8* |
| | Internet | (0) 0.0 | (1) 0.6 | (17) 10.6 | **(47) 29.2** | (8) 5.0 | *(73) 45.3* |
| | Social media | (0) 0.0 | (0) 0.0 | (4) 2.5 | (7) 4.3 | (9) 5.6 | *(20) 12.4* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 71.163, *p* = *0.001*** | | | | | |
| | *Pearson Correlation* | ***r* = 0.420, *p* = *0.001*** | | | | | |
| **Choosing Criteria to buy HS** | Quality | (1) 0.6 | (0) 0.0 | (0) 0.0 | (1) 0.6 | (1) 0.6 | *(3) 1.9* |
| | Brand awareness | (0) 0.0 | (2) 1.2 | (8) 5.0 | (4) 2.5 | (2) 1.2 | *(16) 9.9* |
| | Nutrient information | (0) 0.0 | (2) 1.2 | (26) 16.1 | (36) 22.4 | (0) 0.0 | *(64) 39.8* |
| | Manufacturer's production certificate | (0) 0.0 | (2) 1.2 | (20) 12.4 | **(39) 24.2** | (17) 10.6 | *(78) 48.4* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 78.338, *p* = *0.001*** | | | | | |
| | *Pearson Correlation* | ***r* = 0.269, *p* = 0.001** | | | | | |
| **Preferred form of HS** | Powder | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | (0) 0.0 | *(1) 0.6* |
| | Pill/capsule | (1) 0.6 | (0) 0.0 | (6) 3.7 | (5) 3.1 | (1) 0.6 | *(13) 8.1* |
| | Jelly | (0) 0.0 | (1) 0.6 | (18) 11.2 | (9) 5.6 | (1) 0.6 | *(29) 18.0* |
| | Liquid | (0) 0.0 | (5) 3.1 | (23) 14.3 | **(45) 28.0** | (9) 5.6 | *(82) 50.9* |
| | Food | (0) 0.0 | (0) 0.0 | (6) 3.7 | (21) 13.0 | (9) 5.6 | *(36) 22.4* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ **= 38.059, *p* = 0.001** | | | | | |
| | *Pearson Correlation* | ***r* = 0.322, *p* = *0.001*** | | | | | |

| | | *Reason for consuming supplement** | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Stay Healthy (n) %* | *Medical (n) %* | *To improve diet (n) %* | *To perform better (n) %* | *Increase energy (n) %* | *Total (n) %* |
| **Frequency buying HS** | Every week | (0) 0.0 | (0) 0.0 | (0) 0.0 | (1) 0.6 | (0) 0.0 | *(1) 0.6* |
| | A few times a month | (1) 0.6 | (5) 3.1 | (22) 13.7 | (19) 11.8 | (3) 1.9 | *(50) 31.1* |
| | Every other month | (0) 0.0 | (0) 0.0 | (22) 13.7 | **(41) 25.5** | (7) 4.3 | *(70) 43.5* |
| | Rarely | (0) 0.0 | (1) 0.6 | (10) 6.2 | (19) 11.8 | (10) 6.2 | *(40) 24.8* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | ***$\chi^2$ = 23.480, p = 0.024*** | | | | | |
| | *Pearson Correlation* | ***r = 0.285, p = 0.001*** | | | | | |
| **Preferred Combined Nutrient HS** | Multivitamins | (0) 0.0 | (1) 0.6 | (17) 10.6 | **(38) 23.6** | (6) 3.7 | *(62) 38.5* |
| | Multivitamins & minerals | (1) 0.6 | (3) 1.9 | (16) 9.9 | (25) 15.5 | (12) 7.5 | *(57) 35.4* |
| | B-complex vitamins | (0) 0.0 | (2) 1.2 | (21) 13.0 | (17) 10.6 | (2) 1.2 | *(42) 26.1* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | ***$\chi^2$ = 16.208, p = 0.040*** | | | | | |
| | *Pearson Correlation* | ***r = -0.166, p = 0.035*** | | | | | |
| **Preferred Single Nutrient HS** | Vitamin A | (0) 0.0 | (1) 0.6 | (5) 3.1 | (1) 0.6 | (2) 1.2 | *(9) 5.6* |
| | Vitamin C | (1) 0.6 | (2) 1.2 | (14) 8.7 | (17) 10.6 | (3) 1.9 | *(37) 23.0* |
| | Vitamin D | (0) 0.0 | (1) 0.6 | (24) 14.9 | (21) 13.0 | (6) 3.7 | *(52) 32.3* |
| | Vitamin E | (0) 0.0 | (1) 0.6 | (7) 4.3 | **(31) 19.3** | (6) 3.7 | *(45) 28.0* |
| | Folic Acid | (0) 0.0 | (1) 0.6 | (4) 2.5 | (10) 6.2 | (3) 1.9 | *(18) 11.2* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ = 23.578, $p$ = 0.099 | | | | | |
| | *Pearson Correlation* | $r$ = 0.206, $p$ = 0.009 | | | | | |
| **Preferred Herbal HS** | Garlic | (0) 0.0 | (2) 1.2 | (11) 6.8 | (11) 6.8 | (3) 1.9 | *(27) 16.8* |
| | Feverfew | (1) 0.6 | (0) 0.0 | (15) 9.3 | (17) 10.6 | (2) 1.2 | *(35) 21.7* |
| | Ginger | (0) 0.0 | (3) 1.9 | (14) 8.7 | (13) 8.1 | (2) 1.2 | *(32) 19.9* |
| | Ginseng | (0) 0.0 | (0) 0.0 | (10) 6.2 | **(29) 18.0** | (7) 4.3 | *(46) 28.6* |
| | Blackseed | (0) 0.0 | (1) 0.6 | (4) 2.5 | (10) 6.2 | (6) 3.7 | *(21) 13.0* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ = 25.569, $p$ = 0.060 | | | | | |
| | *Pearson Correlation* | $r$ = 0.231, $p$ = 0.003 | | | | | |
| **Preferred Non-conventional HS** | Yeast | (0) 0.0 | (4) 2.5 | (12) 7.5 | (16) 9.9 | (7) 4.3 | *(39) 24.2* |
| | Lecithin | (1) 0.6 | (1) 0.6 | (18) 11.2 | (14) 8.7 | (2) 1.2 | *(36) 22.4* |
| | Potato starch | (0) 0.0 | (1) 0.6 | (17) 10.6 | **(26) 16.1** | (6) 3.7 | *(50) 31.1* |
| | Almond flour | (0) 0.0 | (0) 0.0 | (7) 4.3 | (24) 14.9 | (5) 3.1 | *(36) 22.4* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ = 20.867, $p$ = 0.052 | | | | | |
| | *Pearson Correlation* | $r$ = 0.161, $p$ = 0.042 | | | | | |
| **Preferred another type of HS** | Fish oil | (0) 0.0 | (2) 1.2 | (13) 8.1 | (25) 15.5 | (12) 7.5 | *(52) 32.3* |
| | Virgin coconut oil | (1) 0.6 | (1) 0.6 | (9) 5.6 | (9) 5.6 | (2) 1.2 | *(22) 13.7* |
| | Olive Oil | (0) 0.0 | (0) 0.0 | (12) 7.5 | (16) 9.9 | (1) 0.6 | *(29) 18.0* |
| | other than listed | (0) 0.0 | (3) 1.9 | (20) 12.4 | **(30) 18.6** | (5) 3.1 | *(58) 36.0* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | $\chi^2$ = 17.895, $p$ = 0.119 | | | | | |
| | *Pearson Correlation* | $r$ = -0.127, $p$ = 0.107 | | | | | |
| ***(Perception)*** | | | | | | | |
| **Health Status after HS** | No change | (1) 0.6 | (0) 0.0 | (1) 0.6 | (1) 0.6 | (0) 0.0 | *(3) 1.9* |
| | Improved | (0) 0.0 | (1) 0.6 | (16) 9.9 | (13) 8.1 | (2) 1.2 | *(32) 19.9* |
| | Much improved | (0) 0.0 | (2) 1.2 | (19) 11.8 | **(37) 23.0** | (7) 4.3 | *(65) 40.4* |
| | Very much improved | (0) 0.0 | (3) 1.9 | (18) 11.2 | (29) 18.0 | (11) 6.8 | *(61) 37.9* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | ***$\chi^2$ = 60.830, p = 0.001*** | | | | | |
| | *Pearson Correlation* | ***r = 0.186, p = 0.018*** | | | | | |
| **Health beliefs after HS** | To Improve appearance | (0) 0.0 | (1) 0.6 | (16) 9.9 | (9) 5.6 | (0) 0.0 | *(26) 16.1* |
| | To lose body fat | (1) 0.6 | (5) 3.1 | (27) 16.8 | **(51) 31.7** | (7) 4.3 | *(91) 56.5* |
| | To skip meal | (0) 0.0 | (0) 0.0 | (11) 6.8 | (20) 2.4 | (13) 8.1 | *(44) 27.3* |
| | *Total* | *(1) 0.6* | *(6) 3.7* | *(54) 33.5* | *(80) 49.7* | *(20) 12.4* | *(161) 100.0* |
| | *Pearson Chi-Square* | ***$\chi^2$ = 27.954, p = 0.001*** | | | | | |
| | *Pearson Correlation* | ***r = 0.322, p = 0.001*** | | | | | |

Moving forward, the statistical analysis of the Pearson Chi-Square shown in Table 3 indicated a statistically significant association ($p \leq 0.05$) was found between:

1. HS consumption by illness and reason for consuming HS ($\chi^2$ = 78.345, $p$ = 0.001); most responses (13%) indicate a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (ulcer/hyperacidity vs. to perform better: $r$ = 0.213, $p$ = 0.007).
2. Important factor to buy HS and reason for consuming HS ($\chi^2$ = 78.345, $p$ = 0.001); most responses (28.6%) indicate a significant Pearson's correlation ($p \leq 0.05$)

with strong effect size (strength) or magnitude of association (country of origin vs. to perform better: $r$ = 0.410, $p$ = 0.001).

3. Getting information about HS and reason for consuming HS ($\chi^2$ = 71.163, $p$ = *0.001*); most responses (29.2%) indicate a significant Pearson's correlation ($p \leq 0.05$) with strong effect size (strength) or magnitude of association (Internet vs. to perform better: $r$ = 0.420, $p$ = 0.001).
4. Choosing criteria to buy HS and reason for consuming HS ($\chi^2$ = 78.338, $p$ = *0.001*); most responses (24.2%) indicate a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (manufacturer's production certificate vs. to perform better: $r$ = 0.269, $p$ = 0.001).
5. Preferred form of HS and reason for consuming HS ($\chi^2$ = 38.059, $p$ = 0.001); most responses (28.0%) indicate a significant Pearson's correlation ($p \leq 0.05$) with strong effect size (strength) or magnitude of association (liquid form vs. to perform better: $r$ = 0.322, $p$ = 0.001).
6. Frequency buying HS and reason for consuming HS ($\chi^2$ = 23.480, $p$ = 0.024); most responses (25.5%) indicate a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (every other month vs. to perform better: $r$ = 0.285, $p$ = 0.001).
7. Preferred combined nutrient HS and reason for consuming HS ($\chi^2$ = 16.208, $p$ = 0.040); most responses (23.6%) indicate a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (multivitamins vs. to perform better: $r$ = -0.166, $p$ = 0.035).
8. Health status and reason for consuming HS ($\chi^2$ = 60.830, $p$ = *0.001*); most responses (23.0%) indicate a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (much improved vs. to perform better: $r$ = 0.186, $p$ = 0.018).
9. Health beliefs after consuming HS and reason for consuming HS ($\chi^2$ = 27.954, $p$ = 0.001); most responses (31.7%) indicate a significant Pearson's correlation ($p \leq 0.05$) with strong effect size (strength) or magnitude of association (to lose body fat vs. to perform better: $r$ = 0.322, $p$ = 0.001).

In contrast, the statistical analyses of the Pearson Chi-Square shown in Table 3 indicated that a statistically insignificant association ($p \geq 0.05$) was found between:

1. Preferred single nutrient HS and reason for consuming HS ($\chi^2$ = 23.578, $p$ = 0.099); despite the significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (vitamin E vs. to perform better: $r$ = 0.206, $p$ = 0.009).
2. Preferred herbal HS and reason for consuming HS ($\chi^2$ = 25.569, $p$ = 0.060); despite the significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (Ginseng vs. to perform better: $r$ = 0.231, $p$ = 0.003).
3. Preferred Non-conventional HS (HS that are not common or not ordinarily used) and reason for consuming HS ($\chi^2$ = 20.867, $p$ = 0.052); even though there is a significant Pearson's correlation ($p \leq 0.05$) with moderate effect size (strength) or magnitude of association (potato starch vs. to perform better: $r$ = 0.161, $p$ = 0.042).
4. Preferred another type of HS and reason for consuming HS ($\chi^2$ = 17.895, $p$ = 0.119); no significant Pearson's correlation ($p \leq 0.05$) of the effect size (strength) or magnitude of association ($r$ = -0.127, $p$ = 0.107) to perform better.

The statistical findings exhibited above provide valuable indicators of the Malaysian public's awareness, consumption, and perception or belief about HSs, especially the antecedents to the reason for consuming HS. The following section discusses the implications of the findings.

## IV. DISCUSSIONS

Many people are using HSs to strengthen their health and ward off the disease as a lesson learned from the COVID-19 pandemic. More people are becoming aware of the connection between our overall health and wellbeing and the food we put into our bodies. To obtain the nutrients they require, many people use nutritional supplements. Getting enough nutrition has been associated with lowered risks of chronic disease development, greater mental health, and all-around increased wellbeing.

This paper is mainly interoperable in exploring the Malaysian public's awareness, consumption, and perception or belief about HSs. Tactlessly, responses received from those who are not consuming HS were due to the fact that the price of HS is considered expensive as well as other reasons, including that they do not believe HS works, they perceive it as not needed to consume HS, they have different HS beliefs (probably preferring traditional medicine, organic foods, or a certain diet regime), and for some others, their preferred HS is not available in their working or living area. Inversely, the findings of this study demonstrated that most young adults aged 21 to 30 are consuming HS and are aware that they need an internal booster that can help them perform better in their daily routine. People starting their jobs at this age are more likely to need their physical ability to execute their job. Apparently, there is no statistically significant evidence to suggest that age is associated with the reasons to consume HS. Similar results appeared for the other demographic characters, including gender, employment, and monthly income, as shown in Table 3. However, the data suggests that the academic qualification (education) and reason to consume HS are associated with each other, but the effect size (strength) or magnitude of that association was statistically insignificant. Primarily, the constructs investigated in the empirical investigation of the populations in regressing the factors towards HS consumption might turn multifaceted due to the socio-ecocultural environment influences [4, 18, 19], especially regarding perception and beliefs.

There is statistical evidence (with a strong effect size (strength) or magnitude of association) to prove positively that people consuming HS are influenced by their country of origin (the most important factor to buy), the Internet (the major source of getting information about HS), the liquid form of HS

(the preferred form), and the loss of body fat (the main health beliefs after consuming HS). Besides, there is statistical evidence (with moderate effect size (strength) or magnitude of association) to prove positively that people consuming HS are due to ulcer/hyperacidity causality (most illness experienced), manufacturer's production certificate (major choosing criteria to buy HS), purchasing pattern of every other month (frequency buying HS), and perceived health has been much improved (perceived health status after consuming HS). Contrarily, the statistical evidence (with moderate effect size (strength) or magnitude of association) has found negative evidence to prove that people are consuming HS due to the need for multivitamins (the preferred combined nutrient of HS).

Noteworthy, consumers in today's information age are influenced by technological advancements, especially in getting information and assessing their health needs and support. The findings in this study provide a beneficial indicator for scientists, researchers, producers, sellers, and marketers to identify the marketability of their invented HS products. For instance, a cutting-edge advance in HS making is offering promising micro and nano encapsulations, a new technology that has wide applications in pharmaceutical industries, agrochemical industries, food industries, and cosmetics [2, 3], especially in bioproducts. For example, Nirmala et al. [15] and Singhal et al. [20] contended that bio-products, especially bamboo-based goods, have high potential for use as food, nutrition, and medicine but are still underutilized and in short supply. Hence, micro- and nano-encapsulation of bioproducts, especially traditional HS, no longer requires consuming as many capsules or tablets each time, which is troublesome or monotonous to prepare, and/or bitter, pungent, or malodorous HS.

Evidently, there is insufficient statistical evidence to prove that people are consuming HS to perform better associated with the single nutrient HS, herbal HS, non-conventional HS (HS that is not common or not ordinarily used), or another type of HS (other than fish oil, virgin coconut oil, and olive oil). This finding provides a valuable indicator for future studies specifically on bio-based HS products in production, especially among Malaysian HS consumers. Studies [15, 16, 20] hasten further research to create unique nutraceutical bamboo-based goods that benefit society. In particular, bamboo shoots have been used as food and in traditional Chinese and Indian medicine for centuries; they are also well-known as a component of Malaysian cuisine.

## V. CONCLUSIONS

This study has a comparable ability to the Malaysian Adult Nutrition Survey (MANS), conducted in 2014 and comprising a nationwide representative sample of adults ages between 18 and 59 years old, which provided detailed quantitative information on nutritional status, food and nutrient intakes, and physical activity patterns. Specifically, the MANS demonstrates the respondents' pattern of food consumption (habitual food intake) [14]. In addition, it was found that 30.9% of college students use dietary supplements, compared to teenagers, who use 54.1% of vitamin and mineral supplements and 40.2% of food supplements [23]. Therefore, this study sufficiently presented the current state of awareness, consumption, and perceived food supplement consumption and benefits among the public in Malaysia. In addition, this study adopted a published self-administered survey questionnaire for the cross-sectional survey to gather information about the respondents' use of food supplements, their motivations for doing so, the presence of any illnesses or medical conditions, and their perception of their health state following supplement use. Thus, extended analyses of exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) are required to establish the goodness of the measuring instrument. Furthermore, a future study is summoned to extend the study to cover a more comprehensive outlook of HS, including the chemical properties, nutritional information, and health information on the HS product's label. The key finding of this study called for public health agencies in Malaysia to intensify health awareness campaigns, especially related to HS consumption. On the edge of social media influences, the public needs a credible informational source for advice on the safety and health guide to prevent unprecedented organ failure, especially liver and kidney failure due to HS consumption.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.


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